

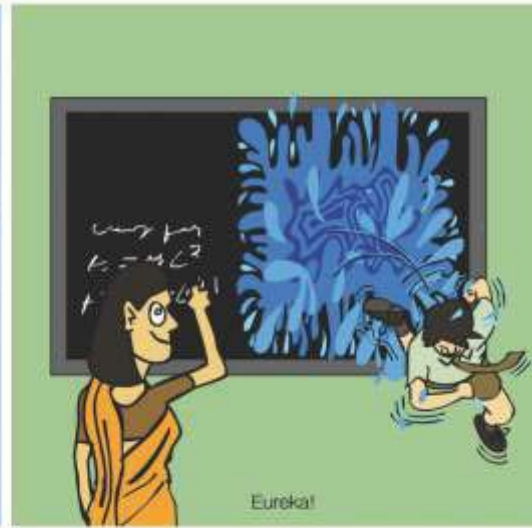


Azim Premji  
University

A publication from  
Azim Premji University

# Learn*ing* CUR*ve*

Issue XIX, April 2013



— INNOVATIVE —  
**TEACHING-  
LEARNING**  
PRACTICES

Inside : The Humanities, The Sciences, Voice of Learners, Reviews & Resource Kit

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“Learning Curve is a publication on education from Azim Premji University. It aims to reach out to teachers, teacher educators, school heads, education functionaries, parents and NGOs, on contextual and thematic issues that have an enduring relevance and value to help practitioners. It provides a platform for the expression of varied opinions, perspectives, encourages new and informed positions, thought-provoking points of view and stories of innovation. The approach is a balance between being an ‘academic’ and ‘practitioner’ oriented magazine.”



## *From the editor*

**T**here is a certain dynamics at work when a teacher enters a classroom which is quite different from any other happening in a school. All of us know this – after all, schooling, like childhood, has been a universal experience.

What that instant change in atmosphere is, what it is due to, are both difficult to define. But – there it is: the bell rings, one teacher leaves taking part of herself with her, even while leaving something behind, and another enters, bringing something of herself, of her subject and the way she plans to impart it.

Even the timing of a class (the period, as it is called) is of the essence – the early morning is preferred by science and maths teachers because they are perceived-very debatably- as subjects which need students to be at their brightest and best.

The four walls of the classroom, then, enclose the teacher's own constituency – where oftentimes attitudes towards a subject are made or marred for life. How often have we heard the complaint that someone hates maths or physics or geography because they had an unsympathetic first teacher, who either taught that particular subject unimaginatively or was 'boring'.

Hence, this particular issue of the Learning Curve.

As the Editor, I'd like to explain why all of us at the Learning Curve felt that it would be right to explore the ways in which a subject can be taught and made valuable as a lifetime experience. We wanted to give as many teachers as we could a voice – with which to explain what they have done which has given joy and satisfaction to both the teacher and the taught. As any teacher will tell you (and as every teacher knows) few things in life can equal the pleasure of transferring what one knows and loves to someone else and if this process is successful, it sets the background for further learning. The time spent in the classroom can either be the most valuable experience or it

can be rendered completely useless because it was repetitive and not thought and imagination provoking.

The result of our brainstorming is this issue on Innovative Practices – recipes that have been tried and tested and found to be efficacious, not methods recommended by textbooks. They are practical and completely doable in the most ordinary circumstances, as most classrooms in India find themselves in. No special equipment is required to try out these ways of teaching and the common thread running through all of them – though the subjects themselves may be unrelated – is just the desire to make a difference, which, in turn, results in children becoming totally involved in the learning process and taking the responsibility to do more than was ever imagined.

We have in this issue articles from across the country, from teachers of varied subjects at varying levels and we have included some very interesting departures from the expected – such as using the game of bridge as a tool to understand concepts in maths. Teachers have talked about their students as inspiring them to strive ever harder to ring in the changes.

We are as a nation given to pessimism about progress in various fields. Here we have articles which are exactly the opposite – on reading the voices, I am sure there is going to be great optimism at the future of Indian education. Teachers are everywhere trying their best to change the outcomes within the classroom. This issue gives its readers a glimpse into the school as a dynamic, organic organisation which changes according to the demands made upon it.

We hope that every teacher will find the articles in this issue of help and a starting point for experimenting with her own group, so that learning becomes pleasant and happy. We look forward to feedback and criticism so that we can improve our endeavours.

Prema Raghunath  
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## SECTION A - THE HUMANITIES





01

## The Journey from “Can I?” to “I CAN!”

Gauri Mirashi &  
Parul Patel

*In October 2009, eight 10 year-old children from a small village named Lordi Dejgara near Jodhpur, Rajasthan, India, stopped sixteen child marriages.*

*In 2010, a few 11 year-old students from Lancaster, Pennsylvania, U.S.A partnered with the local government to design bicycling paths in their city to tackle obesity.*

*In 2011, five 13 year-old students from Taipei, Taiwan revisited and preserved their culture by rejuvenating a heritage song that no-one knew about.*

These are three out of thousands of such stories from different cultures and countries. The one thing that runs through all of them is the power of children to change their communities. Or in the words of Kiran Bir Sethi, founder of Design For Change, “The spirit of ‘I CAN’.”

Kiran is a designer who became a teacher, a principal who grew into an education reformer, an advocate who morphed into a social entrepreneur. A trained graphic designer from National Institute of Design, Ahmedabad, she comfortably uses the language of



The “I CAN” spirit!

design — iteration, prototype, design specs — to develop not only curriculum innovation, but also community-based social programs.

Her reasoning is simple. If children are told, for the formative fifteen years of their life, that they have NO choice, that they must do as they are told, it is ridiculous to expect them to be ‘prepared to face the real world’. If all a school does is manage children efficiently **in school**, it would serve no meaningful purpose. Surely **common sense** suggests that school is about preparing students to engage with thoughtful action in life? Such a purpose **must** involve making sense of the world, interrogating its contradictions and negotiating its challenges.

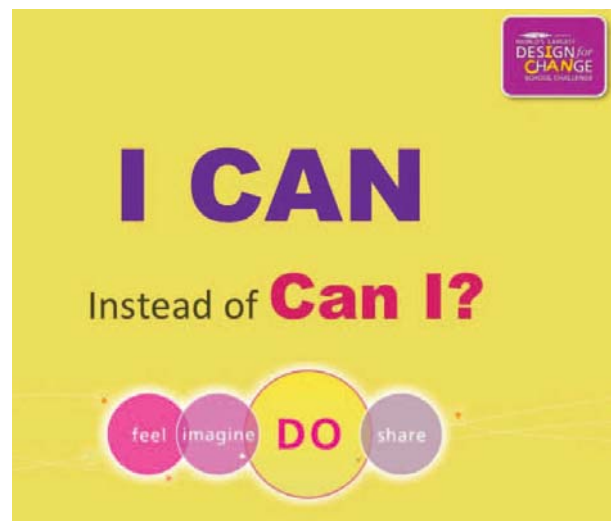
With the aim of translating common sense into common practice, Kiran Bir Sethi started the Riverside School- as a laboratory to prototype design processes that enable “exceptional” teaching and “transformative” student participation. At the school, all curriculum is custom-developed year-by-year, tested with student feedback and then modified. Both processes and outcomes are captured on paper, documented for future use and refined.

What the common sense approach has demonstrated is that you can get children to care about quadratic equations, photosynthesis and poetry **AND** also be concerned and sensitized to child abuse or democracy. It is no longer just about being the best at math or science or even the strongest or fastest, it is becoming increasingly important to recognize our children for attitudes such as empathy, collaboration, adaptability and skills such as team work, problem solving, digital literacy and design thinking. These skills and attitudes are recognized by leading educationists as the ‘21st century’ skills!

In response to the felt need of including children in the spirit of giving and believing in their ability to make change, the Riverside Team launched **Design For Change** in 2009. In the first year itself, DFC reached out to 30,000 schools in India, encouraging

students to create change around them. Today the movement has spread to over 35 countries and is inspiring millions of children to **be the change they wish to see in the world**.

Design for Change (DFC) asks students to do four very simple things –Feel, Imagine, Do and Share (FIDS). Using this easy framework, children of all ages are coming forward, speaking out their minds, designing and implementing projects that really touch the heart of their communities- from tackling age old social problems like caste discrimination and female infanticide to reducing the weight of school bags, from vaccinating girls against a dangerous virus to helping the unemployed get a job, from creating a better learning environment at school to taking charge in local communities to teach their grandparents, children are proving that they have what it takes to design a future that is desired.



FIDS Process

The first step of the process is to **FEEL** – anything that bothers the children, anything they want to change. This involves analysing why this specific problem bothers them, observing the human patterns that underlie the problem and interacting with the various stakeholders involved in it.

The next step is to **IMAGINE** the best-case scenario. It encourages children to think about what the situation would look like if they were given the power to re-design it! At this point, it is not necessary to think about the feasibility of the solution. What is important is that they let their imagination go wild and actually **visualize** the desired solution.

The next step is **DO** – implementing their imagination. Keeping in consideration all the resources available the students develop a plan of action to actualize their best-case scenario. Once the strategy is in place, they go out and implement it!

And the last step - **SHARE** – encourages students to reflect upon and share their experience with the wider school community, with parents, and with the world! This allows other people to replicate their solution if they face a similar problem and also delivers the message – if we can, so can you! It also allows for public scrutiny and suggestions that can enrich their story of change.

The classic example to demonstrate the effectiveness of Design Thinking and FIDS narrated at Riverside involves the 3rd grade students who wanted to tackle the pile of garbage that sat outside their school gate. The obvious solution for the children was to go out and clean it and so they did. A week later, the garbage was back. The students realized that they had jumped to the first solution that came to their mind. They had skipped the essential steps to question why, to observe and to identify the human patterns that created the problem in the first place. Using the FIDS process they were then able to develop a more sustainable solution involving the people who put the garbage out in the first place.

The role of the mentor is critical to the success of this process. From the very beginning, the environment must be conducive to student ownership, collaboration and creativity. Students must be made to feel in-charge and accountable. The problem they choose does not have to be of global importance –

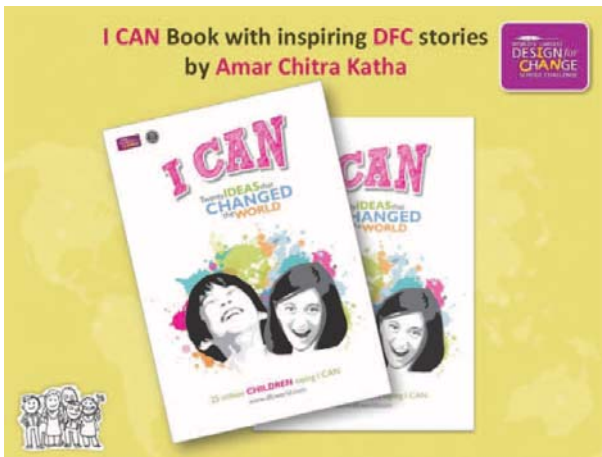
climate change or poverty or unemployment – but one that the students experience and care about themselves. The mentor must also push the students to understand the cause rather than the symptoms of the problem, allow them to prototype, make mistakes, refine and perfect their process and product. It is also the mentor’s responsibility to help the children see that to solve and even understand the problem they need to interact with the wider community. Facilitating meaningful community interaction allows students to step out of the classroom and present, defend and experiment with their ideas in front of a wider audience.

Design For Change is available for teachers and students to be used in two formats.

The Design For Change School Challenge is a one-week challenge that asks children to identify anything that bothers them and provide a solution to it. This is the first step where children learn to say I CAN instead of CAN I? All the DFC resource material is available online in 9 Indian languages and 6 Global languages – free for anyone to download! The DFC website ([www.dfcworld.com](http://www.dfcworld.com)) has become a great platform for sharing stories of change where students from across the world find inspiration in each other’s work.

The other format is the DFC Curriculum, which can be implemented by the teachers for an entire academic year allowing the students to work on more long-term solutions. For schools that have “Value Education” or “Socially Useful Productive Work” period, the DFC Curriculum serves as a great framework for these sessions. The publishing house Pearson Longman has even included the DFC Curriculum in their middle school value education textbook series titled “A Beautiful Life”.

In addition, Amar Chitra Katha (ACK), the leading publisher of children’s books in India, has captured these student-led stories in an entire book titled “I CAN – 20 ways in which children are changing



In 2012, Design for Change hosted the very first of its kind 'Be the Change Conference' wherein designers, performers, students and teachers from across the world came together to share their DFC experiences. The average age of the speakers at this conference was just 14 years! The success of the event made it clear that if we just give children the opportunity, they will surprise us!

Four years since its launch and in over 35 countries our DFC experience has only strengthened our belief that EVERY CHILD CAN!

the world". This book contains 20 stories of change all implemented by young citizens around the world! ACK also turned a few DFC stories into comics to be printed in Tinkle Magazine- the celebrated comic magazine in India. Through ACK and Pearson Longman, students are reading about and finding inspiration in heroes their own age!



BTC Conference



PARUL PATEL is the administrative backbone of the Design for Change (DFC) Initiative. Associated with Riverside School since 2011, she has been actively involved with Design for Change since its inception in 2009.

GAURI MIRASHI is the coordinator for DFC India. She looks forward to hearing from you at [india@dfcworld.com](mailto:india@dfcworld.com)



## 02 Freedom from Teaching

Meenakshi Umesh

### Introduction

I am no expert at anything and I would like to say right at the beginning that I am still learning. My ideas on what a school should be like are based on my memories as a school teacher. To be frank, when I started Puvudham learning centre I did not know how children should be taught or what kind of an environment children needed, but I did know that, as a student, I had not learnt anything of value in the classroom. So I presumed that all children do not learn in such environments.

Based on this presumption, I looked back on my experiences and realized that most of the memories were of anger and resentment at the school and teachers. It was then that I felt that I wanted to be different: I did not want any child to look back on her school life and remember me with such negative feelings.

It was then that I came across the words of a famous teacher. *A young monk once asked him, "Tell me master, what masters are for?" He had smiled and replied, "Well! They're for nothing at all! They teach you what you already know and show you what you have already seen."* This stuck in my mind.

I was further educated by my children as I observed how they learnt without being taught! I observed that the child uses its body to learn. The body is the first tool for learning. The body teaches the mind and the mind builds a world of pictures, experiences and actions that the body is involved in. The body experiences are instrumental to construct the outside world inside the mind. Trust, self-confidence, co-operation, honesty, truthfulness, sensitivity, autonomy and other

positive (and even negative) attitudes stem from personal experiences. I also observed that anything was learnt fastest and best when the child decided to learn it. Learning is full of challenges for the mind, even when the will is its own. This being the nature of learning, the role of the teacher was an enigma to me.

The child's mind is very active and inquiring. I was surprised by my daughter's perception when she was around three years old. She was able to deduce where our cows were grazing by observing the egrets flying around. She knew that the egrets liked to perch on the cows. She sucked all the grasses and flowers and knew which ones had nectar or sweet sap in them! She could recognize the differences in the grasses just by looking at the blades. If I gave her a stem of grass that did not have a sweet sap she would say, "No, not this ma!" Even before my son, aged two years then, could voice his questions, I had observed him doing an experiment. We had a lot of small triangular pieces of Cudappah stone lying around. One day I saw him make a triangular piece of stone stand on its base and then he pushed it down. It was interesting how he touched it to make it fall. After a lot of trials he knew that if he wanted to use very little effort he must touch it at the tip. And what followed was an even more surprising. He picked up some stones and went and sat down a little far away and then threw stones at the tip to make it fall. In this activity he was engrossed for more than an hour! *And there are studies that say that the attention span of a small child is only about six minutes!*

Slowly I came to the conclusion that I did not have to teach anything, but had a lot to learn. The only use my children had for me was my reading skills.

To read them stories and sing songs, and find answers for their questions in the encyclopedia, that's all I did!

## The philosophy

When I decided to start the school, I wanted to give the same kind of freedom to move, inquire and learn to all the children. But the children who had already been to school and dropped out were very afraid to ask questions. At that time I decided to make some of the Montessori material.

The idea of working independently with their hands in the safe environment of the classroom was very appealing. Alongside making vegetable beds, composting, mulching, herbal sprays and seed selection was very interesting and appropriate for all of us since we were all farmers first.

Now I was beginning to have a clear philosophy for our school. The purpose of education is defined by our way of life and the purpose of our life. What is the purpose of man's life? Many philosophers have tried to answer this question. They have all arrived at their conclusions through different theories. But the fact remains that purpose was born before man – so to speak. The purpose of continuity of life, the purpose of harmony of living beings in any biosphere, the purpose of one life feeding another, the purpose



Observing insects

of the Sun, the Water, the Sky, the Earth and the Air. Evolving from this the only purpose of man's life would be to support all these other purposes within his limited means.

The term development is very controversial. Development as it is generally understood stands for accessibility to roads and electricity and a whole lot of comforts and products that come along with these two. But such development generally brings with it a pollutant called greed.

When we look at the tribal societies which have not got corrupted with this development, we find a level of contentment and happiness that we can not see in the most developed parts of the world. In early societies, before all this confusion about development clouded the common man's view, each society was aware of its collective dependence on the surrounding landscape and the flora and fauna therein.

Organic agriculture or farming was the basis of all great civilizations. It was the first art, craft, science and economics that man learnt. Farming was the foundation of the evolution of all the other specializations of work and study. Yet farming is now forgotten and lost in machines and spacecrafts that can do no good to anyone without the basis of farming and food production. Farming is the most important occupation on earth for nothing can survive without food. While this simple fact has not changed, the attitudes of society have shifted drastically. Farming is now left to the people who are considered incapable of doing anything else. Farming is not considered a worthy occupation. It is felt to be the lowest of occupations. Education plays a key role in this distinction. For example, most farmers cannot read what goes into the things they use in the farm. Most people cannot read the warnings on the pesticide packs. Nor can they read the instructions of self-protection. Farming is done by people who have no notion of pollution of the soil, water and air, by people who can never be expected to understand the phenomenon

of global warming, open market economy or even the importance of planting trees.

In our school we treat farming as a very important activity. Amongst career options like doctor, engineer, teacher, 'farmer' is included with pride.

### The genesis

I was born and brought up in Mumbai. 20 years in Mumbai opened my eyes to the various facets of the urban life and the realities behind these. After finishing my degree in Architecture from Sir J.J. College of Architecture, my search for an alternative brought me to Auroville near Pondicherry where I worked with low cost eco-friendly construction technologies. I had always been interested in children and schools and often went to Isai Ambalam where I met Umesh who was doing Organic farming. Being disillusioned in the same way after finishing his B tech in Mechanical engineering from IIT Chennai he was also looking for an alternative way of life.

After working with a few organizations for some years we decided to settle down on our own and practice the various alternatives in farming, construction and education. In 1992 we bought a completely degraded 12-acre piece of land in a drought-prone area of Dharmapuri District in Tamil Nadu. There were about two acres of arable land where we could grow dry land crops and 10 acres of eroded hill slopes on which we could only hope to regenerate the land by creating a forest. For the first 3 years there were good rains and we were able to do farming and a lot of soil and water conservation work. Numerous indigenous species of trees and grasses regenerated. We also planted forest trees and sowed fodder grass. The completely barren brown piece of land was slowly coming to life when the rains became erratic and undependable. In 1997 the rains failed completely. Our crops all dried up in the fields. We then understood the plight of the farmer.

That year we decided that we could not completely depend on rain-fed agriculture to support us and so

we bought some land in a valley with a dependable source of water. But due to prior intensive use of fertilizers and pesticides the first two years of organic farming failed to produce good yields in the irrigated land. In the third year natural balance began to establish itself. We were careful not to apply even herbal sprays when we noticed beneficial insects. By the 4th year the land had regained its health and our outputs improved. Around this time we decided to work with local people to convert to organic methods of agriculture, through their **children - the future farmers**.

So we started a school in 2000 based on the ideologies of Rabindranath Tagore, Mahatma Gandhi and E.F. Schumacher using methods demonstrated by Maria Montessori, David Horsburgh, Rudolf Steiner and Janet and Glen Doman. We had 7 children in 2000. Now we have 90 children in our school. The school charges a fee based on the occupation of the parents and the economic situation of the family. We also run a hostel for children of migrant labourers. There are 30 children in the hostel. The children live and learn with us. The day scholars are children of nearby farmers. All of them are first generation learners.

But we faced a problem. The parents were keen to have their children to learn English and asked us to educate them in such a way that they could find a job



Puvvidham children gardening

quickly and leave the village. They did not want any ideas about their children continuing to farm organic or otherwise. Now there was the dilemma- what do these children need to learn? Who will decide?

## The environment

*Someone has said, “The only person who is educated is the person who has learnt how to learn; how to adapt and change; who has realized that no knowledge is secure, that only the process of seeking knowledge gives a basis for security. Reliance on process rather than on static knowledge is the only thing that makes any sense as a goal for education in the present circumstances.”*

With these basic perceptions we went about designing our school environment and content. The total focus of all that we do in Puvudham learning Centre is to try to create an environment where the inherent sensitivity and intuition of the child is sharpened and encouraged rather than demoralized and snuffed out. Sensitivity to animals, to plants, to nature as an entity, to other people and to the inner personality or the self is kept alive through working with nature. We try to understand the child. We completely trust the child. Our empathy and confidence in their good nature is reciprocated by the children. We are all individuals who are imperfect and who have shortcomings. But we are open to sharing our fears and learning from our mistakes.

Each of us is accountable for our actions and any one can challenge any action. There is a great sense of



community and we share the work of maintaining our campus and toilets. Cooking, cleaning, laughing, teasing, we all have a great time together.

**Sensitivity makes space for creativity and scientific discovery and is the door to the formation of a philosophy of life and the guiding hand for self-discovery.**

In conventional schools learning has become fragmented, removed from life and has been made very abstract. It is rarely that a child can make connections between what he/she learns at school and what happens in real life.

Our intention is to **integrate life and learning** and help children to synthesize knowledge through the observations and experiences made available to the child in the school environment or the real life environment.



Telling time with the sun's shadow

## The content

Keeping all these requirements in mind, we decided to classify our learning into five basic modules:

**Five elements: The Sun, Earth, Water, Air and Space.**

The five elements are essential for survival. The children learn the physical properties and experience

these elements through their five senses. The adult just draws the children's attention to certain aspects of the element that they are relating with the concepts to be learnt. The teachers write stories and songs based on the concepts the children need to learn. Our curriculum has evolved on this foundation but has included the story telling and singing tradition as a means of passing on ideas effortlessly.

The basic essential concepts deemed necessary by the educational boards and institutions we incorporate in stories and songs which are repeated and recited in class. The children make concept drawings to express what they have understood from the stories and songs. There is a lot of talking among the children and with the teacher. The children are free to move in and out of the classroom and as long as they do not disturb the others, they can participate on their own terms. Emphasis is placed on reuse of paper, proper use of learning material, respect for other living things in the environment. Mathematical activities like counting, sorting, classifying, measuring, measured drawings, scaled drawings and geometrical drawings like the traditional rangolies are all used to include mathematics in the class activities.

Drawing is an important expression of the children's inner worlds. The children are happy to draw and we are happy to learn about their inner most dreams and troubles through these pictures which they share with us. A lot of emphasis and time is given on making drawings of plants and trees, flowers and insects, sceneries and buildings. The children learn a lot of details about the object by observing it and drawing. A lot of questions are also generated and there is a lot of discussion among the children as they observe what others have observed and they have missed.

Discussions, walks, observations and questions are a part of everyday classes. Children are guided to speak about what it is they know about the element or the concept and then the teacher helps them to build on their existing knowledge of the same.



The children are divided into groups. On an empty plot of land they decide and mark the part they want to grow plants in. They measure the plot and draw it to scale. They design the rows and decide what they want to plant. They calculate the quantity of seed they will need. They mulch, water and watch their plants grow. They measure the rate of growth, count the number of flowers and compare with the number of fruits. They observe and sketch the plant parts and the insects and birds that visit. Finally they compute the time they spent gardening and the quantity of vegetables they could harvest and make a cost analysis of their activity. They also learn to make natural pest control extracts and vermi-composting. They learn a lot about the plants, herbs, and trees, creepers that are found in the region. They learn to identify them and use them for medicine or food or composting or mulching. They are connected with the surroundings through these experiences and all their knowledge of physics, chemistry, biology, mathematics, language and drawing is evolving from this experience. The knowledge is changing and growing all the time and is ready to be used.

Since the emphasis is on generating wonderful experiences which will help the children build a wonderful, loving, trustworthy and honest world inside their minds, we make sure that the children have enough chances to meet many visitors and interact with them. They also travel to other parts of the

country and spend around 15 to 20 days in different cultural and climatic regions. Travel does open up their horizons and they bloom and their fragrance fills our lives.

**This type of knowledge synthesizing process, we believe, will empower the child and make him/her feel that their methods of learning which helped them acquire so much knowledge till they got to school is a valid method.**

**This approach has two main aims: firstly, to make the experiences that students have at the school relevant to the student's lives. Secondly, the method gives value to the children's own knowledge thereby helping them to continue in the same vein without any negativity.**

Children have a lot of experience outside the school while helping out at home, while socializing and playing. This knowledge of theirs is generally

brushed aside as useless. In our school these experiences can be discussed, validated, and used to build positive responses. The children can bring up any of their concerns and they will be taken up as seriously as any concept to be learnt.

**By celebrating and using the knowledge that children have about the environment, and by presenting farming as a positive choice socially, the children from our school will have a more balanced perspective.**

We do hope that the fact that they have had so much time to dwell on it will help them resist the universal pressure to make money the sole object of their work and maybe a few years down the line they will find ways of living a simple, dignified, economically satisfying and fruitful life based on farming and the values they have imbibed from our school.



Born and brought up in Mumbai, MEENAKSHI has a degree in Architecture from Sir J.J. College of Architecture. She has worked with low-cost, eco-friendly construction technologies at Auroville, near Pondicherry. For several years, she, along with her partner, Umesh, has practiced various alternatives in farming, construction and education in a drought-prone area of Dharmapuri District in Tamil Nadu. In 2000, they started a school based on the ideologies of Rabindranath Tagore, Mahatma Gandhi and E.F. Schumacher using methods demonstrated by Maria Montessori, David Horsburgh, Rudolf Steiner and Janet and Glen Doman. They now run the Puvudham Rural Development Trust, that works on developing effective organic farming techniques and providing a humane and child-centered education environment for children in the Nagarkoodal area of Dharmapuri, Tamil Nadu, India. For more details, visit [www.puvudham.org](http://www.puvudham.org). She can be contacted at [puvudham@gmail.com](mailto:puvudham@gmail.com)

**03**

## Towards Responsible Citizenship:

Civics Education in Anand Niketan, Sewagram

**Sushama Sharma**

“Tai\*, We have an urgent request”, children of Class V gathered around me and wanted to talk to me as soon as I entered the class. The restlessness was quite obvious from all the faces. “Yes, tell me, what’s the matter?” I asked. “We are quite unhappy with Sangharsh’s behavior with the P.T. teacher in the morning today. He has been rude and unfair with tai and we feel that he should immediately say sorry to her?”, all of them expressed their anguish. I tried to understand what all had happened in the morning and realized that Sangharsh, a student of Class VII, along with two other friends of his class, was non-attentive and non-cooperative during the weekly physical drill on Saturday morning. I was told that Dimple, the physical education teacher, asked him to be with the group or else to get out of the group if he did not want to participate. Children continued to be in the group and also were having fun together (may be they had something interesting to share more than the drill) when the teacher did not see them. Disturbed by this ongoing behavior for quite some time, the teacher gave Sangharsh a slap. Obviously this, not being a common feature in the school, feeling insulted, Sangharsh answered back saying that she could not slap him like this. The anguish stemming from the humiliation was very obvious, probably much more stark than the irritated teacher’s slap because of Sangharsh’s deprived background; his father’s addiction had led the family into violence. Having been exposed to the teachings of Dr. Ambedkar, Gandhi and also to children’s rights, he was a fearless, intelligent and sensitive child with strong emotional outbursts occasionally. According to the children’s desire, a meeting of classes V, VI and VII with all the teachers was called and the matter was taken up for discussion. It wasn’t that the other children

sided either him or the teacher, but they certainly had sympathy for the teacher, as they felt that managing a large number of students would be a tough job if students did not realize the importance of the activity and did not co-operate. According to them Sangharsh’s act was disproportionate to that of Tai. The discussion continued for more than three hours in which multiple questions were discussed like -

1. Was the teacher’s act right? Did she not realize that slapping the child is not a good way of making the child understand the importance of work? What made her slap the student? What else could have been the action? What was her take on the issue?
2. Was Sangharsh’s behavior correct? What made him behave like this? What made him so much disinterested in the activity? What would have been the better way of behavior on Sangharsh’s part? What was his take on the issue?
3. Should we have physical drill at all? What are the advantages and disadvantages of this activity? Should we keep this school activity or for that matter any other activity a compulsory one? Which activities should be compulsory and which could be optional and why?
4. What if one doesn’t feel like participating even if one believes that the activity is important? When such situations occur? When such a condition arises, what does a teacher and student do?
5. What are the acceptable ways of communicating our situation to others fearlessly?
6. What is freedom? How do we differentiate it from whim? Do we have the freedom to act in a way that hinders the well-being of others?

\*‘Tai’ is the term used for the teacher, meaning sister in Marathi

7. Why do we react negatively sometimes? Does it help? What can be the better ways of actions then? How does a small thoughtful pause help us to act with reasoning?
8. Is discipline important for an individual? If so what could be the right way of disciplining-externally driven or internally driven? Is this process different for children and teachers or adults?
9. What is the role of others who are present at the time when any such inappropriate incident occurs?
10. What could we do as a school hereafter?

The whole discussion led to an understanding at everybody's level to work further with mutual understanding of a certain kind. Sangharsh was sorry for his impulsive and distractive behavior. He shared that many times if things go against him or his ideas, he gets furious and reacts and is unable to control his anger. Tai felt sorry for her lack of patience and thought that she could have handled the situation differently. Other children were satisfied with the discussion and the teacher's group came out of their restlessness over Sangharsh's behavior. It was also decided that if a child is unwilling to participate (beside the normal reasons for which children are already being allowed / suggested to rest) in any particular activity after giving a full thought to it, he or she should be allowed to do so till felt necessary. However, he or she must choose any other activity of interest and should not disturb or distract others. Over a period of time, the child may give a second thought to the decision taken earlier. All the same everybody was consistent on not giving an excuse to anybody (except on health grounds or any other jointly acceptable reason) for the cleaning work as it was considered vital for individual development.

This whole incidence narrated here is the part of all the efforts that we have been putting to make the school work democratically. School is a small society where everybody has to follow certain rules.

Mostly rules are made by the school and children are made to follow them. If there is violation of a rule, children are punished, mostly without listening to a cause which can be worth. No dialogue is held over the reasons for specific rules. Civics is an important subject through which we intend to equip children over a period of time to be a responsible citizen of a democratic society. Thus, it becomes important for all those in education to think of the ways of creating opportunities for our children to get ready for such roles. Our children need to understand the meaning of the concepts like "social republic". They should be able to both understand and analyze in their social context and feel the need of the constitutional values like –

1. Justice-social, economic and political
2. Freedom-of thought, expression, trust and religion
3. Equality of status and opportunity

Children also need to understand the meaning of the words like 'Unity' and 'Integrity'. It is important for them to realize the difference between the Nation and the country; and thus to understand the sociopolitical processes those nurture togetherness among people and those just emphasize boundaries at the cost of hatred. Our children need to critically understand the traditions of rich cultural diversity at the same time cultural discrimination therein so as to nurture in themselves the right attitudes to take decisions in their daily lives. The important challenge is also to give them an opportunity to understand the new socio-cultural and economic discriminatory processes that are affecting our social surrounding, our beliefs and practices.

Children have a lot more ability to analyze things than the adults / teachers think. Underestimation of their capacities is largely due to the non-readiness of adults and teachers. It is important to realize that children construct their own concepts and thus we need to change from banking approach of teaching to

an approach that gives them an opportunity to do and explore, observe, think and analyze the world around them critically. The natural and social environment and happening therein provide immense learning opportunities for the child. The requirement is that we, the teachers, come out of excessive dependency on information based standardized textbooks (which mostly have been taking care of the interests of a specific class and culture). Children in the open air of the school, themselves take cognizance of multiple things which can be used as the entry points for further investigation and mentoring thereby making learning process more participatory. News items – from local to national and global, gathering of relevant data, listening/referring to multiple views on different matters, discussions, etc all these help children to develop their own ideas and opinions. To make this happen, the teacher needs to be an eager learner himself/herself. The culture of dialogue and enquiry needs to be nurtured. This is possible only when the teacher has a deep respect and love for the child. With this readiness, it is possible to be comfortable with children in a democratic mode.

To quote an incidence of the kind, I remember, students of class IV coming to me with the desire to organise a school rally against corruption a year back. This was in response to Anna Hazare's nationwide agitation. This initiative from children's side was used as an opportunity for understanding the criticalities of corruption. The proposal was put up in the school meeting to which children from class IV to VII responded very positively. We did come up with a small rally but only after a rigorous exercise. At the end of the discussion, the initial list of readymade slogans like, "Anna aap aage badho, ham aapke sath hai" were replaced by self-made, self-driven slogans like- "MeheNat se khayenge, bhrashtachar se ladenge". Understanding the structure and working of the republic was also understood as a part of this process. Selection of songs to be sung on the streets, preparing banners, taking permission from the police



Rally against corruption

station, all such activities were of immense interest to them. The incident made them realize that citizens should be vigilant about the working of the government at the same time has to be self-disciplined. It needs to be ensured that mere collection of information and understanding is not sufficient. Children should be encouraged to take up action as per their ability or else the whole effort just becomes a wishful thinking waiting for someone else to begin.

Manual labour has been looked down upon in India. Excessive importance to intellect with an aspiration for white collared jobs has been the Indian feature for centuries. This has led to a social imbalance leading to a stark difference in the haves and have not's. This has also led us to underestimating the creative energies and contributions of a large section of the society which have been the producers, craftsman and service providers. This lack of acknowledgement of traditional wisdom has also been of great disadvantage to us as this has led to bookish, inactive, non-creative and sterile education greatly deskilling the Indian population. This has also led to the unconcerned and arrogant attitude on the part of the people in white collared jobs. To combat this, Anand Niketan has a balance of 3 Hs- Hand, Head and Heart as was suggested by Gandhiji for the holistic development of an individual. Gardening, Cooking, Vastrakala (Art of fabric making- spinning, embroidery, stitching, block printing etc.), art and music, clay work, cleaning, repair and maintenance of simple machines etc. , all such experiential learning opportunities (along with

the normal subjects taught in mainstream schools) have not only been helping children develop practical skills and intelligence, but have also been helping in providing opportunities to understand the world

and its complexities better. These pedagogic features have certainly helped the teachers and the students in realizing the meaning of SWARAJ to some extent.



Studying soil erosion



Engrossed in taking care of their vegetable beds



Learning by doing



SUSHAMA is the Principal of Anand Niketan, Sewagram, Maharashtra. The school is inspired by the Gandhian Philosophy. Anand Niketan is a school for children from 3 to 13 years, started in 2005 in the premises of Gandhi Ashram as a neighbourhood school and today has a strength 170 children. With an academic background of M.Sc. Anthropology and M.A. Elementary Education, Sushama has been working in the field of education for last 25 years. She can be contacted at [sushama.anwda@gmail.com](mailto:sushama.anwda@gmail.com)



## 04

## Innovate to Empower

**Sudha Mahesh**

*“If we teach today’s students as we taught yesterday’s, we rob them of tomorrow.”*

*- John Dewey*

Needs of children are plenty and they continually move from general to specific and group to individual. Some of their virtues like immense curiosity, vivid imagination, deep interest in exploring their immediate environment, sponge-like assimilation, long span of attention in what interests them, non-stop questioning, physical energy and many more, always intrigue me and make me wonder how such young bodies are gifted with such dynamism.

I notice that when students follow their own interests, independent identity or a “sense of self” is established. This is true of all children no matter how old they are or what backgrounds they come from. If provided with a conducive environment and diverse opportunities, favourable for nurturing intellectual ability and unparalleled capabilities, they are sure to develop life skills because everything they do or learn seems to have a bearing on their future.

This only further strengthens my belief that students require facilitators, not teachers, to guide them through their learning process.

Looking back at my own experience, I started my first job little realising that I would be required to teach math compulsorily. My jitters started. I remembered not being a very good student of Mathematics. I took time to grasp new concepts and understand their relevance to daily life. In retrospect, it struck me that, teaching has long been mostly teacher-centric, using the traditional “Chalk and Talk” approach, directing children towards gaining knowledge needed just for

scoring marks. This methodology failed to recognise the fact that learners can be visual, auditory or kinaesthetic. I, for one, was surely not an auditory learner. Hence it did not help me much. My assessment made me shift my focus to include skill building in my teaching to help students enjoy learning. In order to keep abreast of the shift and to raise the bar towards such changes and challenges, I consciously introduced a lot of innovative teaching techniques that focussed on developing problem-solving and critical thinking skills in students.

It also opened my eyes to the fact that students need to be developmentally ready and this will depend not on their chronological age but on the first hand knowledge they get for expanding their intellect. It is very essential that all educators understand this difference. It’s never late to learn.

The minute I understood this, I was able to enjoy Math to the extent of authoring books for Cambridge.

Capabilities apart, children must also understand what, why and how, things happen out there in the society to which they belong and to which they need to give back. Society is not an arena merely to contest capabilities between people to find out who is better but a balance between many individuals with varying interests, ideas, opinions, limitations and let downs. Our teaching should help students recognise this equilibrium and not just develop their academic capabilities. One is considered successful not when he is standing alone as a literate person but only when

he is sensitive and is able to bond with a nurturing network of people, no matter what their strengths, weaknesses and abilities are. The universal truth is, if we do not prepare children for inclusion and acceptance by peers early, they will be paying a great price to strike the balance later.

Today we are at the cross roads with greater awareness about the need for flexible education based on life skills. It is very essential that students learn to deal effectively with the demands and challenges of life and the society tomorrow.

My personal experiences and strong conviction about what empowers students, has made me implement skill based teaching / learning programmes using innovative teaching methods across the curriculum in our school. To facilitate this, we work with a classification of learning objectives, dividing learning into lower order and higher order skills. While acquiring KNOWLEDGE, UNDERSTANDING AND APPLICATION, are considered lower order skills, the ability to ANALYSE, SYNTHESISE AND EVALUATE are considered part of higher order skills. While it is essential to have the lower order skills, it is necessary to inculcate the higher order skills to empower every child.

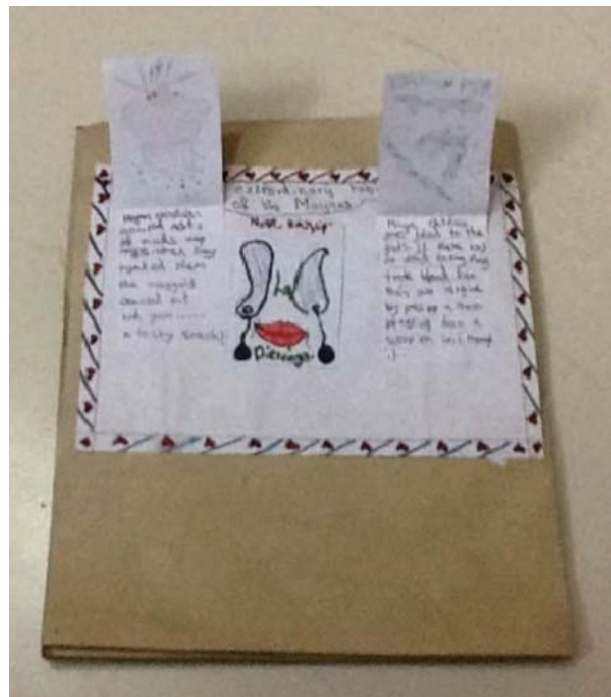
One may ask what innovative teaching is. To me, any teaching that can clearly communicate the teller's thoughts to the listener without difficulty and make one apply the learning both in known and unknown situations, thus strengthening oneself, is innovative teaching. Such an education will not only take a student to a higher platform but also help him take his society and the nation forward. It is important that this awareness cuts across all and reaches far and wide.

There isn't a fixed format for teaching through innovation. Challenges are all around us and so are ideas. Thinking "out of the box" brings about ideas; ideas aid creativity; creativity connects different facets of knowledge; knowledge gives strength.

Given here are some activities done at our school to make teaching and learning fun and effective.

### **"To be a Mayan child"**

While studying Mayan Civilisation, to arouse curiosity and give knowledge about Mayan childhood, the students of class 5 were organised into small groups and given a set of cards representing simple images connected to aspects of Mayan childhood. Children took turns to be 'Kim' (a Mayan boy) and tested the other's ability to observe and recall the order of the cards. The game made the children familiar with the images. So, they were later able to make quick connections between the image and the historical detail. The factual knowledge was recorded in a lift-the-flap format and the children recalled facts using a visual clue. Once the knowledge was embedded, they were able to reflect upon aspects of what it might have been like to be a Mayan child 2000 years ago!



### **"Around the world in 80 minutes"**

As an extension of an English lesson where students studied about an audio guide tour of Taj Mahal, the 7th graders, dividing themselves into 7 groups, pre-

pared an around the world cultural extravaganza through a well-planned audio guide tour. As a first step, they heard Museum Directors speak, noted the formal tone and the factual details captured in such descriptions before scripting their own audio clippings for a few main cultures in each continent. After recording their scripts they made an audio presentation to students and teachers along with some charts, maps and artefacts. The classroom was rearranged like a museum with 7 locations. An information desk was set up to kick start the audio guide trail. Visitors got their passport booklets stamped before listening to the presentations through a headphone. Their valuable comments were compiled and discussed later. This novel, well planned activity, was their original creation. They had honed their researching, speaking and organizing skills. They virtually stole the show.



### “Cell Jelly”

A Science lesson on animal cells for 6th graders. To understand the concept better, the students were helped to make an edible model of an animal cell and eat it too. They used pineapple jelly to represent cytoplasm in the cell, marshmallows of different colours to create the Endoplasmic Reticulum, Mitochondria and Golgi bodies, M&M’s for Ribosomes, and a pear cut neatly for the Nucleus. This hands-on activity using known food items helped them register the names of the cell organelles easily and also get an idea of the relative sizes of each organelle and their

positions. Most of all they enjoyed eating it at the end.



### “Word bands”

Yet another innovative game to check if students of grade 6 knew the meaning of a couple of complex words.

The chosen words were printed on headbands and tied around all the students’ foreheads. Everyone was able to see all the words except the one on his/her own forehead. The goal was to help a child guess the word written on his forehead by others giving him as many clues as possible. It was amazing to see the different ways in which the clues were being given. The game also turned into a team building session since children were trying hard to get their classmates to find the word. The students were pleasantly surprised to find all the words in the comprehension passage that they were given the following day. It also gave them the confidence to work independently on the passage.

Fifth graders were introduced to “fractions” through a video posted by their teacher (that’s me!) on the school’s intranet website. With children being able to access this video from their home, each one of them had enough time to view the video many times over to understand the concept. They shared their comments and understandings online with me and their



peers too. This is a part of the “flipped classroom” methodology adopted at school for all classes from grade 5, where children are introduced to a concept by their teachers through online audio/video/presentations even before the topic is taken up in class, so that, they have already set the bar for the discussion to progress from basic to advanced level in a short period of time. They use these videos for revising during tests as well. One of these videos can be viewed at:

<http://www.youtube.com/watch?v=Xa2MFPT3bOo&list=UUfVik3oDDMYFoYKD2X7rv7Q&index=1>



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05

## How the Montessori methodology gives rise to innovative teaching-learning outcomes

Uma Shanker

The Montessori Method is one hundred and five years old and to talk of “innovative teaching-learning practices” with reference to it seems to be an oxymoron!

However, the truth is that for a variety of reasons, its principles and practices are not yet widespread to make it the accepted way of organizing classrooms. Therefore, it is still possible to talk of the Montessori Method, when followed in the classroom, in its true spirit, as one that does give rise to innovative teaching methodologies and optimal learning outcomes.

Montessori defined education as assistance to life. If that indeed is our aim and if we were to state our own dreams of creating institutions of excellence where children will find the best practices suited to their specific needs and characteristic way of learning at that stage of their development, Montessori’s philosophy will give us the ideal match because her method was born out of years of observation of the child.

The classroom, set up for a 3-6 year old, is therefore different from the one we prepare for the 6 -12 year old as their respective needs and characteristics are as different as those of the different stages of the butterfly’s life cycle! While we do accept that the infant’s nutritional needs are different from the toddler’s and those of the toddler different from the school-going child, most schools seem to have been designed as though all children from 3 or 4 to 16 can make do with the same kind of classroom organization and teaching methods.

Over the years, however, many schools in private and public spaces have tried to bring in alternate ways of helping children learn.

### The Classroom

The classroom is prepared by the teacher taking into consideration the needs of the age group 2½-6 years. There is enough space for the children to spread their work mats on the floor. Once unrolled, the work mat becomes the child’s own space or territory. Some children may work on chowkis which are low tables. The materials are displayed in low three-tier shelves placed along the wall. These enable the child to see, choose and handle the materials independently. There are pictures on the wall at a height where children can look at them whenever they want and for as long as they want. These are not the regular cartoon pictures, but those hand-drawn with details of matters of interest to children. There may also be letters of the alphabet in English and the regional language written in beautiful script by the teacher. In places where the classroom is not large enough, children carry their mats and materials to the adjoining verandah and carry out the activity.

### The learning materials

In the Montessori environment there is a range of materials around four main areas: exercises of practical life, sensorial activities, language and arithmetic.

These have found their place in the environment after many years of observation of children and taking into consideration the sensitive periods or critical periods of learning. The activities have to be meaningful to children and therefore we cannot bring in material simply because we find them attractive. Our focus is on offering the child age-appropriate activities that will stimulate him to work leading to deep involvement in the activity or a state of concentration.

The materials for **exercises of practical life** help the children settle into the new environment and are built around the day-to-day activities of the adults around him. He does holding, carrying things, pouring of grains and liquids, folding dusters and napkins, dusting, wiping shelves and floors, cutting vegetables, rolling chapathis, etc. The activities are adapted to the locality in which the school is located and therefore lend themselves to the creativity of the teacher. Montessori's **sensory apparatus** are universally well known and readily available in the market with manufacturers, as also is her material for **arithmetic**. However, how rich is the classroom with **language materials** depends entirely on the teacher who creates classified pictures around a variety of themes to enrich the child's vocabulary. At a later stage, the child prepares himself for writing without actually writing by working with different materials like the Sandpaper Letters and the Movable Alphabet, (a box containing cut-outs of the letters of the alphabet, which the child arranges in order as he listens to the sounds of the letters in a word). She also prepares picture cards with name slips when the child reaches the reading stage. Booklets are prepared around various topics with single words or phrases on each page and a matching picture on the other side for the child to read and gain confidence.



Maria Montessori

## Methods followed in the classroom

The teacher shows the children the way in which to manipulate the material through a formal “presentation” of the material. There are opportunities for individual, group and collective presentations. At this stage of development, it is observed that the child prefers to work by himself and even when two friends choose to work close to each other, their way of working is not one of collaboration, rather each to his task, but in happy camaraderie.

Montessori environments provide freedom for the children from the age of 2½ to choose, to work, to move, to talk etc. But these different kinds of freedom come with certain limitations. The child, who has the freedom to choose the material he wants to work with, has to first have it formally presented to him by the teacher and then it has to be available on the shelf. If another child is working with it, he has to wait patiently for it to be put back or make another suitable choice that he finds equally appealing. This seems to be a natural way of helping children develop a sense of social responsibility and Montessori calls it the “cohesion of the social unit.” In another equally important way, this is also an opportunity for the development of the will power of the child.

The Montessori environment enables the child to explore, manipulate and work repeatedly to achieve mastery over the tasks he undertakes and to arrive at a deep understanding of basic concepts in mathematics and language and thus it prepares him for future academic work as well as for life itself.

## Learning Outcomes

One of the ways of addressing quality in education is to look at what we want our children to know or become when they leave pre- primary and move to the primary, primary to elementary and so on till they leave school with the school- leaving certificate.

“Learning by rote prevails in top schools” is the headline of the article in the Hindu (December 12,

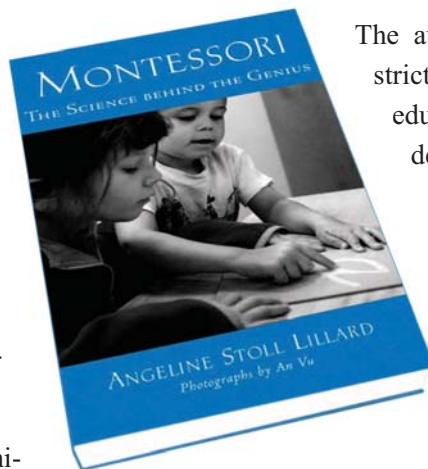
2011) of a study done by WIPRO EI. Many parents report that their children going to primary classes in private schools are asked to write answers only from the text and are marked wrong if they write in “their own words.” How do we expect children to outgrow these early expectations from teachers and suddenly start thinking out of the box when they are in high school?

Montessori states, “Growth comes from activity, not from intellectual understanding. Education, therefore, of little ones is important, especially from three to six years of age, because this is the embryonic period for the formation of character and of society....” (The Absorbent Mind, Maria Montessori)

Psychologists Angeline Lillard of the University of Virginia (author of *Montessori: The Science behind the Genius*) and Nicole Else-Quest, now at Villanova University, surveyed children who had participated in a random lottery to attend a public Montessori school in Milwaukee. The study appeared in the *September 28, 2006 issue of the journal Science*.

I quote, “A study comparing outcomes of children at a public inner-city Montessori school with children who attended traditional schools indicates that Montessori education leads to children with better social and academic skills” ...than their counterparts in traditional schools. “Montessori education is characterized by multi-age classrooms, a special set of educational materials, student-chosen work in long time blocks, a collaborative environment with student mentors, absence of grades and tests, and individual and small group instruction in academic and social skills. More than 5,000 schools in the United States, including 300 public schools, use the Montessori Method.”

Among the 5-year-olds, Montessori students proved to be significantly better prepared for elementary school in reading and math skills than the non-Montessori children. They also tested better on ‘executive function,’ the ability to adapt to changing and more complex problems, an indicator of future school and life success.”



The authors concluded that “...when strictly implemented, Montessori education fosters social and academic skills that are equal or superior to those fostered by a pool of other types of schools.”

To appreciate how effortlessly children develop their social skills in this kind of environment, I quote, Mrs. Padmini Gopalan, president of the Sri

Ramacharan Trust: “One of the friends of our Trust wanted to celebrate a family event at the Chennai Schools, Corporation of Chennai, in Mylapore where we had set up a Montessori classroom. She brought the children some sweets and snacks one afternoon. The children were asked to sit in a row around the classroom and the visitors started serving them the snacks. I was amazed that the children between 3 and 5 years waited patiently to be given the sweets and savouries. There was no clamour, no demands, no crying and yet there was no fear either of the teachers or the visitors. One of them even commented on the food and said, ‘This vadai is very good, but it must be from an Iyer home, because there are no onions in it!’ Is it because they have learnt to wait for the materials to be available to them and now trust that they will get their share?”

The qualities that a child of six may reveal when he leaves the first Montessori environment are self-confidence, self-esteem, a sense of responsibility, the ability to articulate his thoughts, self-motivated learning, commitment to completion of a task that he

has taken up, and most of all, the ability to concentrate on the task at hand. Each of these qualities, if we consider them as learning outcomes, can be illustrated with experiences from the classroom.

For a child an important prerequisite for all learning through his school years is the ability to concentrate. A constant admonition from teachers and parents to the child is, “if only you paid attention or concentrated, you could do so much better!” But where are the opportunities given to children to concentrate in a natural manner?

In the Montessori environment, children are able to achieve a certain level of attention and mindfulness, even within a short time of joining school. One of the first activities in which a child may start concen-

trating is when he starts threading beads and later when he starts transferring grains from one container to another. This habit formed early in life develops naturally when the child carries out activities which he has chosen because of his inherent interest in them.

In conclusion, if as educators, we have dreams of creating meaningful learning environments, we should start as we mean to go on. When we view early childhood in this spirit, it becomes crystal clear that we need to develop practices that focus on the holistic development of the child in an organic manner that gives the time and space for the natural growth of the child.

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**06**

## Constructing History – bringing enquiry into the History classroom

**Sriparna Tamhane**

One of the reasons why students dislike History is because they cannot connect with it. They don't understand the past in a way that enables them to compare and contrast events, periods and individuals or to make links across time and understand the present in the light of the past.

Another reason for disliking the subject is because students are not often given experiences which make them enquire. Enquiry helps students appreciate the true value of studying History – thinking and planning a way through a problem, asking questions, undertaking research, identifying relevant evidence and evaluating its reliability, moving from tentative to firmer conclusions on the basis of that evidence, making conclusions (tentative or otherwise) and effectively communicating it. Through the process they get an opportunity to think like a historian and construct History.

While introducing the subject to the students of class six in a school run by J. Krishnamurti Foundation in Pune, I often pointed out that everything had a history: the children themselves to begin with, their families, their school, places and objects they were in touch with. I encouraged them to explore and construct some of this history.

One such experience led us to investigate and construct the history of an old temple in the vicinity about which none of us in the school community seemed to know much. It was a challenge indeed, since having chosen a not-so-well-known temple, I was not sure whether we would find enough evidence to enable our research. I began nevertheless, realizing that the children would have at least gone through the process of enquiry and realized how historians worked.

Since we had no literature to fall back on, we began by visiting the temple which required a couple of hours' climb up "Shambhu hill", named after the Shiva temple we were about to explore. Twenty of my twelve year old students and I trudged up the hill along with our sketch books, notebooks and pencils, with excitement and a spirit of adventure.

I had requested the priest to be present during our visit, in order to guide us. The initial part of the visit included exploring the temple premises. The children observed and learnt about the different parts of the temple: the 'garbhagriha', where the main idol was housed, the 'sadhana sthal', the place for prayers, the 'mandap' in the centre, where people gathered, the 'tulsi sthan', with the basil plant, an important part of any Indian temple, the adjoining 'Bhakta nivas' constructed to shelter pilgrims, the 'parikrama' the path built around the temple for circumambulating, the 'shikhara' or the spire above the temple, a common feature of temples specially in north India. etc. They also found out about the material used for the construction of the temple. This was, in a way, their first lesson on temple architecture. Children captured sketches of different parts of the temple in



An Old Hindu Temple



Sunrise at Shambhu Hill

their sketch books. It was later a treat to see some of these sketches, often with intricate details, demonstrating not just their artistic skills but also their keen observation.

The shocking discovery that women were not allowed into the ‘garbhagriha’ (sanctum sanctorum) led to a series of questions and induced much indignation among the young ladies in the group; an incidental learning about gender discrimination in places of worship, for biological/cultural reasons that the budding critical thinkers found outrageous. Several other questions like “Is it necessary to go to a temple to worship God?”, “Why are most priests men and not women?”, “Why does one have to perform certain rites to please God?”, “How can sacrificing an innocent animal be a part of worship?”, “If the purpose of all religions is to spread peace then why is it that we fight so much over different religions?” were raised by the children and discussed over the next few days. Clearly there were beliefs and traditions that they could identify with and some that they could not. It was reassuring to know they were not too inhibited to question some of these.

The priest also told us about the social, cultural and economic dimensions of the annual ‘mela’, an event during which the otherwise deserted monument suddenly transformed into a hub of activities pulling people from the neighbouring villages in flocks. This led to the next question about the management of the

temple. Who organized such events? Who managed the day to day affairs? How was the money required for the maintenance, generated? The priest referred to a Trust that had been formed, to handle the temple affairs.

During our tour, we constantly looked for evidence in the form of inscriptions with recorded history. We did find a couple of inscriptions, which told us it was 200 years old, that a Holkar king had chanced upon four ‘Shivalingas’ at the site while hunting and that Ahalyabai Holkar had funded the building of the temple. The children later followed this trail to find out the connections that the Holkars had, with the region they lived in.

We also asked the priest, about the history. He narrated this in bits and pieces, with several interesting anecdotes, which we tried to put together. We had to relentlessly probe however, in order to know more.



Inscriptions on a temple wall

At the end of the visit we did have a narration. It was important for the children to realize however, that what they had just heard as the “history” was but only a version created from the memory of one person, orally conveyed to us. Surely there would be other pieces of evidence to corroborate or support or challenge that version?

Our sincere attempt to locate some literature, however, was initially in vain since we could not lay our hands on a single source.

We now decided to check whether other versions of the history existed among the people. We visited the local village nearby and met the village head as well as an old school teacher, who gave us some glimpses of the history, most of which seemed to be similar to the narration of the priest. We now wanted to get in touch with at least one member of the Trust. Our endeavor led us finally and quite miraculously, to a source of significance – a copy of a document which was of immense value to us.

The creation of this document had a history of its own. At some point, in order to preserve the heritage of the place, the people of the Trust had wanted to renovate the temple as it was very old. They had intended to provide drinking water, plant more trees, create rooms for shelter and parking spaces for all pilgrims. They had soon realized however, that the land on which the temple had been built, had belonged to the Forest Department and therefore, in order to renovate, they would need the permission of the Central Government. While drafting a proposal to the Government of India, they had to put together the history of the temple and the religious and social significance of the monument. The total cost of the project was 15 lacs. Since the monument had been recognized as a ‘Class – C’ place of pilgrimage, they had hopes of getting from the government the money needed for the renovation.

The most propitious moment of our journey was to get hold of an old, dusty, bound version of the copy of this document. The children spent time in studying the proposal, retrieved from it whatever information they could and cross checked some of the information gathered earlier.

The document actually did corroborate most of what the people had narrated orally. Since no formal book on the monument had apparently been written, this was as far as we could possibly go in constructing what was a tentative history of the ‘Shambhu Mahadev’ temple but so was most of the history that we studied, was it not? Tentative conclusions till proved wrong by fresh evidence?

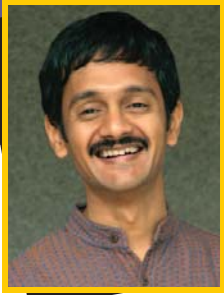
By using available sources to construct an account of the past, children learn that accounts of the past may differ, because evidence is incomplete and that the past is mostly reconstructed from different viewpoints. It is this process and this realization that I had hoped would remain with the children.

When we began, we did not know whether we would be able to go beyond the oral traditions to construct the history, whether we would come across any other corroborating evidence in the form of literature or inscription. Even if we hadn’t, the experience would still have taught us something about the basics of historical enquiry.

What else did I achieve through the experience?

Apart from generating an interest in a historical monument, exposing children to some basic elements of temple architecture, observing and discerning evidence, using a historical building to make connections between various disciplines, increasing an awareness and sensitivity towards our built heritage and encouraging a critical examination of values and traditions handed down to us, I was able to encourage children to explore, enquire and construct history within their limited sphere of influence.

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**07**

## Innovations as a 'Teacher'

**Rishikesh B.S.**

It was nearly 15 years ago that I was part of this 'group' – a breed of human beings who loved doing what they did for a living though it was very unstable in terms of a career and paid a pittance! This group had one key thing in common and that was the thrill we got by interacting with students within the four-walls of a school classroom and interacting with them by exploring a certain domain of which we were supposed to be 'expert consultants'; well, isn't this what regular teachers do, then why am I trying to differentiate this group from that of teachers? Yes, we did have things in common with regular teachers, for instance, we did engage students within a teaching-learning framework, but we were quite different from being 'teachers' for many reasons of which I'll state three key ones. One, when we interacted with a group of students, it was quite possible that, that would be the first and last time we would ever interact with that group of students in a classroom setting (so, if we wanted to be successful, we had just that one hour or less to make a lasting impression unlike a teacher who would have the entire year if not more). Two, the teachers used a textbook as their key resource material and we used the daily newspaper as ours (yes, our resource changed every day). And three, unlike the teachers in a school who had their respective resources based on their subject, everyone part of this 'group' had the same resource (the daily newspaper!), whether we were dealing with physics or biology or music or theatre or history or anything else.

The group of people I'm talking of are in popular terms called 'NIE consultants' where NIE is an acronym for the phrase 'newspaper in education'. The consultants are spread across the country in all the major cities associated with many National dailies who hire their services. The modus operandi is simple – once a person associates with a newspaper as a NIE consultant, she/he is given a list of schools at the end of every week to go to the following week. The school list mainly consists of private schools of different kinds as well as the Kendriya Vidyalaya's (KVs) in some cities. The consultants' task is to conduct classroom based sessions with students of these assigned schools. These sessions are class-wise and a consultant could have any class from I to XII assigned in a school. When the schools opt for the NIE program (The program is today run by most of the National dailies across all the major cities of the country; the genesis of this program is an innovative experiment that New York Times started in the early 80's and by the end of the decade it had arrived in India under the aegis of the Times of India. The program soon caught the fancy of other large newspapers in the country such as The Hindu & the Deccan Herald), they decide which of their classes will be part of the program and each school comes up with its own logic to decide on the classes; for instance, for the KVs classes XI & XII was in the program because they felt these teenaged students will benefit the most out of a program of this kind by giving them different perspectives & providing a 'world view' of

many things; for some schools the higher primary students were ideally suited and not the lower primary ones, while some other schools felt that all elementary level classes could find this program useful but not the high school classes and so on. For many schools high school classes were not to be disturbed as their focus would be on preparing for the boards and in such schools it was clear that NIE program was looked at as some extra-curricular stuff. However, there were many schools who felt the program sits well into their plan of holistic development of their students. For the NIE consultants, all this variety meant opportunity to engage with different kinds of students in different kinds of school settings and in that was the challenge as well as the excitement. I was part of this group of ‘expert consultants’ in the city of Bangalore and in the four years that I was part of this program I got the opportunity to engage with more than a 100 schools and with students from class I to class XII. It is based on these four years of experience of interacting with students on a daily basis that I attempt to write this article from my memory of the exciting classroom experiences and all the preparation that went into each of these classes. My attempt is to share the kind of preparation that went into these sessions and how it all unfolded within the four walls thereby hoping to provide some insights to those who may wish to experiment with this pedagogical approach.

For most NIE consultants the day begins with a thorough perusal of that day’s newspaper and identifying stories that have appeared which can be used as the TLM for that day. Post this, the a fast - paced preparation begins by checking the school list to see which are the school(s) that have been assigned for that day and the classes in those schools which one is supposed to be engaging with. Once this is noted, the consultant consults memory or the diary to check if the school or the classes are first time visits or a repeat visit based on which the in-depth prepara-

tion of mapping of the stories in the newspaper to the class syllabus and competency level is done. An example will be in order here: the International news these days is dominated by the political confrontations in Egypt. Assuming that one of the lead stories in the paper is on Egypt and related to the President Morsy’s attempt to assume autocratic powers, and if one of the higher primary classes was part of the engagement on the given day, an automatic choice for a History consultant (which I was) would be to ‘take’ students into Ancient Egypt! Drawing references to the manner in which the Pharaohs ruled regions around Egypt for many millennia in the period before the Common Era, comparing it to the current protests in Egypt against the presidential decree and then engaging the students in discussions on current political paradigms we operate in would have been the plan. However, it is most important to keep the plan flexible as at most time the consultant would not know at what level to pitch the content because it could be a first visit to the school (yes, this gets taken care of in repeat visits when one has a fair idea of the level at which students engage in a particular school; so, in that sense, my experience tells me that usually it is at the school level rather than the class level, at which student engagement levels can be benchmarked). Interestingly, many a time, the plans fail sometimes moderately and at times com-



pletely. Hence, though there is a critical need to have a plan for the sessions, it is even more important to have alternative plans. For example, going with the above mentioned Ancient Egypt lesson plan into a class VII, one may find that the students have very little idea of anything that you want to talk about – they may not know what is the ‘common era’ and trying to explain the period one may realize they are unaware of the Gregorian calendar and what constitutes the period before Christ and so on. In which case, one begins by pitching it at a level far lower than class VII – explaining the idea of a ‘timeline’ and plotting various incidents on it beginning from the most recent mega events and then attempting to get them into a discussion on how things may have been many, many years ago in Ancient Egypt is one approach that could be taken. In some schools, this could be a level one pitches for students in class III! This, in fact is what made the consultant’s life exciting.

On the other hand, one could encounter students in a school who are completely clued into these aspects. The school could be an elite one with students having access to technology within the classroom and even their home background contributing to these high levels of understanding of the content. In such a scenario, it is imperative that the consultant brings to the discussion fresh perspectives and alternative thoughts to have an effective engagement. In fact, it is for these situations that consultants would have to do their ‘morning’ fast-paced homework diligently. There is nothing more embarrassing for a consultant than to get into a class and realize that the students know just as much or much more on the topic planned for.

The other interesting thing that many consultants did is to integrate different subjects in the discussions. To elaborate this point let’s stay with the same topic on Egypt. As a History consultant, it is a lost opportunity if we don’t weave into the discussions aspects which

technically would be studied under the other streams of social science such as Geography and Civics. For instance, the unique location of Egypt on the rim of the Mediterranean with the access to waters that lead to Europe and the desert that leads into African mainland are important geography related data points that connect into various incidents in History from the more recent Suez Canal related events to those involving the Roman emperors and Egyptian rulers like the tragic story based on Cleopatra & the Ceaser; similarly, the discussion on autocracy could bring into discussion various forms of Government, virtues of democratic models of governance allowing the students to explore and deepen their knowledge ultimately leading to emergence of fresh perspectives going much beyond what a focused discussion on history would have yielded.

There are many lessons I could take away from these experiences. I believed that my sessions left a lasting impression on students and my belief was reinforced every time I either had a student (whom I surely would not have remembered) or a staff member of a school (who also sat in these sessions many a times) not only identifying me as a NIE consultant, but also recounting the session I had taken in their school many years ago. If such a lasting impression can be left on both, young and old minds, with just one session, the question is how one could do this on a regular basis as a regular teacher. The answer of course is in the practices that are there to see by the many wonderful teachers that we have, who by their sheer diligence, hardwork, innovation and love for their students go that extra mile to understand their students before engaging with them. For the NIE consultants like me, that was the trick. To figure out as early as possible in the session as to what the students knew or did not know and build on it with things that interest them.

The hard work for the NIE consultants came in the form of the impermanence of the resource material

that we were allowed to use. One could argue that without this challenge and with a more permanent material like a text book, the consultants could have planned in advance and hence done even better in delivering this program. But the successful consultants were the ones who turned this handicap or the challenge into an opportunity by working hard & in fact made the ‘rest’ feel that using that day’s newspaper as the resource material made life easy! For a ‘history’ consultant dealing with the ‘dead’ past, using the daily newspaper as a resource did come

handy in one respect – students realized (without having to communicate explicitly) that the content we were engaging with had current relevance!

Well, the best part is that what is mandatory for NIE consultants, is an ‘option’ open for all teachers, irrespective of the schools they work in, syllabuses they follow or the students they engage with. How about making the newspaper your key resource material when you engage with an audience the next time around?



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08

## Music of Language - Language of Music: Teaching/Learning through Music

Nalini Ravel

*Music gives a soul to the universe,  
Wings to the mind, Flight to the imagination...  
And life to everything.*

- Plato

*Music expresses that  
which cannot be said and on which  
it is impossible to be silent*

- Victor Hugo

Music is an integral part of human life. We use it to communicate, educate, inspire, entertain and instill a sense of social understanding.

I always believed that music is a very strong tool to learn/teach language. Whether it is pure classical music, folk music, film music, pop music or the soft background music being played during teaching-learning process – all contribute in the development of language skills.

This is the reason that I used music in my teaching and have seen positive results of it.

Since my childhood I was very fond of music and the home environment was also very musical. We were told legends about Tansen that he could bring down rains with his rendering of Raga Malhar and start fire or light lamps with Raga Deepak. It is also said that he was able to bring wild animals to listen to his music with rapt attention. Such was the power of his music! So as a teacher I could relate to the importance and power of music in the classroom processes. I had also read a few articles which suggested that the music can contribute to the cognitive process and impact the learning and that the researchers have discovered that music stimulates specific regions of the brain responsible for memory, motor control and language.

### Why Music?

The rhythm, rhyme and repetition of musical sounds and lyrics attract children because music engages a child's mind, body and soul in a very interesting way. Use of music makes learning joyful for children and they are able to imbibe new information easily. Even as adults we experience this. Can we ever forget the popular jingles where advertisers have used musical techniques for years? Some of the famous jingles like - "Lifebuoy hai jahan, tandurusti hai vahan", "Vicks ki goli lo, khich-khich dur karo", "Badshah masala" and "Nirma ...Washing powder Nirma", "Hamara Bajaj" or "Karram kurrum lijjat papad..." are created specifically to help us remember these products. If advertisers can get consumers to focus and remember their product, why can't teachers use a folk tune, shloka chant, poem, or for that matter a film song to teach language skills and concepts? It would definitely make teaching learning process more effective. Because music can:

- Increase the ability to listen and learn
- Bring element of fun to the classroom!
- Increase attention, retain and recall information
- Relax the mind
- Improve students' reading, writing, and thinking skills

- Enhance creativity.
- Help multisensory learning (auditory-listening, visual-dancing, kinesthetic-clapping and tactile-playing an instrument)
- Cater to different learning styles - children with special needs

But how to begin? The question did bother me for some time. But I had to start somewhere. So in my primary classes, I began with singing the poems of the text books and making the children to sing them. One child started tapping the desk the moment we began singing. It took just a few seconds for all the children to become ‘tabalchi’ or drum player. One started beating his tiffin box and the other started ‘playing’ his spoon-glass, the third one started clapping and the fourth one was tapping his feet on the ground! It was a little noisy but all were very happy and class was lively! From then on it became a regular practice to sing the poem across all the classes, from primary to +2 levels.

The next challenge was to go beyond singing the poems of the text book and use songs/music to teach new concepts. To do this I planned to pick a few words that were of the children’s level and interest and were pertaining to the competency that had to be taught, write my own songs and set them to a simple tune.

Soon I got an opportunity to implement this idea. I had to teach the Hindi names of ‘weekdays’ to second graders of my English medium school. I chose simple words like ‘chuk-chuk, rail, khel etc. to write the song. Now I needed a simple or very popular tune for the song. Since this was an English medium school, the children were familiar with the rhyme ‘London Bridge is falling down... falling down’. So I composed the ‘weekdays’ song in this tune. The song that finally emerged to teach the names of the days of the week was as follows:

Chhuk Chhuk Chhuk Chhuk chalti rail..... chalti rail..... chalti rail....

Chhuk Chhuk Chhuk Chhuk chalti rail  
Sarapat bhagi

Aao khelen dinon ka khel ..... dinon ka khel .....  
dilon ka khel .....

Aao khelen dinon ka khel .....  
Har ik din

Somavar ko sona chhodo..... sona chhodo..... sona chhodo.....

Somavar ko sona chhodo Susti chhodo  
Jago-jago School ko doudo..... School ko doudo...  
School ko doudo.....

Jago-jago School ko doudo  
Ghanti baj gayee

Mangal ka din bada niralaa..... bada niralaa..... bada niralaa....

Mangal ka din bada niralaa  
Kitana pyara

Masti men duba jag sara.... jag sara...jag sara...  
Masti men duba jag sara

Nacho gaao

Budhvar ko buddhi chamaki..... buddhi chamaki.....  
buddhi chamaki.....

Budhvar ko buddhi chamaki  
Padh lo pothi

Sab bachchon ne li thumki..... li thumki..... li thumki.....

Sab bachchon ne li thumki  
Nacho tum bhi

Brihaspai ne hamen sikhaya..... hamen sikhaya.....  
hamen sikhaya.....

Brihaspai ne hamen sikhaya  
Kya hai sikhaya ?

Pedon ka mat karo safaya.....nahin safaya..... nahin safaya

Pedon ka mat karo safaya  
Inko bacha lo

Shukravar ko kaho shukriya..... kaho shukriya.....  
 kaho shukriya.....  
 Shukravar ko kaho shukriya  
 Apne prabhu ka  
 Prabhu ne kya kuch hamen diya.... hamen diya....  
 hamen diya....  
 Prabhu ne kya kuch hamen diya  
 Socho socho

Shanivar ko adhi chutti.... adhi chutti... adhi chutti...  
 Shanivar ko adhi chutti  
 Kam padhte ham pothi patti  
 Shanivar ko adhi chutti.... adhi chutti... adhi chutti...  
 Shanivar ko adhi chutti  
 Kam padhte ham pothi patti

Akhir aya hai ravivar...han ravivar... vah ravivar  
 Akhir aya hai ravivar  
 Chhutti chutti  
 Khelo, khao, jhumo yar..... jhumo yar..... jhumo  
 yar.....  
 Khelo, khao, jhumo yar  
 Chhutti chutti

The children moved in a line like a train, clapped,  
 danced, jumped and learnt the names in no time.

Later, I went on to write songs on ‘*matras, sanyukt vyanjan*’ and a few more concepts in language.

*(Some of these can be heard on the digital learning resource (CD) titled ‘Hu-ba-hu’ produced by Azim Premji Foundation. A few other CDs, produced by Azim Premji Foundation, on Hindi language also have language-related songs.)*

### Using music in other subjects:

Once I came across a Fraction Song in a U.P. text book:

- Papaji bazaar se aye, sang me ek seb le aye,  
 Chunni boli main khaungi, Munni boli main  
 khaungi,  
 Bantvaaraa ab kaise ho, seb ek hai ladki do,  
 Itane me aye nanhi Radha, sujhaya usane  
 adha-adha.

- Baba laye ek tarbuz, bole chak kar khao khub,  
 Us ghar me hain ladake char, kaise bante karen  
 vichar,  
 Baba bole aao aao yaar, isake kar den tukde char  
 Alag-alag tum khao bhai, isako hi kahate  
 chouthai.

Inspired by this I created a song on Addition to the  
 tune of “London Bridge” once again and shared it  
 with my colleague who taught mathematics. The  
 song was:

### Addition Song

Thhelam-thhel bhai thhelam thhel,  
 Thhelam-thhel bhai thhelam thhel,

Aao khelen jod ka khel,  
 Aao khelen jod ka khel,

Ek hai murgi ande char,  
 Ek hai murgi ande char,

Kul hain kitane bolo yaar?  
 Ho gaye PAANCH, sun mere yaar.

My friend liked it a lot and then all the other subject  
 teachers also felt that they should give it a try in their  
 respective subjects. Their enthusiasm convinced me  
 that music can be used across all the subjects.

Around the year 2000-2001, we started using  
 computers for teaching-learning process. It was a  
 thrilling experience for both teachers and the chil-  
 dren. The children started enjoying the song-music  
 method more than before. Because it required them  
 to go to the computer lab, record their own voice,  
 play harmonium, tabla, mridang, keyboard, violin  
 as accompaniments for the song and finally use it in  
 their power point presentation. All these activities  
 gave new dimensions to the creativity of the children  
 and immense satisfaction to me.

At times it was challenging to write a song or provide  
 a tune to it. On such occasions I depended on my  
 ‘akshay or unfailing bank’ i.e. my students. I would

give them the topic, a few key words and ask them to write tiny little songs. Then we would combine all the songs to come up with the final version. After this we would think of a tune, either original one or some known song (even a film song at times!). The children loved these songs and were very proud of them because they had created them. This proved to be a strong tool to bring out their talent and nurture it.

This was about writing, composing music and singing songs. Apart from it, I have also used music in my classes in various other ways. For example play a small piece of classical instrumental music (sitar, sarod, santoor or flute) and ask the children to write all the adjectives that come to their mind (for example melodious, soothing etc.). Then they would share them with the class, discuss their meaning and different usage and thus increase their vocabulary. I would ask them to observe and discuss the subtle difference between words like pain and anguish OR *shant and shanti*.

There is one more activity that children like very much. Play a song in the class and ask the children to listen to it carefully. Then give them the handout of the same song with blanks in between. The children try to fill in the words from their memory and then sing the song. I would modify this activity a little for the older children and ask them to replace certain original words with their synonyms keeping in mind

the rhyme and the meter. This effort brought forth many ‘*ashukavi*’ or nascent poets. This activity also impacted their listening and comprehension, reading and writing skills as well as improved their pronunciation and vocabulary.

During this period we also started playing soft music before and after the assembly program and during the lunch break. This was appreciated by the parents and children both.

There are many ways to use music to facilitate language learning. We need to explore them and see what works best for us. The students will always remember their language classes and the teachers because those songs will remain in their psyche for years to come.

If music can aid learning by increasing a child’s interest then what are we waiting for?

*Music happens to be an art form that transcends language – Herbie Hancock*

*Music is the soul of language – Max Heindel*

‘This article was first published in Hindi on the Teachers of India portal ([www.teachersofindia.org](http://www.teachersofindia.org)), in the year 2010-11.’

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**09**

## My Experiments with Language across Curriculum : Teaching English with the Project Approach

**Nivedita Bedadur**

A bunch of thirty eager faces confronted me on my first day in sixth standard. Then they were bolder and clamoured around my desk with cries of miiis, miiiis, miiss! Shall we open our text books? What lesson are you going to do? Where is our teacher? Are you going to teach us English? Arhan does not learn his spellings. Seema gets poor marks in dictation. Will we have dictation every day? Atul learns his questions and answers by-heart.

What was I doing here? I wondered. Why wasn't I in Class 12 discussing persuasive writing or styles of letter writing? How would I handle a bunch of motley kids? They could not even sit in their places! Would I shout at them, bring them to order, instill fear in them? What should I do? In the few minutes of indecision while the children increased volumes of uproar I had a sudden flash of inspiration. "Let us go to the school lawn under the Bodhi tree," I said. "You are my army I am your general. Let's go down the stairs in complete discipline". The idea seemed to appeal to them. Here was something new to do instead of learning the spellings of words. So they marched behind me while my brain chalked out a plan. We sat under the tree of knowledge and while the chatter subsided I told the children that we would work through the entire text book doing projects. Each lesson would be a project and each one would be different. There were many queries – about questions – and answers, about learning the meanings, about spelling and dictation. We decided we would do all that but first we would do projects.

### The First Project

What was the first project? The first lesson was Columbus and the discovery of America. We decided

to dramatise it. So we made groups. One group did the posters, another group the props, the third group linked up the dialogues with narration and still another spelt out the costumes. What did people wear in those times? What did they eat? What did the ship look like? What did they carry with them? These questions troubled us and we went to the library and solved some of them. We poured over books and drew diagrams and wrote dialogues. Atul cried because he wanted to be Columbus. Veena did not like the way the posters were done with the group so she fought with them. I had to arbitrate, shush and set rules but we thoroughly enjoyed ourselves. We then put up a small skit. We floundered, we fluttered, we scrambled to look at the dialogues and we learnt, but HOW!

### Other Projects follow smoothly

One of the lessons was on evolution. In those times there were no LCD projectors. We had an overhead projector so we made transparencies on the stages of evolution and had a seminar. Each group took up one stage of evolution and did a presentation. I doubt if University students can make better presentations in this day and age of cut-copy-paste. Of course we had our problems, where would we find the material, the diagrams, simple explanations? The librarian was roped into our plan. He became a kindred soul. He was informed in advance about the next project and the next visit of these book locusts. He would then keep all possible information in all the books he had, ready for our invasion. As the year passed, and I was given additional charge of the computer laboratory, we introduced ourselves to power point and explored its possibilities by making slide shows from dental

health to mental health! By this time the children and I became co travelers in this journey.

### Co-travelers on the Journey of discovery

What should we do with the next lesson? What is it about? Health and Hygiene. Let's have a party! Let's have a salad show! This led to a discussion - group making, types of salads we could bring, foodstuffs and calories, healthy food and junk food. The children made groups, listed ingredients, consulted their parents, brought the ingredients, discussed and created recipes, finalized and tried them out, changed them, fixed them, tasted them, made recipe charts, wrote calorific values and held a salad show for teachers to taste and enjoy! Hungry teachers were well fed that day and we hear that all the classes had a better day!

### We are masters of all we survey!

Then there was a time when we did surveys : A survey of the dietary habits of teachers, a survey of parents who smoke, a survey of TV viewing, a survey about plant lovers. After this we represented results graphically, in the form of pie charts and bar graphs. We wrote small reports and circulated them. We put these reports in the school magazine to raise awareness about issues like the detrimental effects of smoking, poor eating habits or mindless T V viewing.

### Problems and Solutions

We began to observe all sorts of problems and tried solving them by writing letters to newspapers. Our school was flanked by two slum areas and whenever the school administration tried to build a compound wall for the school grounds, it was broken down by the slum dwellers in the middle of the night as it obstructed a thoroughfare between the two slums. Moreover the extreme end of our school ground was used for defecating by the slum. We wrote letters to the Indian Express describing these conditions. One of the students lived near the newspaper office. She

offered to reach these letters to the editor. When the editor found a handful of letters written by Class VII students, - for now we had moved on- he was stunned. He reciprocated by publishing parts of them with photographs of the breached compound wall. Soon there were toilets in the slums. The compound wall was rebuilt leaving a thoroughfare for the slums, the children from the slums had a standing invitation to play cricket in the compound! Some moves were by the corporator, some by the army unit which our school catered to, some by our friends. And all this was inspired by a poem by Robert Frost!



### Children need to go 'live' and experience a slice of 'life' for learning to happen!

Were my children learning English? Were their spellings improving? Were they writing questions and answers? Were they writing essays and letters? Yes and no. We knew we had to do all these things for these were the things that would appear in the exams. So we had a compromise. We would do all this sometimes in the middle of a project and sometimes afterwards. But now I wonder whether spelling dictation led to any learning or were spellings imbibed by my children while writing reports and letters about real people to real people. What use are questions and answers that we ask children to write regularly after

a lesson? Isn't it better to express one's views and write original pieces like dialogues, posters and narratives for skits, questions for surveys and recipes to understand health and hygiene? An original piece of writing even when done in groups is a production which is takes off from the text. We do not cover the text. We uncover it! We discover it! We recover it! And then all this has connection with what is happening in the rest of the classes. Health and hygiene is not just a story or an article to do dictation on. It is a living piece to be connected with what the science teacher said, what newspapers say, what we hear on TV.



What were my children learning? They were learning to work cooperatively, to accommodate diverse abilities, to argue a point, to write reports, to search for information, to present information in various formats. Were these skills useful for other subjects, I wondered. "What have you been doing with my children?", asked Rajani, my colleague and their class teacher, one day. "Why, are they becoming totally unruly?" I asked in trepidation. Many teachers had complained about the noise in my classes. The Principal had once asked me what I was doing and I explained. She did not seem convinced and sternly told me to be prepared to face the parents if there were problems on Parent Day. But Rajani gave me a

sweet surprise. "No, she said, "but I wondered why you were teaching them statistics!" I wasn't doing anything of the sort but analyzing surveys and doing diagrammatic representations had equipped them with the principles behind analyzing data by comparing things and mapping them on an axis. This had seemed to help Rajani deal with the same topic in her Statistics class. So, in the next few days we had this whole line of little monkeys sit on the compound wall during the lunch time counting the heavy vehicles and the small vehicles polluting the environment so that we could talk about the effects of pollution. Rajani and I had decided to collate science and language whenever we could. Our discussions with the children produced reports supported with data. Our children had just learnt how to make and write a good factual argument. Observation, data collection, analysis, finding proof, recording it and finally proving an argument were scientific skills which the children developed unobtrusively and spontaneously while practicing their language skills.

I often wondered whether we were teaching English as a subject or teaching children to think by themselves. Was it important to teach a text book in a language class? What was I teaching? A text book or language skills, Lessons or thinking skills? I felt suffocated by the boundaries of a text book. I wanted my children to fly, and to learn to fly on their own! Did the lessons in the text have anything to do with the world of the child? Did they let her think of her life on the playground, did they help her to learn Science, Maths and Geography! Did they connect with her life, her likes, dislikes, hobbies and friends? How did learning a few spellings, answering a few questions, doing a few exercises on word building or grammar really help to develop thinking skills or even language skills? In fact what are language skills? Are they a bunch of rules or are they related to choosing the right word, the right phrase and saying and writing things clearly and precisely, knowing what to say on a particular occasion, to a particular

audience and how to say it? If these were the skills my children should acquire, wouldn't creative activities tied to their life inside and outside school achieve our aim in a better manner? The text book was, I felt a supplementary reader for the teacher to trigger thoughts and to provide guidelines for enhancing the vocabulary and reading writing skills of the students. It was the teacher's task to develop cognitive skills of thinking, communicating thought, collating thoughts, designing an argument, thinking of the framework of an article or report and then articulating thoughts

precisely and clearly as theme, purpose and audience demanded. Language teachers cannot work in isolation from other subjects, language is the mother of all the vehicle of all thought whether from the domain of Maths, Science or Geography. Was it not the duty of the language teacher to equip the student with thinking skills? If it was then language had to go 'live' and do things related to the child's world, her problems, her learning in other subjects. And this will not happen unless we learn to use the text as a springboard for diving deep into life itself!



NIVEDITA is presently working as Specialist, Academics and Pedagogy in the University Resource Centre of Azim Premji University. She has been interested in research on the use of mobiles for language learning and has conducted some experiments with SMS and language learning and a research study on the same subject has been published in Continuing Professional Development – Lessons from India a book published by British Council. She has an experience of teaching English at secondary and higher secondary levels through her long stint at Kendriya Vidyalayas in India and abroad for more than 29 years. In the course of her career she has also worked as Vice-Principal and Principal in Kendriya Vidyalayas and a private CBSE school. She is a recipient of the incentive award for teachers during her career as a teacher in Kendriya Vidyalaya, Kathmandu. She can be contacted at [nivedita@azimpremjifoundation.org](mailto:nivedita@azimpremjifoundation.org)

**10**

## Creative Teaching and Contentment

**N. Nagaraju**

### Context and challenge

The most contented days of my life so far are the days I facilitated the learning process for primary school children in a remote village in the Anantapur district of Andhra Pradesh. I am able to say these words after completing 6 years of service as a Government primary school teacher. From the very first day of my career I realized that the excellent methods that I had learnt during the course of study were difficult to implement in the classroom. It was neither the right time nor the right context. But I am sure the knowledge gained during the course of study is good enough to tackle all kinds of situations. In the initial years of my service, with no courage to face the system and the demands from the community; I compromised and became a part of the large system. However, it took me a few years to get the momentum to meet the demands that the community put on schools in terms of learning outcomes.

The following were some of my observations in a 'typical' village school:

1. Many parents wish to see learning outcomes in their children within no time (in a week)
2. Many children can recite rhymes given in the textbook just for the sake of recitation (no focus on introduction of particular alphabet, concept, context and meaning)
3. Orally they can spell out all the vocabulary listed in the textbook without proper identification and recognition of the words
4. Exercises given in the textbooks are filled by either elders at home or neighbours
5. A feeling among the community that playing games (activities) is not good for education and

that the teacher comes to school only to play with children

6. An understanding that noise in the school means no discipline

The various stakeholders are habituated to see the school from a particular angle. Conscientious efforts of six months made people in the village believe that the things happening in the school was towards betterment of their children only. I spent a lot of time interacting with the majority of the parents regularly to explain the purpose of education, its importance, etc. To make understanding easier for parents, I drew the example of agricultural activity, where they get a good harvest only after tedious work for six months; starting with sowing seeds to harvesting, every stage requires much attention and care. Educating the child is similar; it requires a lot of time, care, and concern. It is unlike electricity where if you turn the switch on, the bulb will glow instantly.

In this context, while I was faced with a number of challenges as a teacher, I saw them as boons to implement a creative teaching learning method, using newspapers as a source for teaching (thanks to Eenadu Telugu daily Sundays supplement for children, "Hai Bujji")

### Introduction and identification of alphabets

**Step 1:** Introduction of alphabet through a rhyme not necessarily given in the text book.

**Step 2:** Asking 4 /5 questions for which answers will be the words starting with that of the alphabet intended to be learnt.

**Step 3:** Writing the answers on black board differentiating the first alphabet which is selected.

Example (Telugu first vowel: అ) (a)

మీ ఇంట్లో వంట ఎవరు చేస్తారు ? (అమ్మ, అక్క, అవ్వ)  
Mee imtlo vamta evaru chaesthaaru? (amma, akka, avva)

నీవు ఇంటికి వెళ్ళగానే పుస్తకాలను ఎక్కడ పెడతావు ?  
(అరుగు)

Neevu imtiki vellagaane puthkaalanu ekkada pedathaavu? (arugu)

మీనాన్న ఉదయాన్నే పొలానికి దేనిని తీసుకొని వెళతాడు ? (అరక)  
Mee naanna udayaannae polaaniki daenini theesukoni velathaadu ? (araka)

పులి, సింహం ఎక్కడ ఉంటాయి ? (అడవి)  
Puli simham ekkada umtaayi ? (adavi)

For each and every question expected answers are given in brackets and when children do not come up with these expected answers, I had to probe a little bit further till I got the desired answers. This probing activity has some advantages.

It allows the child to speak (a good activity for a new-comer to the school, as it helps in the socialization process), He/She overcomes fear (helps in making conversations and communicating), and most important is that it helps the student and teacher grow closer and know each other better.

**Step 4:** Reinforcement of introduced alphabet

The poem given in text book or one that is used in step one is copied on a chart and the words with the letters to be learnt coloured brightly

This is followed by repeating of these words, with reference to their respective pictures

Step 5: Exercises for children

A piece of newspaper with three to four lines of 10 to 15 words is given to each child for home work. Children have to go over the taught alphabet with

pencil on that piece of paper (Be careful as sometimes this activity becomes contagious in children and they will start circling alphabets in whatever printed document they come across, including sometimes their elder sibling's textbooks!)

**Step 6:** Evaluation

Ask students to think of names of various things that they come across and try to come up with words beginning with the same letter of the alphabet.

పిల్లలు ఇంటి దగ్గర ఇది చేస్తారని అమ్మ కొడుతుంది? (అల్లరి)  
Pillalu imtidaggara idi chaestharani amma kodutumdi (allari)

మీరు మీ తలను దీనిలో చూస్తూ దువ్వు కొంటారు (అద్దం)  
Meeru mee thalanu deenilo choosthoo duvvu komtaatu (addam)

This method requires a lot of patience and time to see results. The teaching-learning process for the first few letters takes a lot of time. Once the students are familiar with the method, it gains momentum and less time is required for the remaining letters and *maathras* (*gunimthaalu*) also.

The same method, with small changes, can be used for teaching *maathras*. How vowels are related to consonants to get *maathras* (*gunimthaalu*) is introduced through a rhyme.

**Step1:** The following rhyme is to be practised with rhythmic claps

అ ఆ ఇ ఈ ఉ ఊ  
A aa I ee u oo

క కా కి కీ కు కూ,  
Ka kaa ki kee ku koo

ఎ ఏ ఐ  
E ae ai

కె కే కై...  
Ke kae kai

ఒ ఓ ఔ  
O oo aou

కో కో కౌ .....,  
Ko koa kaou

అం అ:  
Am aahaa

కం క:  
Kam kahaa

**Step 2:** With the help of the a teaching-aid developed for the purpose, *mathraas (gunimthaalu)* for all the consonants can be shown and used for the purpose of training and reinforcement.

Two wheels are made of cardboard - one slightly bigger than the other. The outer margin of the bigger wheel is filled with symbols of maathraas and the inner wheel with consonants. Just below the maathraas, two windows are made, as shown in the picture. By turning big and small wheels and by choosing the appropriate window, mathraas for all consonants are displayed to children.

**Step 3:** A few words are prepared in such a way that that the consonant with particular maathraa appears as first letter in a few words, as second position in the next few words, and as last position in a few words.

Example:

విమానం, విరామం, విషయం  
Vimaanam, viraamam, vishayam

చెవి, రవి, కవి  
Chevi, ravi, kavi

అడవి, నిడివి, మనవి  
Adavi, nidivi, manavi

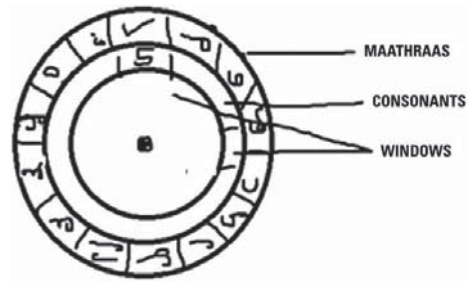
**Step 4:** Is similar to the exercise mentioned in introduction of alphabets using the newspaper as a tool, except that here, instead of alphabets, mathraas are the focus.

**Step 5:** Picture with different objects can be given and the children asked to identify the names of the

objects (like one given in the assessment paper shown in the annexure).

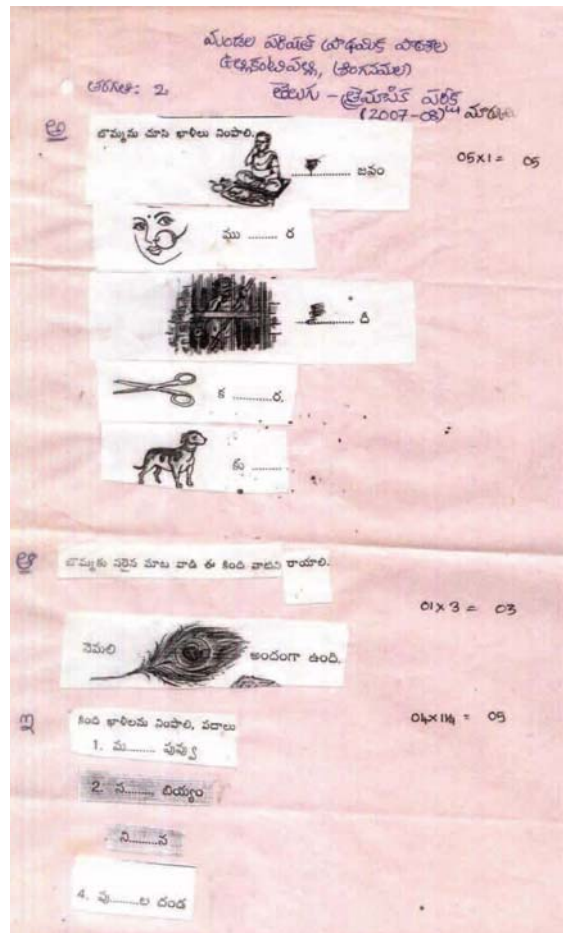
### Annexure

1. Diagram of the teaching aid mentioned for teaching *mathraas (gunimthaalu)*

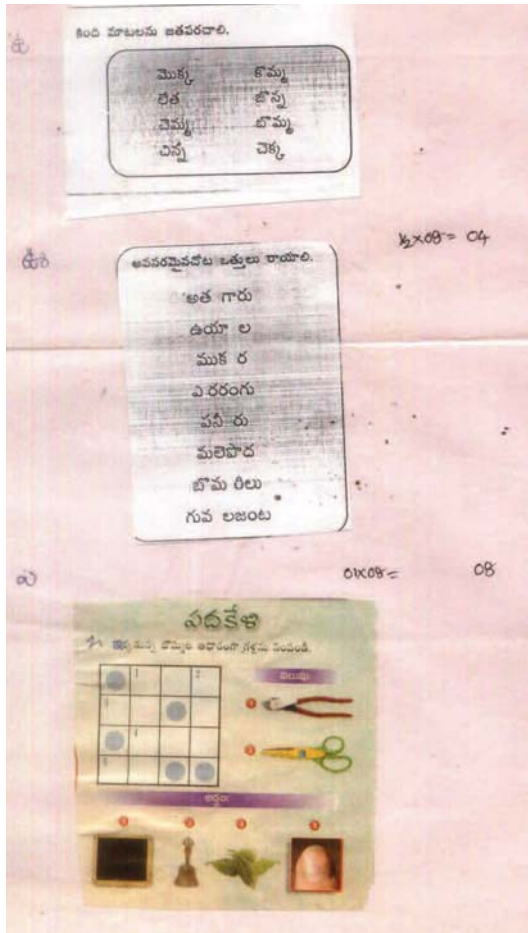


2. Assessment paper used few years back for class 2 children using newspaper cuttings.

(a)



(b)



(c)



NAGARAJU is Editor-Telugu version of [www.teacehrsofindia.org](http://www.teacehrsofindia.org) portal-a joint initiative of Azim Premji Foundation and National Knowledge Commission. He has taught language and biology at primary and secondary levels respectively for more than 15 years. For teaching language, he extensively used vernacular newspapers, supplements and magazines which were meant for children. He is interested in evaluation of teaching-learning process in school education and is keen in promoting early childhood education. He can be contacted at [nagaraju@azimpremjifoundation.org](mailto:nagaraju@azimpremjifoundation.org)

**11**

## Children and their parents come running into Schools

**Sujit Sinha**

In many villages, poor families have 5-15 country chicken. Children know that when ‘kutumba’ (family) come visiting, you have to prepare a chicken dish. And when you suddenly need some money, a few chicken can be sold off. But twice or thrice a year there are these epidemics and many chicken die. Yes, they know that there are some veterinarians, both government and private. But who will come to treat 15 chickens? And then they charge too much too. So Class VI, VII and VIII kids were asked – Why don’t you immunize the chicken yourself? They were incredulous – “We are only small children!”, they exclaimed. “How can we do this?” And then one child said – “Why not?” That was the beginning! In 8 villages, about 200 adolescents learnt how to immunize chickens. They went around informing households — “Please do not release your chickens in the morning; we are coming to inject them”. And the surprised villagers saw a group of 5-6 children land up at their doorstep early morning, catch the chicken and confidently inject them. In the first year this was done free of cost; from second year they started charging for the cost of medicine. Chicken death went down; from the third year the villagers willingly paid the cost of medicine plus a fee for the



service. This gave some of the economically poor school-goers some income!

Some of the following questions that arose from this exercise were: What are the breeds of these chicken? How are they different from the broilers? What are the diseases they contract? How do they spread? How does immunization work? Who discovered this? What about goat and cow diseases which affect us very badly? Can we diagnose and treat them? Are these things in our school books? Alas --- School books talk about Australian cows! Can the government veterinarian take classes? The children approached the Block Veterinary Officer. He was amused as well as excited, and came and taught them on how to diagnose goat and cow diseases. And then the children wanted to organize a goat – cow vaccination camp. The Vet was excited as he had his quota to fill. And then the children sat together and designed a household survey format: How many cows and goats ? Age ? Breed ? Do you have land ? Source and difficulty in getting fodder ? Diseases ? etc. Then they went around collecting the data and had a lot of fun in the process too. Later, they sat with the data, made tables, bar diagrams, pie charts, and Mathematics became fun and useful! They knew how many houses had one cow, how many 2-5 , how many 5-10 and how many had cows but no land, milk production, price at which cattle were sold, etc. A group of children had so many questions to ask! Next, they publicized and organized the cow-goat veterinary camp. The school, villagers, panchayat members and block officers all mingled together in preparing and organizing this camp. It was a huge learning and fun mela!

So what is school education? We all know that even after wonderful policy documents and beautifully written down aims of education, as well as numerous kinds of efforts, for most adults, parents, teachers and children, school education is about sitting in one place in a room for 4-5 hours, day after day, trying to read and understand the text book, hopefully assisted by a teacher, going home and memorising it, and ‘vomiting’ it in some exam.

Sandip Bandopadhyay writes in ‘Sriniketan’: “Sikshasatra was founded on July 1, 1924 near Shantiniketan . Each boy was given a small plot of land and encouraged to treat it as a playground and experimental farm. He was also at liberty to choose a craft according to his interest and aptitude. Only one hour daily was devoted to the learning of the three Rs. Each craft was treated as a project and a source of non-formal learning. The 1928 report categorically stated that craft should be of ‘definite economic value’ and the products should be of ‘real use at home and should command ready sale outside’. Sikshasatra thus anticipated Gandhi’s ‘Basic Education scheme’ in more than one respect.”

Ananda Niketan, started in 1937 at Sevagram by Mirabeen and others, and then guided for many years by the Aryanayakams (who had worked in Sikshasatra for some time before moving from Shantiniketan to Wardha), and beautifully described by Marjorie Sykes in her book, ‘The Story of Nai Talim’, had closed down in 1960s like most of the other Basic or Buniyadi or Nai Talim schools all over India. But a plucky Sushama Sharma backed by Talimi Sangh, restarted it in 2005. And as Ankit, student of M.A.Education Program 2011-13, Azim Premji University, currently working with the school there, describes: “Each child has an agriculture plot and as they plant and nurture and water their crops, they are learning counting, measurements, mensuration, shapes, angles, data gathering, organizing data, fractions, decimals, ratio-proportion and all the other concepts in NCERT Mathematics books for classes

V, VI and VII. And they are having so much fun that those who had to go away after Class VII wish that they could have continued in this school”. Unfortunately , Ananda Niketan does not have government approval as Maharashtra is not “recognizing” any new Marathi medium schools and it is only till Class VII! So, while Gandhi and Tagore’s dream has a precarious existence, in the meantime, some children are having fun combining “work and education”.

But wait – are only children going to have fun? What about their parents? Swanirvar, an NGO working in North 24 Parganas district of West Bengal and running 4 experimental schools, decided to do some exercises with parents in May-June 2002. Parents (mostly mothers) from the same village were seated together and encouraged to draw a map of their village. In some cases Swanirvar teachers set the ball rolling by asking everybody to first draw the road from their house to the school. In all cases the parents soon got quite involved and started putting in all the roads, big trees, the more widely used tube-wells, key shops, schools, places of worship, and even individual houses, particularly their own! The second exercise was to make timelines. To illustrate what this was, Swanirvar teachers first helped one individual participant to describe his/her life through a timeline, and then parents were divided into groups to prepare a lot of timelines. The day after the exercises, the teachers were accosted by many mothers



who had not or could not come to this workshop and demanded to know why they had been left out of the fun! Over the years, Swanirvar has got proficient at being able to involve both literate and illiterate parents (fathers also joining) in these workshops. Therefore, parents now appreciate what Swanirvar does with the children, even if these things are not part of the text books! So, there are the parents who make and multiply teaching aids for us (and make a few extra to take home too!); then there are the veterans who guide the “new” mothers. Parents look forward to the workshop days which it is now organized separately for parents of children in classes I-II and parents of children in classes III-IV.

Many interesting things have been tried and are being attempted by “alternative” schools everywhere. Things like toilet survey, water surveys, tree surveys and their analysis and then certain follow up actions are enjoyable, usefully productive, lead to all-round development of the child, increased

sensitivity, democratic habits, etc. Will millions of village children get an opportunity to learn this way and thereby transform rural India? NCF-2005 is sympathetic to the idea. Some state governments might be willing to give it a shot. Many will have to collaborate to take this forward. Different text books like “Apne Aas Paas” of Digantar and “Our Land Our Life” of Uttarakhand Seva Nidhi will have to be written. And each region will have to come with area-specific and appropriate things to do and ways of doing this. As an illustration, let me quote Sonam Wangchuk of SECMOL, Ladakh: “Sometimes the only way the school can contribute to education is by remaining shut. For instance the schools stay open in the summer season, when there is so much that the children can learn from the farms. The way to ensure that children learn about agriculture is not by starting agriculture classes for them, but just to remain closed for a month in the summer, when the children can automatically learn from the fields.”



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**12**

## A Middle School Experience: can Self-Control be taught (or learned), not imposed

**Yamini Patil**

I strongly believe that children are instinctive learners (learners by nature). They learn from their environment, family and peers. Their learning is not only limited to the knowledge but also includes the social skills necessary to be accepted by the peer group and be a part of it. Of course, every child goes through the spells of being stubborn, quarrelsome and quirky.

I believed that to accommodate, appreciate, respect and share with others would be learnt in the classroom. Middle school is the time by which I thought this would be sufficiently imbibed by the children and would have made them identify their own groups .

My experience with the middle school students always supported my belief. I also noticed that effective learning happened in the comfort groups.

My experience with the middle school students always showed that the non-threatening atmosphere of the comfort groups always helped children air their views openly, value others opinions and discuss the pros and cons of their actions, although there were inter- and intra- group rivalries. However, these were not to the extent which affected the learning process. The problems of individual members could be resolved through discussions within the group and the problems with other groups by discussing them with the whole class. Perhaps this process was going on for such a long time that it lulled me into believing there could be no exceptions. That's the reason I ignored the symptoms.

It happened with my class VIII students. I knew that there would be teething troubles as the class was new to me. It was my practice to spend the first class discussing the dos and don'ts. The students themselves

came up with what was allowed in the class and what wasn't. When it came to not interrupting others and not passing snide remarks, many were looking at each other and rolling their eyes. I did not pay much attention to it. I should have!

I let a month go by so that the students get acquainted with the new teachers and new syllabus .I thought transformation from junior school to middle school was bound to be a little unsettling and bound to make them fidgety. But when the class did not settle down even after two months, I began to observe the class keen to find out what the problem was. What I found out really disturbed me. A section of students had become really silent, as if they had withdrawn into themselves. They were the ones who were quite active in the initial stages, but slowly they had become invisible. The reason was they seemed to be scared to even open their mouths, let alone participate. There was a section of boys in the class who would pass scathing comments even as others were sharing their views or answering questions. It was not as if they were singling out a few. No one seemed to be spared from their uncalled- for comments. There were many who retaliated, which led to arguments. Many a time, the issue being discussed got completely derailed.



Most of the productive class time was being eaten into these unnecessary arguments. Speaking to them personally had not effect as they seemed to revel in the attention that they were getting, while ignoring them was making them more aggressive.

I began to seriously reflect on what was happening. I felt the situation was getting out of hand. These were not the children who would take pleasure in pulling out a butterfly's wings. But they seemed to enjoy the discomfort others felt when they passed comments. It was as if they had no control over what they were doing.

Provisionally, we were given the article 'What if the Secret to Success is Failure' by Paul Tough to discuss in our teacher training session. The article laid emphasis on how character was as important as intellect and identified a set of strengths like zest, grit, self-control, social intelligence; gratitude, optimism and curiosity that would help them to succeed in long term. What was being discussed in the article seemed quite relevant to my eighth standard . My priority was self control.



I knew talking about self control was not going to have any impact on the students. The very mention of self-control would put them off. I needed to involve students in such activities where in they would begin to think of self control. While sharing book reports, one student in the class was talking about a character in a story who got angry often. I took this opportunity and asked her if she was justified in getting angry.

Some felt she had the right to get angry and others thought that she should have more control over her emotions. At the end of the discussion, students were able to give responses to what made them angry and how the situation might have been if they had controlled their anger. Most of them did not see any reason to control their anger because they thought that it was entirely the other person's fault.

The next step was a purely physical activity with the help of music and drama teachers. The students were asked to move their bodies in a particular way to synchronise with the drum beat. When the beat changed they had to change their movements. Most of the time, they did not change their movements when the drum beat changed. When questioned what made them not go with the rhythm, they realised that the fault was theirs and not the drums. As these activities were going on, some posters on self control were displayed. No formal discussion was entertained on the content of the posters. But the children in groups were discussing these posters. After a gap of one week the final and important activity was taken up. The class was divided into groups of three for a role play. The theme was teasing in the class. Each group was asked to play the roles of a victim and an adult. The students responded enthusiastically. A few groups came up with interesting solutions. Most of the role plays showed the victim reacting violently to the teasing and the adults punishing the tease. However the interesting ones were those where the victim showed unusual restraint by ignoring the tease initially and when it did not have any effect. He/she informed the person in no uncertain terms such behaviour would not be tolerated. Interestingly, the grown ups in these role plays were involved only in the end to conciliate and not to punish. That these role-plays made the students thoughtful and reflecting was evident in the reviews of the role-plays.

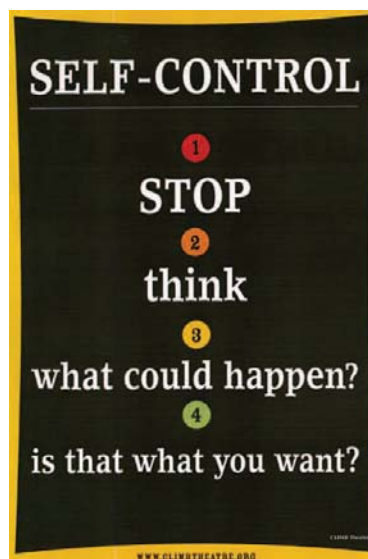
I entered the classroom the next day with my fingers crossed. The first thing I noticed was every group was involved in animated discussions. The

moment I entered the class a chorus went up. “Akka, no lesson today please. Let’s discuss what we did yesterday”. What came up in the discussion showed that the entire process was not in vain. It seemed to have had considerable effect on the class especially on the victims of teasing. Those who used to react violently to teasing said that they would stop doing so and would ignore them as the others were getting the satisfaction by needling them. Those who silently suffered said that they would firmly tell the bullies not to bother them. The best thing that they came up with was to show their displeasure at being disturbed especially when the class is going on, was to pick up

their chairs silently and go and sit at the back away from the distracters. They said that they had excised self-control by not arguing and not getting distracted. As the same time, they had denied an opportunity to the other person to disturb them.

Did the problem get solved? No, children being children, there were lapses. But the whole process helped at least a few to realise that the solution lay in their hands.

I am grateful to TVS School, Tumkur, Karnataka, for all the experiences and freedom it has given me.



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**13**

## Nali-Kali in Primary Schools in Karnataka

**Padmaja M.R.**

Education is not a pool of stagnant water. It is always flowing. As it flows it carries with it several ideas, techniques and innovations and heads towards universalisation of education.

Among the many experiments to ensure quality education, Nali Kali, or Joyful Learning, is a unique concept that has been put into practice. It is child-centered, activity-based learning that helps children imbibe values apart from acquiring school education. Nali Kali creates the right atmosphere for the child to learn in a friendly and joyful way, at a leisurely pace.

The concept of Nali Kali took birth in a remote hamlet in Heggadadevankote taluk of Mysore district and gradually spread to other areas and as it spread it evolved with new ideas and revisions and has now been implemented in all the government primary schools of Karnataka. Children of Classes 1, 2 and 3 are covered by this method of teaching.

Highlights of Nali Kali

- Multi level learning
- Quality education
- Self learning
- Learning at own speed
- Joyful learning

### The Nali Kali Classroom

The Nali Kali classroom is unique and is distinct from a normal classroom. Learning materials need to be arranged and kept ready before the class begins.

Learning materials that need to be arranged in the classroom and their brief description:

### 1. Learning Cards

These cards contain small nuggets of learning material. These cards are kept in the Nali Kali classroom and arranged separately according to class, subject and milestones. These learning cards are supplied by the Department of education, Government of Karnataka.

### 2. Progress charts

These charts are also supplied by the department and are displayed according to subject and class. These contain step numbers according to milestones and logos. Each milestone reached marks the level of skill and knowledge acquired by the child. Children have to mark their progress in these charts and the progress chart is the most important document for each child.

### 3. Group discs

These discs contain information about which activity has to be carried out in which group and under whose supervision. There are discs for each of the five groups: for language, mathematics and environmental studies for classes 1, 2 and 3. Each disc represents a group and the group number, name of the supervisor for the group and the logo that represents the activity of that group.

Activities are carried out thus:

- Partial help by the teacher
- Complete help by the teacher
- Complete help by friend
- Partial help by the friend
- Self learning

Those activities that are group activities are not represented by the logos on the Group discs. Each activity has been allotted a logo which is displayed on the left hand corner of the learning material – cards, work book and reader. The same logo is displayed on the progress charts and group discs.

In languages, animals are used as symbols in logos, and in mathematics, birds are used as symbols in logos. In environmental studies insects are used as logos. These logos help the child mark her place in the progress chart easily, pick up the related learning material and take her place in the group.

#### 4. Learning Grid

Strings are fixed four feet below the roof of the classroom from which the products of craft activities done by the children are hung. These help in encouraging creative talent among children.

#### 5. Wall Slate

This is a four feet high blackboard along the four walls of the classroom and a portion of it is allotted to each child and is called Wall Slate. The children use it to do sums or write sentences as a practice exercise.

#### 6. Weather Chart

Here children observe the weather daily in the morning, afternoon and evening and mark the weather type. This will help in preparing the monthly weather chart.

#### 7. Work Books

The government supplies work books subject-wise for each of the classes 1, 2 and 3, as well as readers in languages for each class. These will have been grouped according to subject and class. These will have to be read by the child after learning under each milestone has been achieved, during the self-learning process and during evaluation.

### 8. Teaching Learning Material

Flash cards, dice, beads, pebbles, sticks, puppets, screens, masks needed to conduct activities and material needed for craft activities will have been arranged according to milestone. All these materials have to be within the easy reach of the children.



#### Handling of Classes in Nali Kali

Since classes 1, 2 and 3 are combined for the teaching process, handling of the class is totally different.

In our school there are in all 95 students in Classes 1, 2 and 3. We have split them into three sections of 32 students each. Three of us are handling these sections as Nali Kali teachers. Each period is of 80-minute duration and there are 4 periods daily – the first period is for Kannada, second for Mathematics, the third for Environmental Studies and the fourth for Radio lessons and English.

The day starts with the children sitting in a circle and doing meditation for a while. The next activity is to mark the weather in the chart. And then the following activities begin:

- As per the progress chart, identify the children for group activity - like singing, playing, story-telling, identifying pictures etc. – and engage them in those activities.



- Mark the progress made by the children in the progress chart.
- Ask a student to place the Group Disc on the floor
- Line up the children in order of their class and subject in front of the Progress Chart related to the topic of that period and make them identify their status of learning besides identifying the logo concerning their next activity to be undertaken.



- Collect the learning material as per the entry made in the Progress Chart and make the child sit in the group concerned.
- The teacher now begins the teaching process and guides the self-learning groups first and then sits in the group that is fully dependent on the teacher for learning and handles the children in that group.

Guidance means giving suggestions on who will do what activity and how; who will help whom and how.



- Teachers repeatedly ensure that all children in all groups are engaged in some activity.



- After ensuring the learning and satisfactory completion of the activity, the progress of the child has to be recorded in the progress card and the attention of the child drawn to the activity to be taken up the next day. Where a child has not satisfactorily completed the activity she has to be asked to repeat the activity the next day.
- After the activity, the children will have to put back the learning materials in its respective places.

## My experience

I was part of the team of teachers selected to undergo six-day training in 2009-10 to handle Nali Kali classes. After training, when I started handling classes, I found the going tough but in a span of 2-3 months I started liking it because of the enthusiasm shown by the children, their activities and the progress made by them.

Nali Kali classes are different from other classes and there are similarities in the competencies of the three classes – 1, 2 and 3.

For example, in Class 1, in mathematics, there is counting, writing, addition, and subtraction for numbers from 1 to 19. In Class 2, a similar exercise is done for numbers from 1 to 99, and in Class 3 it is for numbers from 1 to 500.

Here, as there is scope for learning at the child's own speed, a talented child can learn fast and go further. Similarly, some children might start slowly but will pick up speed gradually. I have seen children of varied abilities going up in their learning over the year.

- Since every child participates in every activity, he or she learns by experience. (See and learn; do and understand)
- Unlike normal classes, there is no mass teaching here and each child is attended to during the learning process. I find this very useful to give personal attention to each child. In fact, even the learning deficiency of children who absent themselves can be overcome.
- As I have observed, a bright child guides other children in his/her group and in the process develops leadership qualities and the spirit of cooperation and adjustment.
- Another feature of this process is that a child starts learning with the guidance of a teacher, fortifies it with the cooperation of friends and finally learns to perform activities independently.

- There is healthy competition among the students in the class. It creates an awareness about the pace of learning and encourages them to learn more and instills in them self confidence. Learning then becomes a challenging task for them. Physically challenged students also get motivated to learn in this process.

## Challenges of the Nali Kali system

- Despite all the aforesaid positives/strengths of the Nali Kali method, teachers handling these classes have to face many challenges.
- It is difficult to handle a class if there are more than 30 students.
- Since the teachers have to be present in the class throughout the duration of each day's sessions it is taxing both mentally and physically.
- Teachers can find it difficult to handle a class where the students of all the three classes are in the learning group and several learning points have to be taught for each class of students
- There are similarities in the competencies of Classes 1 and 2, but for Class 3 the level of teaching is higher and therefore it is better to separate Class 3 for teaching.

## Conclusion

True, there are challenges in this system but compared to all other schemes implemented by the department of education, Nali Kali appears to be the most effective in ensuring quality education. The cards, charts, workbooks, readers, and discs are extremely effective in teaching and several teachers, education experts and officials have striven to prepare them. These are being constantly revised and information about the revision is being given to the teachers in Tele-mode. Also, problems being encountered by the teachers while handling classes are also being looked into and solutions developed.

Even for a child who does not complete all the milestones in an academic year, this system permits her to complete the pending milestones in the beginning of the next academic year and then start learning the milestones of the next year.

The evaluation process is continuous. A child is evaluated at the end of each milestone through plays,

activities and oral answers to the questions in the cards. The children are free from the fear of a formal examination and can evolve their personality in a learning atmosphere that is free and friendly.

I have derived more satisfaction in teaching students through this method compared to any other method.



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## SECTION B - THE SCIENCES



**14**

## Have humans evolved from apes?

An inquiry-based approach to understanding Evolution

Sindhu Mathai

Inquiry-based investigations are at the heart of current innovative approaches to teaching and learning Science. Learning is considered effective when students engage with concepts to be learnt and also develop abilities of scientific inquiry. This was especially apparent when I recently taught a course on “Evolution” using such investigations. The experience of one activity was particularly satisfying, and I have narrated it here. Though this was done as part of an optional course at the Azim Premji University, it can be done with students from Classes 9 to 12. Heredity and Evolution is first introduced in Class 9 (Science), further explored in Class 10 (Science), and detailed in Class 12 (Biology) as per the National Council of Educational Research and Training (NCERT) textbooks<sup>(1)</sup>.

The topic itself is significant, and I kept recalling the oft quoted, perhaps now clichéd words of evolutionary biologist Dobzhansky (1973): “Nothing in Biology makes sense except in the light of evolution”. I spent time right from the first class on the plot of the story of evolution: natural selection. Discussions in class left me doubtful. Theories in science have a way about them: once understood, they startle you with their explanatory power, yet astonishing simplicity. The theory of natural selection propounded jointly by Charles Darwin and Alfred Russell Wallace in 1858, is no exception. Sensing alternative conceptions among students during class discussions, I realised that an engaging activity which could consolidate understanding of different concepts had to be the key.

During my searches I came across a set of simple, hardly resource intensive activities on Evolution from the National Academy of Sciences, U.S.A.<sup>(2)</sup>.

One such activity was titled “Investigating Common Descent: Formulating Explanations and Models”. This activity brought together the fundamental concepts leading to an understanding of evolution by natural selection, though the thrust was on the molecular evidence. At the same time it led students through an inquiry-based investigation by formulating hypotheses, conducting an investigation, examining molecular evidence, inferring from it, and if necessary modifying or even rejecting the initial hypothesis. Students were also led to examine and answer the question: “Have humans evolved from apes?” Prior to this class, they were led through the history of development of the theory through an interactive time-line<sup>(3)</sup>. They were also introduced to the life and work of Darwin through the PBS NOVA documentaries<sup>(4)</sup>. They had read extracts from the works of Lamarck, Wallace and Darwin to understand changes in understanding the process of evolution and the development of Science<sup>(5)</sup>.

### Understanding the conventions of a discipline: tables and cladograms

The investigation was divided into three parts. It was written in the form of a teacher’s guide with diagrams and worksheets which could be easily adapted / modified. Students worked in small groups of about 4-5. The first part required examination and comparison of characteristics of apes and humans. The comparison was on several features such as posture, leg and arm length, brain size, etc. This was followed by a tree diagram (morphological tree, cladogram) which compared relationships between apes and human beings. Like shared conventions in a discipline, cladograms are used by evolutionary biologists to represent relationships between organisms based

on common descent. The presentation of data in this form, gave me a chance to explain features of this convention to them. For this I sought the help of a paper by Gregory, R.T. (2008) <sup>(6)</sup>.

### Formulating hypotheses

The table and evolutionary tree brought out relationships between different mammals and human beings, and students were asked to draw out relationships between the apes: gorillas and chimpanzees (designated G and C respectively), human beings (designated H) and a common ancestor (A). This was to be done using another tree-like representation. However the tree diagram did not indicate this explicitly. Students were a bit confused then as to how they may draw such a relationship. The expectation was to hypothesise or come up with a verifiable or testable relationship represented using a tree diagram.

Being a visual learner, I sensed at least some of the students may also like to see pictures of the two apes mentioned to help them formulate this hypothesis. So I obtained a few pictures from the internet and projected it so that they could get a sense of the features. A couple of examples are given in Figures 1 and 2.



Figure 1

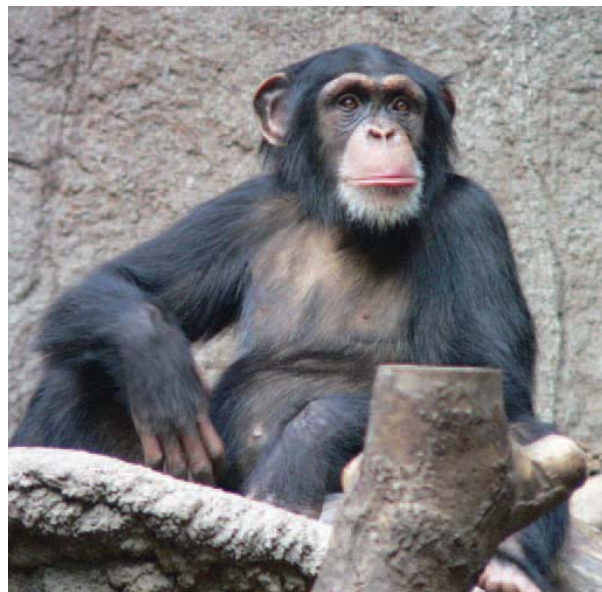


Figure 2

The hypotheses that came from students were varied. Most groups had formulated more than one hypothesis. Figures 3, 4 and 5 are taken from submissions of students (VS, TS and NK).

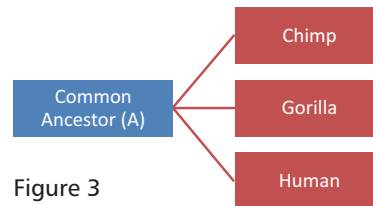


Figure 3

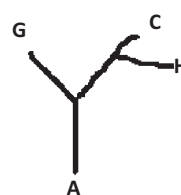


Figure 4

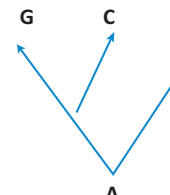


Figure 5

### Comparing gene sequences: what can molecular evidence reveal about relatedness?

Having come up with tentative hypotheses, students then proceeded to test their hypotheses in Part II. The method involved comparing relationships between gorillas, chimpanzees and the common ancestor by

comparing genes coding for the protein haemoglobin (pigment giving rise to the red colour of blood in most vertebrates). Students were given handouts of the procedure and guiding questions for discussion in the previous class and asked to read it before the investigation was conducted. The commonly heard acronym 'DNA' evoked feelings of complexity in several of them.

The procedure however was akin to a child's game. A strand of DNA is composed of a sugar-phosphate backbone, nitrogenous bases: Adenine (A), Guanine (G), Thymine (T) and Cytosine (C), and hydrogen bonds between bases of a complementary strand forming a double helix. Adenine pairs with Thymine; and Guanine with Cytosine. A gene is a segment of DNA and hence students had to work with segments of DNA composed of 20 bases each. The sequence was given for each species (as per currently available evidence) in the description of the investigation. For example, the sequence of the human (H) DNA strand is: A-G-G-C-A-T-A-A-A-C-C-A-A-C-C-G-A-T-T-A. Similarly sequences coding for haemoglobin in Gorillas (G), Chimpanzees (C) and a hypothetical Common Ancestor (A) of these organisms were given. Paper clips of different colours: one for each base was distributed in assorted boxes for each group. Students had to synthesise DNA strands for each species as shown in Figure 6.



Figure 6: Photograph taken by a student (BJ) of a strand of gorilla DNA made with paper clips

The first base was marked to indicate the sequence. Human DNA was compared with gorilla DNA and then Chimpanzee DNA separately. The comparison was done base to base (paper clip to paper clip). The number of matched bases was counted along with the number of unmatched bases (which could also be inferred). The final numbers were entered in a table. The Common Ancestor DNA was saved for Part III of the procedure.

One of the students (VS) represented her comparisons with colour coding as shown in Figure 7.

"The created sequences (with color coding) looked like this:

Human	A	G	G	C	A	T	A	A	A	C	C	A	A	C	C	G	A	T	T	A
Chimp	A	G	G	C	C	C	T	T	C	C	A	A	C	C	G	A	T	T	A	A
Gorilla	A	G	G	C	C	C	T	T	C	C	A	A	C	C	A	G	G	C	C	C
Common	A	G	G	C	C	G	G	C	T	C	C	A	A	C	C	A	G	G	C	C

By comparing Human DNA with that of Gorilla and Chimp respectively, we got the following results:

Human	A	G	G	C	A	T	A	A	A	C	C	A	A	C	C	G	A	T	T	A
Chimp	A	G	G	C	C	C	T	T	C	C	A	A	C	C	G	A	T	T	A	A

15 matches, 5 unmatched bases

Human	A	G	G	C	A	T	A	A	A	C	C	A	A	C	C	G	A	T	T	A
Gorilla	A	G	G	C	C	C	T	T	C	C	A	A	C	C	A	G	G	C	C	C

10 matches, 10 unmatched bases

Figure 7: Representation of the matching of DNA strands by a student (VS) using colour codes for each base

### Mutations from a common ancestor: how are we related to the apes?

In Part III, students' previous understanding of mutations and their significance as 'molecular clocks' in the evolutionary process was reinforced. Comparison of strands of DNA of each species with the common ancestor would lead to information about mutations and hence help predict how and when speciation occurred: or when a new species formed and diverged from a common ancestor in the evolutionary tree. The common ancestor DNA was therefore compared with each of the others: human, gorilla and chimpanzee, and matches and mismatches were again counted and tabulated as before. The completed tabulation looked like this representation made by one of the students (BJ).

Hybridization data for human DNA (from Part II)		
Human DNA compared to:	Number of matches	Unmatched bases
Chimpanzee DNA	15	5
Gorilla DNA	10	10
Data for common ancestor DNA (from Part III)		
Common ancestor DNA compared to:	Number of matches	Unmatched bases
Human DNA	10	10
Chimpanzee DNA	12	8
Gorilla DNA	17	3

The data was discussed in class. They were asked to re-look at their hypotheses in the light of the data. Were they happy with it, did they want to make any modifications to what they had formulated?

Looking at the table and cladogram presented in the beginning of the exercise, as well as the photographs of the chimpanzee and gorilla, most of the groups had hypothesised that gorillas and human beings were more closely related. However, the data obtained in Part II indicated that chimps and humans shared more bases in the gene coding for haemoglobin than gorillas. Also, from Part III, gorillas had more matches with the common ancestor, followed by chimps and then humans, indicating greater relatedness between gorillas and the common ancestor. The tree that is then perhaps most explanatory would be that shown in Figure 4 (Hypothesis b).

Students enjoyed conducting this investigation, and arriving at the data and the simple inference drawn from it. However the answer to the question posed in the beginning “Have humans evolved from apes?” was still not apparent at this point. Since the designated 2 hours for the class was over, I asked them to complete this discussion as homework after inferring from data analysed in class.

## The grand conclusion: Inferring from evidence which runs contrary to popular notions

The surprising and thought-provoking element of the activity was still to come. Several assignments reasoned with the available evidence that humans had indeed evolved from apes, bringing out the common alternative conception of a ‘ladder-like’, ‘gradual progress’ model! However the data that they had presented as evidence was correct and in keeping with the shared understanding that had developed in class. In the case of one student, TS, conceptual change could be sensed in his writing: “The conclusion that can be derived is that although humans have evolved from apes....” he had left off there to go into elaborate details of the analysed evidence, finally concluding: “This exercise gives evidence for the fact that all the three organisms (gorillas, chimpanzees and humans) might have evolved from a common ancestor and in due course of time due to mutations in DNA there might have been these changes observed.”

Voila! However looking at the trend in a couple of other assignment submissions, I decided that more reinforcement was required to make this leap from the evidence and the tree diagram (Figure 4) to the logical inference, and hurriedly composed this mail to the class: “Dear all, If you have a few minutes’ time today, I request all of you to go through the video: [http://www.pbs.org/wgbh/evolution/library/11/2/quicktime/e\\_s\\_5\\_100.html](http://www.pbs.org/wgbh/evolution/library/11/2/quicktime/e_s_5_100.html)<sup>(7)</sup>. You need QuickTime or Real Player to view it. Without considering the investigation in the last class, could you think about what it means to say ‘Humans have evolved from apes.’ Doesn’t it mean that an ape in the course of evolution became a human being, or a chimp / gorilla evolved to a human being? Can you claim that based on the analysed evidence? We will discuss this in class today.”

The video viewing in class brought out further clarifications and discussion. A few of the early assign-

ment submitters, re-submitted based on their changed understanding. Subsequent assignments showed greater reasoning on the process of natural selection that could have led to the evolution of humans, chimps and gorillas.

In all an exciting activity which clarified and brought together key concepts leading to an understanding of evolution by natural selection, revealed underlying, resistant alternative conceptions, and was engaging for students to assimilate and accommodate. As a teacher, the use of this method of inquiry was an immensely satisfying and fruitful experience.

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## Image credits

Figure 1: Inaglory, B. (2009). Male gorilla in SF Zoo. Retrieved from: [http://en.wikipedia.org/wiki/File:Male\\_gorilla\\_in\\_SF\\_zoo.jpg](http://en.wikipedia.org/wiki/File:Male_gorilla_in_SF_zoo.jpg) on 7th December 2012. Licence: Creative Commons Attribution-Share Alike 3.0 Unported

Figure 2: Lersch, T. (2005). Common chimpanzee in the Leipzig zoo. Retrieved from: [http://en.wikipedia.org/wiki/File:Schimpanse\\_zoo-leipzig.jpg](http://en.wikipedia.org/wiki/File:Schimpanse_zoo-leipzig.jpg) on 7th December 2012. Licence: Free Software Foundation: GNU Free Documentation License, Version 1.2.

Figures 3 – 7 and Table 1: Assignment submissions of students: VS, TS, NK and BJ as indicated in the body of the article. Permission obtained.



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15

## The Creative Language of Mathematics

Sneha Titus

Teaching mathematics at the pre-university level has always been perceived as a task strictly circumscribed by the focus on the crucial public examinations which as students who embark on this course are told by all and sundry ‘can make or break your career’. Add to this the rigours of the content heavy ISC (Indian School Certificate) course and the jump from high school mathematics – no wonder innovation and creativity are forced to take second place while preparing students for ‘Life!’ And yet, can one make sense to adolescents without innovation and creativity? Don’t we need to hear what they make of the subject we are teaching? Students like to make their opinions heard and while it may not be possible to devote contact time in class to this, I find that beginning the course with a writing exercise enables me to get to know my students much faster. So the first task I usually set is an essay which encourages students to share their experiences in mathematics and their attitude to it. One such essay was based on the 2001 movie ‘A Beautiful Mind’. I used the quote ‘There has to be a mathematical explanation for how bad that tie is’ and asked students ‘Do you agree with John Nash’s underlying sentiment that mathematics is all pervasive? Describe some of your encounters with mathematics in unexpected situations’. When a homesick international student spoke of being in a minority and how his emotions were related to numbers, I knew that exercise had done what no counselor could do- get an adolescent boy to speak about his feelings! Many students approach mathematics with negative feelings and it is important to address and accept them instead of treating the subject as a nasty pill which is ‘good for them’.

Writing also develops skills such as logical reasoning and the ability to present a valid argument which are highly valued in mathematics. For this reason, I would revisit the writing exercise during the term, often in conjunction with the English teacher. We would assess the exercise for both writing skills as well as mathematical accuracy. One of the exercises that I used was based on the exponential function  $e^x$  which has a very special property that the derivative (the rate of change) of the function is equal to the function itself. This function apparently inspired the mathematician Jakob Bernoulli to design his own epitaph ‘Though changed, I shall arise the same’. After we studied the exponential function and its inverse, the logarithmic function, students wrote an essay on the phrase ‘Though changed, I shall arise the same’. Inventiveness, creativity, individuality and a strong understanding of the nature of change came to the fore- surely we need to develop these skills along with mathematical rigour?

One of the examples used to illustrate beauty in mathematics is a sequence of numbers. While beautiful patterns can be observed, students who are working under pressure often have no time to appreciate what seems to them an endless array which does not connect in any way to their immediate experiences. A particularly difficult exercise is to sum a series and while formulae can be developed and memorised for the sum of an arithmetic or geometric sequence, students of standard 11 are required to develop the sums of sequences in which the differences of the numbers are in arithmetic or geometric sequence! For example, the sequence  $1 + 3 + 6 + 10 + 15 + \dots$ . Perhaps you have guessed that the next

term is 21 since the difference between the successive terms is 2, 3, 4, 5 and so on. While the enthusiastic mathophile enjoys finding an expression for the  $n^{\text{th}}$  term of the sequence and the sum to  $n$  terms too, it is often hard to teach relentless theory to novices to the area. Which is why, when I taught this topic one December, I found it easy to ask a student to model this problem on the Christmas carol, ‘The Twelve Days of Christmas’! Instead of asking the sum to  $n$  terms, the challenge to her was to find out how many presents were sent to the singer by her ‘true love’ – of course without adding up the numbers.

The trigger questions that I used were:

- Is there a pattern you can recognise from the number of presents received each day?
- Can you connect this pattern to one of the sequences you have studied?
- Without counting, can you find a formula which calculates how many presents the girl receives on a particular day? (as the verse describes)
- How many presents did the girl get totally if she got a new set plus a repeat of all the old sets each day? (as the chorus says)

A beautiful bulletin board emerged complete with tiny presents but most valuable of all was the pattern emerging from these presents, one which enabled her to understand the difference between between  $T_n$  (the  $n^{\text{th}}$  term of the sequence) and  $S_n$  (the sum to  $n$  terms of the sequence) and explain the formula:  $S_n = 1/6 (n)(n+1)(n+2)$ . When she calculated the total number of presents to be 364, this sparked a hot discussion on whether one would rather get a present every day of the year (except perhaps one’s birthday!) or receive this special treatment on the 12 days of Christmas!

Towards the end of standard 12, students are required to put together almost all the mathematics that they have learnt in functions, differential and integral cal-

culus in the chapter on differential equations. While they regard this as the culmination of their efforts over the last two years, the truth of the matter is that they have a long way to go before they can actually see the math that they study put to actual use. But it certainly helps to have them understand how to use a real life situation and develop a mathematical model from it. And what greater eye-opener than a murder mystery? I have used the following problem several times (once even complete with a gory bulletin board) to introduce differential equations.

**At 3.00 a.m. one morning the police were called to a house where the body of a murder victim had been found. The police doctor arrived at 3.45 a.m. and took the temperature of the body, which was 34.5°C. One hour later, he took the temperature again and measured it to be 33.9°C. The temperature of the room was fairly constant at 15.5°C.**

**Newton’s law of cooling states that the rate of cooling of a body is proportional to the difference between its temperature and the temperature of the surrounding air. Using Newton’s law of cooling as a model, estimate the time of death of the victim. (The normal body temperature of a human being is 37.0°C).**

*Problem Sourced from MEI Structured Mathematics*

Clearly, the pre-requisites to solving this problem,

- Using the given data to develop a mathematical model
- Setting down boundary conditions
- Understanding of the symbols used in differential equations
- Knowledge of the method of separation of variables for the solution of a differential equation
- Knowledge of the integral of  $\int 1/x \, dx$  and  $\int 1/(x-a) \, dx$
- Use of boundary conditions to get constants of proportionality and integration

would, at the start of the unit, be unknown to the students. But the interesting thing was that after each lesson, they would be able to move a little closer to the solution. Towards the end of the unit, estimated times of death would be flying around the class but credit was given only for a full and complete defense of the logic and mathematical steps used to arrive at the correct answer. An important plus is that in the solution to this problem they understand the importance of seemingly minor details such as the constants of integration, the rate of increase of a function and its impact on the time of death, the conveniences afforded by mathematics such as choosing when time  $t = 0$ , the meaning of dependent and independent variables, etc. No amount of dictated definitions can give students the kind of learning that comes from thinking the problem through.

Of late, technology-savvy teachers have been able to bring a visual element into their mathematics classes using dynamic geometry software and graphing calculators. These not only enable students to do mathematical investigations on their own but have also allowed them to actually understand the meaning of esoteric phrases such as: the limit as  $n$  approaches infinity. Of course, designing a mathematical investigation which provides the right amount of scaffolding while allowing the student to work independently requires some skill on the part of the teacher but such activities provide scope for differentiated instruction and exercises multiple intelligences. What better reason for the teacher to exercise her creativity and bring innovation into the classroom?



SNEHA works at the Azim Premji Foundation and also mentors mathematics teachers from rural and city schools. She uses small teaching modules incorporating current technology, relevant resources from the media as well as games, puzzles and stories which will equip and motivate both teachers and students. A teacher of mathematics for twenty years, Sneha resigned from her full time teaching job in order to pursue her career goal of inculcating in students of all ages, a love of learning the logic and relevance of Mathematics. She may be contacted at [sneha.titus@azimpremjifoundation.org](mailto:sneha.titus@azimpremjifoundation.org)



## 16 Bridge as a Cognitive Tool

Amaresh Deshpande

### Background

In 1996, the United Nations Educational, Scientific and Cultural Organization (UNESCO) stated in a report:

Bridge can develop, as an awakening sport and through its factor of conviviality, one's intellectual faculties and a better knowledge of others. It is for this reason that UNESCO accepts to give its help to the World Bridge Federation for all our work in ways to develop bridge at school and for young people.

### Benefits of learning Bridge

Bridge stimulates both the left and right sides of the brain, improving skills in patience, concentration, logic, imagination, lateral thinking, articulation, mathematics, memory, multitasking, visualization and social cooperation.

Particularly, I have found Bridge to be a classroom remedy for math phobia and diminished attention span.

### Math phobia

There is an entire Wikipedia webpage devoted to mathematical anxiety, commonly known as math phobia. It is a condition that can start in a child as early as first grade and cuts across all of society wherever mathematics is formally taught.

When students say they don't understand mathematics, it is more indicative about their emotional state than their cerebral. Even when they encounter a creative and sensitive teacher, the moment he puts down, say 'x' and 'y' on paper or draws a triangle, they are transported back to their emotional state of fear / hatred / indifference – as the case may be. So

it would be a while before those students are able to overcome their particular emotional condition; and in today's fast-paced world how long will that take when life is so busy for everybody!

Having taught mathematics informally for all school ages, I feel that to treat math phobia, it is more effective to tackle it from outside the subject rather than from within. About three years ago, while teaching (urban and rural children) in three schools in Auroville, the idea - of using Bridge as a corrective tool – emerged, since cards certainly don't carry the emotional baggage that mathematics does in a scarred student.

In this way it is easier to affect a fundamentally empowering – I too can independently think - change in this student using selective aspects of Bridge, where logic / problem-solving can be seen and experienced to be accessible, and as a start, mathematics will begin to feel lighter. Such a psychological shift in the student is as fundamental as the shift of having learnt to ride a bicycle or keep oneself afloat on water. Just as there is no question of ever forgetting cycling or swimming, once learnt – in the same manner there would be no relapse in the student in that which has been internalized. That point must be reached, and through Bridge – can be reached.

### Diminished attention span

Children today are over-stimulated because a large part of their time outside school hours is spent on Facebook, Twitter, text-messaging, video games, surfing the net and television. The effect of all of this is that kids in classrooms have become restless and distracted and their attention spans are ever

decreasing. Since academics can never compete with this kind of relentless stimulation, students are easily bored. No doubt today's kids are much sharper in many ways precisely because of this stimulation, but many equally valuable abilities from an earlier generation are lost. These include the quiet and the patience to be able to read a book, or more generally, to engage in an activity that takes time to unfold and where no instant gratification may be available.

From the experience gained through my recent Bridge workshop at the Bangalore International School, I feel that Bridge can be an effective antidote to the world-wide problem of over-stimulated and restless kids in a modern classroom. Two boys from fifth grade - A and J - particularly come to mind.

Both are distracted kids, but differently so. A is quiet and lost in his own world (what one might call 'spaced-out'), while J is volatile and disruptive. In the beginning A couldn't string his thoughts properly together, in fact was impulsive and gave incoherent, random answers. But because he liked the game, he stuck to it and gradually learnt to answer the questions thoughtfully and precisely. As the workshop progressed, A was able to work his way through increasingly complex situations, sometimes just mentally, that requires a much higher order of concentration than it takes to play out the cards on the table.

As for J, he hardly needed time to work out the problems (most of them he did mentally), generally being the quickest in class. During the workshop, J no longer displayed his usual disruptive behavior except on a single occasion when he got very upset with a fellow student - whom he pushed; then threw his cards on the floor and walked out, but I suspect the fellow student was needling him. Rather, J was always enthusiastic even when I asked him to assist others who were struggling. His helping didn't always work out, because often he was too fast in his explanations and got bored if he wasn't understood.

So the task with J was to keep him challenged with tougher problems, and given the format of the workshop that allows for different abilities to function at their own speed, it was possible to engage J for reasonably sustained periods of time.

### Why hasn't Bridge taken root in schools worldwide?

In 2005, Bill Gates and Warren Buffet donated one million dollars towards the cause of teaching Bridge in American schools. Unfortunately nothing substantial of note seems to have come of this. Besides this generous and concerted effort, there have been several more humble attempts to introduce Bridge in schools worldwide, yet there appears to be no sustained, pedagogically rigorous teaching program according to the information available on the internet.

In the past, teaching of Bridge (as with most general books on Bridge) began with *bidding*. This is much too abstract a topic to start with most adults, never mind children. Over time MiniBridge was developed as an intermediate game before beginning Bridge. MiniBridge bypasses *bidding* and instead focuses on the *trick-taking* aspect of Bridge. But even Mini-Bridge can become too theoretical when taught by an overbearing missionary bridge player / teacher.

In fact, therein lays the problem. School teachers almost never know Bridge; so most of the attempts to introduce Bridge / MiniBridge to school students have been by Bridge players and Bridge teachers who have not had much experience of dealing with children.

Within the Indian context, a further problem exists; the commonly held view of cards being associated with gambling.

### Teaching methodology which I have evolved

I begin with open-card problems known in Bridge world as *double dummy* problems. These are akin to



endplays in chess – and like pieces on a chessboard, all the cards are visible at all times to everyone present at the table.

The distinctive feature of my open-card problems is that the individual cards do not belong to the person sitting behind them and that the persons sitting at North and South seats are not playing against the people sitting East and West. Rather it is the North-South cards that are playing against the East-West cards.

Working through the open-card problems, students have gradually learnt the importance of calming down and relaxing; then to focus on the given task and start independently thinking, working through a variety of if-then scenarios from all the four perspectives (i.e. from the North, South, East and West directions, irrespective of where the student is sitting at the table); then arriving together at the optimal solution within their small group (of up to four students); and lastly to articulate to the whole class the group's (wrong or right) answer. In this collaborative way of problem-solving, competition is eliminated altogether since none of the players themselves are winners or losers; rather it is the North-South or East-West cards that win or lose.

Competition leads to one-upmanship and to psychological domination of a minority of 'bright'/quick/loud students over the majority of the group. Problem-solving, I feel, is better approached through cooperation and non-competitive dialogue where each participant (in a small group) has an opportunity

to articulate his / her own reasoning and for others to check its logical validity with respect to their own articulation – the idea being that everyone should get a chance to speak and be heard, irrespective of whether one is right or wrong. The emphasis then is on the process and not loaded in favor of the 'correct' result. Thus all the answers are equally discussed in detail, in an environment that is essentially non-threatening.

From the open-card problems, I lead the students on to selected Bridge software that deal with the trick-taking aspect of the game (to learn to identify patterns and apply the relevant techniques learnt from the open-card problems to the situations occurring over fifty two cards); then on to MiniBridge (where students experience the trials and tribulations of team dynamics); and lastly, to the full game of Bridge - which as someone once succinctly observed:

“This is a most humbling game, and sometimes it seems you get sucked in to a Black Hole and will never get out. Don't worry. As the doctor said to the patient with a kidney stone, ‘This too will pass.’”

### Scaling the Bridge program for urban and rural schools

In collaboration with experienced curriculum coordinators, a comprehensive Bridge syllabus could be designed and then tested in a few willing schools for the period of one year – the idea being to introduce Bridge, in a phased manner, as a topic in mathematics textbooks from grades one to nine.

Subsequently, a training course could be designed to be taught (optionally) in teacher-training colleges and institutes so that young teachers would have working knowledge of the game.

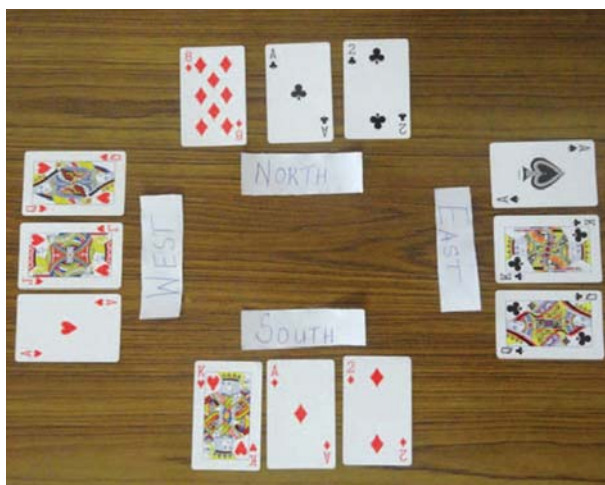
Bridge books are unavailable in vernacular Indian languages, so translation work of important books would be necessary for creating a body of resource material.

## Sample open-card problem

(A single person playing chess will usually play fairly and optimally from both white and black pieces, gaining perspectives from the two sides. Similarly, in this open-card problem, the person/s should play impartially and optimally from each of the North, East, South and West seats).

Rules: North and South cards are one team playing against the East and West cards that form the other team. All the four suits (Spade, Hearts, Diamonds and Clubs) have equal hierarchy – and within a suit, the hierarchy from high to low is: Ace King Queen Jack 10 9 8 7 6 5 4 3 2. The object of the game is for each of the North, East, South and West seats to take tricks for one's own team. A trick requires four cards and the highest card wins the trick. It is necessary to follow suit, which means when a spade is led, the next player (going clockwise) must play a spade if the player has a spade; else a discard is made. A discard can never win a trick, irrespective of how high the discard may be. Whoever wins the first trick, starts the second trick, whoever wins the second trick starts the third trick and so on. The (given) score must be reached, but only after each card has been played optimally from every seat – which the solution of the problem will clarify.

**Situation:** Arrange the twelve cards open-faced on the table according to the picture.



**Target:** Starting North, win three tricks (in total) for the North-South team, playing optimally from each of the North, East, South, West seats.

### Solution:

#### Wrong answer #1

Trick 1: North leads Club Ace, East follows suit with Club Queen, South discards with Diamond Two and West discards Heart Jack. North wins trick 1.

Trick 2: North leads Diamond Eight for the second trick, East discards Spade Ace, South follows suit with Diamond Ace and West discards Heart Ace. South wins trick 2.

Trick 3: South leads Heart King for the third trick, West follows suit with Heart Queen, North discards Club Two and East discards Club King. South wins trick 3.

It seems that North-South team have got the required target of three tricks (North winning trick 1 and South winning trick 2 and trick 3), but only because West didn't discard optimally on the second trick. Notice what happens when West impartially discards Heart Queen on the second trick (seeing that South is going to start with Heart King for third trick). The third trick will duly be won by West since Heart Ace will beat Heart King, the last standing card led from South.

#### Wrong answer #2:

Trick 1: North leads Diamond Eight, East discards Club Queen, South follows suit with Diamond Two and West discards Heart Jack. North wins trick 1.

Trick 2: North leads Club Ace for the second trick, East follows suit with Club King, South discards Heart King and West discards Heart Queen. North wins trick 2.

Trick 3: North leads Club Two for the third trick, East discards Spade Ace, South discards Diamond Ace and West discards Heart Ace. North wins trick 3.

This time it seems that North (alone) has got the required target of three tricks, but only because East didn't discard optimally on the first trick. Notice what happens when East discards Spade Ace on the first trick. The third trick will be won by East since he will have a club remaining which will beat Club Two from North.

**Correct answer:**

Trick 1: North leads Club Ace, East follows suit with Club Queen, South discards Heart King (since that is the card, if kept, will ultimately lose to the Heart Ace from West) and West discards Heart Jack. North wins trick 1.

Trick 2: North leads Diamond Eight for the second trick, East discards Spade Ace (in case South follows suit with Diamond Two, having learnt from wrong answer #1 to save a Club), South follows suit with Diamond Ace and West correctly discards Heart Queen (having learnt from wrong answer #2). South wins trick 2.

Trick 3: South leads Diamond Two for the third trick, West discards Heart Ace, North discards Club Two and East discards Club King. Thus South wins trick 3.

In this correct answer, North, East, South and West have each played optimally in the interest of their own team – and the target of three tricks for the North-South team has been reached.



For many years, AMARESH used to live and work on a farm near Kodaikanal, prepare students of the Kodaikanal International School to write the S.A.T. and occasionally write fiction. Now he travels around India, conducting Bridge workshops in progressive schools for elementary, middle, high school students and teachers. He is also involved with the remarkable Bridge-playing village of Raibidpura in the state of Madhya Pradesh. (<http://bridgebhasha.wordpress.com/>). In between, he tries to find time to mulch the fruit saplings and cut the surrounding weeds that grow so fast on the farm in Kodaikanal. He can be contacted at [amaresh.deshpande@gmail.com](mailto:amaresh.deshpande@gmail.com)



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## The Story of the 4 Mathematical Processes –

An imaginative approach to teaching  
abstract concepts in lower primary school

Renu Bhatia &  
Smitha Mallya

The teaching of Mathematics is a much discussed topic in the sphere of education because too many pupils seem to develop an early phobia for the subject and often, teachers also live in perpetual dread of having to deal with the subject – it is often left to colleagues who are subject ‘experts’ to deal with. As a Class Teacher in a Steiner-Waldorf school, one does not have the choice but to delve into it and find the most creative way to bring this subject to one’s class in a way, one hopes, will build a life-long love of numbers. Since a Class Teacher in a Steiner school takes the class group from Class 1 to Class 8, one knows that this cannot be a half-baked job, because the problems, if any arise from an inadequate understanding in early years, will only have to be fixed by oneself later on!

The four mathematical processes of addition, subtraction, multiplication and division – the foundation of all Math to be taught in the future, are introduced simultaneously in late Class 1 or Class 2 and this is often a time awaited with baited breath by parents and teachers alike. “What will it be like? Will the students get the concept of each process?” “After all the storytelling and fun games are done, will they connect the symbol to the operation?” “When will they make the transition to purely doing sums with the abstract symbols without needing a story to understand the operation?” “Will they see the wonder of Mathematics as relevant to all spheres of life – not just as a concept to be memorized through a method?” As one of the pillars in the 3Rs, one cannot emphasize enough the importance of bringing Mathematics to young students in a creative way to help them then learn so many more things further in their journey of education.

Lofty ideals and very obvious goals – but how does one actually go about it? The one thing I do have on my side is that the subject is brought to the class in a ‘Main Lesson Block’ of two hours every morning for a continuous period of 3-4 weeks, allowing a deep immersion into the subject and plenty of time to digest the matter and come back to it afresh day after day.

It was very clear to me from the beginning that, like everything else I do with my students, the children will understand through images that they connect with and my role would be to bring life to these images. So the preparation for the Mathematics Block was in telling a story that had characters that the children had built a living relationship with. The characters in the story were myself and my six siblings, cousins and friends. My class has got to know them all over time with me through Class 1 and until now through anecdotes, photos, even some visits by family members to my class! The central characters of the story, however, are the 4 uncles, each with a special quirk - one likes to collect, the other likes to give away, yet another likes to make it more and the fourth likes to share equally always. All along I shared the stories with the awareness that a good combination of familiarity of the characters and unfamiliarity of the plot would work very well for my students and me. The quirks of the 4 special uncles were described with funny incidents during my growing up years (exaggerated to drive the purpose of the story) and along with it the symbols were introduced.

The following day, the story unwinds, grandfather on his deathbed, calls the four uncles to pass on the 48 gold coins that were given to him by his father, which

was passed on from his father. The gold coins were a reward by the village lord for doing an act of kindness of building a canal to bring water to the village and prosperity (seeds for another story for another time!). 48 coins are equally distributed in special bags (physical bags are shown - green for +, blue for -, yellow for x and red for  $\div$ .) Addition uncle keeps coins safe, Subtraction uncle gives away to anyone who needs; Multiply uncle ends up trying to make deals that will get more coins; bringing in disharmony until Divide uncle comes in to ask all to put all coins together to be shared equally!

The impact of the story was obvious. Not only was the excitement of the children palpable at each turn of the plot, but also every little prop brought in connected with their inner processing of the concept. The 'Blackboard drawing', another staple of the Steiner teacher's toolkit, when revealed to the class, was received with immense recognition of every detail. Unfortunately, I did not take photos of my blackboard drawing, so have used one from a colleague here for illustration purpose only. The quality that each of the four central characters represented in the story was taken in deeply by the children and transformed into an understanding of the quality of the mathematical process that it was associated with – exactly what the teacher wants to achieve through the whole exercise!



Blackboard drawing

In the 2 weeks following the story, students collected items from Nature in the school grounds. They were asked where it becomes more (+) and where

it becomes less ( $-$ ) to register the idea of addition and subtraction as parallel processes. Similar exercise was repeated with many things in the classroom. Each one wanting to barter sets up shops – again, the concept of transference and therefore addition and subtraction was highlighted. An inventory of classroom articles and count of trees in school was made (addition). Everyday life situations were taken and addition, subtraction, division and multiplication were brought alive. Initially, the children are encouraged to use their 'counters' (a collection of up to 100 identical small objects like cowrie shells, wooden buttons, glass pebbles) to aid their work. Slowly, they are able to wean themselves off the physical counting aid and mentally count their way through their Math work.



Once the processes become fairly clear to the students and a good foundation has been built, the journey is now taken to the next level – abstraction. Symbol is introduced along with the word (more, less, divide, multiply) which are slowly replaced by the 'function' symbol (4 seeds and 3 more seeds becomes  $4 + 3$ )

Children are given enough practice sums to get an understanding of the function even with abstraction. Multiply function is introduced as repeated addition and division as repeated subtraction. Eventually they get to a point of creating their own sums of complexity they are ready for (caterpillar sums/sausage sums -  $2+3=$  tram sums -  $3+4+5=$  and train sums or snake sums -  $4+4+2+3+1+6+5+4$ ).



And of course, particularly in Math as in most other things, practice makes perfect. Four to five minutes are spent just after the Morning Circle, yet another Steiner school staple, to help as a warm up before

the Main Lesson, doing mental Math through situation sums that will have 2 functions as the key elements. 1st & 2nd graders also delight in creating number sums on large scrolls of paper, on the floor, in a story.... Any given opportunity...

In my mind I also keep the real purpose of all 'processes' alive – it is finally for the benefit of all...good economics to benefit everyone. Therefore the stories and incidents consciously carry the message across to sow seeds of good work in future. On a subtle level, I also want my students to, through the study of Mathematics, understand Natural laws - Addition and Subtraction is a parallel process which is constant, therefore they are not viewed only as gain and loss, instead they are mere transference of one thing to another, or from one place to another. This would lay the foundation, for all future life situations, of an attitude of deep confidence in their ability to do things without the fear of loss or lack and with the awareness that abundance and opportunity are the other side of the coin.



RENU BHATIA is currently a Grade 2 Class Teacher and SMITHA MALLYA is a Co-Founder and current Managing Trustee of Bangalore Steiner School. Class Teachers in Steiner-Waldorf schools endeavor to take their students through from Grade 1 to 8, doing all the main subjects of English, Mathematics, Sciences and Social Science. As a first time teacher, Renu draws on the structure & framework of the Steiner curriculum, the collegial aspect of teacher development and of course, good old common sense from raising three sons, to take her students on a joyful learning journey. As a Waldorf parent for 7 years, Smitha has drawn on her immersion into the philosophy of this education to co-author this article. They can be contacted at [info@bangaloresteinerschool.org](mailto:info@bangaloresteinerschool.org)

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## Mathematics can be taught this way too!

H.K. Shubha

Migration of parents brings a lot of challenges to children. One of the biggest challenges is getting adjusted to a completely new and strange environment and it requires a lot of effort for children to get acquainted with their new environment. In such a complex situation, interest and enthusiasm have to be generated among children to give meaningful education in a very short duration.

To understand what it takes to give meaningful education to children of a migrant population, two experimental schools for children of migrant construction labourers were started in 2007, by Azim Premji Foundation.

The purpose of these schools is to build a replicable and sustainable model of quality education for children of migrant labour.

We have a dedicated core team of teachers who have been with the school almost since its inception. They have experimented with a variety of pedagogies, methodologies and sometimes come up with very innovative and effective solutions. One such activity I would like to share with you is teaching children



addition and subtraction through money as well as inculcating the habit of saving and managing money.

Let me give you the background for a savings bank for children in school. Initially, when we were approaching the community and convincing parents to send their children to school, parents agreed to send them to the school because they were allowed to take their younger siblings along with them. Also, because the school was very close to the labour camp where they stayed, children could keep an eye on their homes.

Initially, many children, though curious to know what was happening, refused to come inside the class. That is when parents started giving them one or two rupees as pocket money to convince them to come to school.

Interestingly, many children started keeping their pocket money inside their mouth rather than keeping it in their pocket. They felt that was the safest place to keep their money! Slowly they started giving the money to the teachers for safe-keeping till evening and then took it back.

We started convincing them to save money and use it when they needed it for, say, a haircut or to purchase footwear or whenever they went to their village, and so on.

We started maintaining separate account books for each child. Though it took time for children to trust teachers, after seeing two or three children saving money and using it when they needed, everyone started doing it. Every day, after assembly, children sat in a circle, came with their account books, put the money into the piggy bank and made sure teachers

entered the amount in their book. Each of them knew the total amount saved in their ‘accounts.’

Teachers later realized that they could turn this into a pedagogic practice.

### Objective

1. Understanding number system
2. Understanding the concept of more, less and same
3. Understanding and situating addition and subtraction problems in real life
4. Understand the idea of a calendar

### Life Skills

1. Understanding the importance of saving money and using it meaningfully.

### Activity

Teacher sits in a circle along with children and keeps the saving box at the center. Call one child who has brought money for saving and ask him/her how much money he/she has. After the child responds, ask the child to show it to all the children and put it in the box. If they have more than one coin or note, ask children in a group to add both the values and state how much money the child has. Now ask the children to look at the account book and state how much money she/he already has in his/her account and add the amount he/she wants to deposit. After their response, enter the date and amount in their respective account book. Continue the same activity with all children who have brought money to save.

Similarly, children who want to take money out from their account will inform teachers of the amount they need and explain the reason to the group. The teacher

shows the money to be given to the child and asks children how much money is left in child’s account. Enter the details in their account book, along with dates after discussing with the children and each child needs to write his/her name acknowledging the details written.



### Outcome

In this process, children start recognizing currency and slowly get into the process of simple addition and subtraction. Older children started taking turns to anchor the activity including entering details in accounts book and helping teachers to handle the money. Children love to take part in this process.

The children now save half of the money in the school and from the other half, they buy candy from the petty shop nearby.

This saved money is being used by teachers to teach many concepts related to mathematics like conversion, addition, subtraction, multiplication and division. It gives teachers immense satisfaction to see children learning so well especially given the fact that they have the children with them for such a short while.

SHUBHA has been working with Azim Premji Foundation since 2007. She is associated with ‘Education for the Children of Migrant Labour’ since its very inception of setting up schools. Currently, she is mentoring the Principal of the Azim Premji School at Yadgir, along with anchoring two Migrant labour schools in Bangalore. She can be contacted at [shubha@azimpremjifoundation.org](mailto:shubha@azimpremjifoundation.org)



## 19 Ganesha gives back to Physics

Jyoti Thyagarajan

For many years now, I have taught Physics to the Grades 11 and 12 and it has been the most energizing experience for half the time and almost deathly dull for some of the time.

Most of the physics curricula which I have taught, IB or A Level or ISC, all of which I have taught in equal measures of time, always start with mechanics. So the first thing the students hear is Units, then they hear Vectors, then they hear Speed, Velocity and Acceleration, then they hear Newton's Laws, then they hear Newton's equations of Motion, then they hear Newton's free body diagrams, then they hear Newton's treatment of free fall, then they lose interest. Then, I am left with having to manfully push through energy and power, rotational motion, elasticity, heat transfer and linear expansion in heat before we hit wave mechanics.

Actually, I must confess to trying to paint a dramatically doleful picture. The truth is not so bad. Students managed to keep their interest up through the topics at the big picture level. Occasional days were "full of dole", which was the phrase we made up to keep our spirits up on those days. So, come early the following year, I would set a project to coincide with Ganesh Chaturthi. It counted for 10% for the second year's grade. If nothing, it gave me the chance to link all of basic mechanics together in one elegant package, the elegance being supplied by Ganesha, the package being slapped together by me.

The project needed Ganesha idols. The school I taught in was walking distance from a potters' village and the people at this village made Ganeshas for the northern part of the city. This was fortuitous, because for a class size of ten, I need three unfired

and unpainted clay Ganeshas. Also for each Ganesha, I need two or three "clay slicers", which is a 40 cm length of resistance wire, each end of the wire is twisted around a short stub of a pencil and the pencil acts as a handle. If the wire is placed along a section of the Ganesh and pulled through gradually, it slices the idol in a neat section.

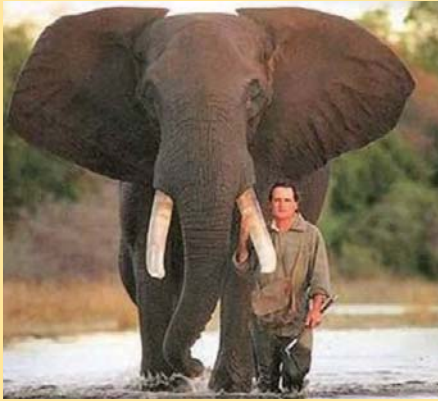
The lab is set with all the usual measuring instruments that is commonly available in a lab, vernier calipers, screw gauge, ruler, weights, force meter, thread, travelling microscope, torque meter and so on. I was happy to supply any of the equipment that the students had used in the lab before, as and when they had the need for it in their experiment.

Each student got the following project prompt on a sheet of paper as well as in my blog:

Before you is an idol of Ganesha. The story of his genesis is interesting and dramatic and can be found at:  
<http://hinduism.about.com/od/lordganesha/a/ganesha.html>

You can also find this image, which I have attached, at:  
<http://treadinggrain.com/2011/made-me-smile/a-elephant-and-man/>

Use this picture to gather data from.



You may use the clay cutter to slice through the idol. I ask that you save all the pieces in the same order that you cut them, so that at the end of this exercise, we can respectfully dissolve the pieces and return the idols to the earth that they came from.

By researching some values of mass, breadth, length, crush-factor of bone material etc, (no more hints!) analyse the physical form of Ganesha and conclude if he is a viable living form. Your conclusion should be supported by numerical data and accurate calculations, as far as possible.

Good luck. You have the rest of this week and the weekend that follows to produce the lab report.

On Friday, we will put all the pieces into a bucket full of water to let the Ganeshas dissolve. If you do not have the readings before Friday, you will not be able to take the readings you need for your project. So, may I suggest that you err on the side of generous when you are taking readings?

So the students got to work and I had a great spectrum of experiments done and many hypotheses proved.

The grading criteria is as per the chart below:

Category	4	3	2	1
Experimental Hypothesis	Hypothesized relationship between the variables and the predicted result is clear and reasonable based on what has been studied.	Hypothesized relationship between the variables and the predicted result is reasonable based on general knowledge and observations.	Hypothesized relationship between the variables and the predicted result has been stated, but appears to be based on flawed logic.	No hypothesis has been stated.
Scientific Concepts	Report illustrates an accurate and thorough understanding of scientific concepts underlying the lab.	Report illustrates an accurate understanding of most scientific concepts underlying the lab.	Report illustrates a limited understanding of scientific concepts underlying the lab.	Report illustrates inaccurate understanding of scientific concepts underlying the lab.
Experimental Design	Experimental design is a well-constructed test of the stated hypothesis.	Experimental design is adequate to test the hypothesis, but leaves some unanswered questions.	Experimental design is relevant to the hypothesis, but is not a complete test.	Experimental design is not relevant to the hypothesis.

Procedures	Procedures are listed in clear steps. Each step is numbered and is a complete sentence.	Procedures are listed in a logical order, but steps are not numbered and/or are not in complete sentences.	Procedures are listed but are not in a logical order or are difficult to follow.	Procedures do not accurately list the steps of the experiment.
Data	Professional looking and accurate representation of the data in tables and/or graphs. Graphs and tables are labeled and titled.	Accurate representation of the data in tables and/or graphs. Graphs and tables are labeled and titled.	Accurate representation of the data in written form. No graphs or tables are presented.	Data are not shown OR are inaccurate.
Analysis	The relationship between the variables is discussed and trends/patterns logically analyzed. Predictions are made about what might happen if part of the lab were changed or how the experimental design could be changed.	The relationship between the variables is discussed and trends/patterns logically analyzed.	The relationship between the variables is discussed but no patterns, trends or predictions are made based on the data.	The relationship between the variables is not discussed.
Conclusion	Conclusion includes whether the findings supported the hypothesis, possible sources of error, and what was learned from the experiment.	Conclusion includes whether the findings supported the hypothesis and what was learned from the experiment.	Conclusion includes what was learned from the experiment.	No conclusion was included in the report OR shows little effort and reflection.

(Thanks to Rubistar (<http://rubistar.4teachers.org/>) for help in creating the above rubric for the Ganesha project)

One student did a comparison of the size of a man and the size of an elephant head and produced a result that was earth-shattering for me. I had always imagined Ganesha to be knee-high, but not true! He would have to be as tall as an elephant to be able to carry that head to the proportion to which we have become accustomed. I accepted this project, although it was almost all math and very little physics.

I do not have a record of actual measurements that the students took. They were almost all students from other countries and at the end of the course went back to their countries. But I remember rough sizes. For example, Ganesha's backbone would have to be of a diameter of about 20 centimeters, it turned out, to avoid being impacted by the head. The weight of the

head forced his legs to be about four times as thick in cross-sectional area if he walked on his hands and legs, or six times as thick if he walked on two legs.

One student looked into the elasticity of the veins and arteries, but ran aground because he did not have access to base figures from the internet. Another student ingeniously realised that the turning momentum necessary to turn the elephantine head would cause a problem, but the linear force to stop the turn could tear the muscles on the neck. He was thinking rotational momentum. He also suggested that if Ganesha ever looked down, the muscles on the back of his neck did not have the bulk to ever lift his head again. This was not supported by data or calculation, and it was not for want of trying in medical data banks. Seemingly,

medical researchers do not test tear limits of bundles of muscles in the human neck. If they do, it was difficult to find at short notice. Students thought that medical sites that handled whiplash wounds should have had the data, but it was not available.

There was a comment on micro-surgery being necessary on one script that I wrote, “This is a little facetious!” against. But my favourite comment was from a German student, who noted that while his research showed that Ganesha was an unviable physical form, as a spiritual form there were few religious figures that could compete with him!

Did the students learn from this exercise? Yes, I would say that they did learn how all of science is interconnected. They also learned that the investigations in real science are sometimes elegantly simple. Did they demonstrate their knowledge of mechanics? I would say some did, and some did not. But is that not the way with term tests, as well? Would I do it again, in another classroom in the future? I would respond with a resounding, “YES!”



JYOTI has taught Mathematics and Physics for thirty years, on both sides of the Arabian Sea. She started teaching in Lusaka, Zambia. Then ten years later, she moved to Liverpool to do a second Masters in High Energy Physics and Education. She returned to Bangalore to work at Mallya Aditi International School for ten years. Then, just to break the ten-year repeating pattern, she moved to Kenya for six years to teach at International School of Kenya. She re-returned to India to work at Aditi again for a short while and “retired” from her formal teaching career after four years at Stonehill International School. Now Jyoti is involved with a dizzying number of initiatives in a mind-numbing number of NGOs. One day, in the distant future, Jyoti promises to really retire. She can be contacted at [jyoti.thyagu@gmail.com](mailto:jyoti.thyagu@gmail.com)

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## Teaching Chemistry Effectively: COULD I HELP?

**Chandrika Muralidhar**

Close to two decades ago, when I stepped into a grade 12 classroom, I have to admit, it was with the enthusiasm of a newbie teacher with dreams of sharing all my 'learnt' knowledge with my students. I was well-armed with the relevant textbook, reference book and a couple of charts. I started off with what I thought was the right way to do so and lectured my way through the next 40 minutes. I stepped out feeling triumphant of having completed my 'task' of 'teaching' my students. However what I could not overlook and shrug off was the disinterested look in the eyes of the students. This went on for a while till it reached a stage when I could not go on in this manner and decided to have a chat with them.

So in one of the classes, we stepped out and gathered around a tree in the school compound. The children were baffled, amused and apprehensive too as they did not know what was in store for them. We started off by talking about what they felt about their school life till then and what plans they had for the years to come. This partly eased them and their comfort of speaking went up a bit. I was however in a rush to talk to them about their challenges in a subject like Chemistry. This was all that I had to ask and there was an outpouring of the difficulties that they faced in the subject. That is when it struck me that as a teacher, it is my responsibility to make the subject as learner-friendly as I can.

This is where my journey began and what I will be sharing now are a few experiences of my teaching days wherein I endeavoured to make Chemistry as approachable and learnable as possible. At the high school level where the focus is primarily on the Board examinations and the children are faced with

the load of not just one subject but many others like Physics and Math, the children look for easy and sustainable methods of remembering data, understanding concepts and also methods that would help them to get the maximum marks. Hence, as a teacher at this level, my constant endeavour was to help them with simple techniques and I primarily operated from that domain.

### Case 1

At the +2 level, organic chemistry carries a weightage of 15% of the whole syllabus and the marks in the examination. The content for this is voluminous and a total challenge for the student. They constantly battle with the challenge of remembering the numerous equations. The major part of the questions in the organic chemistry portion in examinations was based on using chemical equations to convert one compound into another. These kinds of questions are referred to as 'conversions'. For example: conversion of an alcohol to a ketone or an aldehyde to a carboxylic acid and so on. Students found it very difficult to remember the various equations in the textbook and consequently lost out in scoring marks in this portion. To solve this issue we developed what we call as 'flash cards' which each student would possess and write on. These cards are cards made of hard paper like chart paper, approximately of the post-card size.

### What do students do with these flash cards?

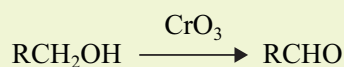
- They write down the important chemical equations on the card. Both sides of the card are used. As far as possible, not more than two cards are used for writing the information for one category of compounds, like two cards for equations on

alcohols, two cards for equations on aldehydes and so on.

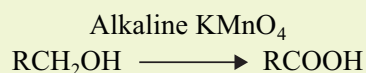
- These cards are strung together for later use.

#### Chemical properties of alcohols

##### 1. Primary Alcohol to aldehyde



##### 2. Primary alcohol to carboxylic acid



How and where do the students use these cards?

- These cards are brought into use when the students need to perform organic chemical conversions.
- For example:
  - If the conversion given is ethanal to ethanoic acid.
  - The student first identifies that this is an aldehyde (ethanal) that needs to be converted to a carboxylic acid (ethanoic acid).
  - He has his set of cards with the equations written on it. He looks for the equation that converts an aldehyde to a carboxylic acid. On identifying this he writes the relevant equation and completes the conversion.
- This is one example. In a similar manner a student works on a few more such conversions.
- It's the teacher's responsibility to encourage the students to use the cards and perform the conversions.

How does the use of flash cards help?

- With constant practice of using the cards the students familiarize themselves with the varied equations and it stays like an imprint in the memory of the child.

- The cards are a condensed version of the voluminous text portion of organic chemistry and are handy to carry and use.
- The child is given the freedom to write the equations on the cards the way she finds it the most convenient for use.

The feedback that I received as a teacher when these cards were used was mainly from students who lost out on scoring in organic chemistry in the tests and examinations. Many felt that it was easier looking at a dozen small cards rather than ten pages in a textbook.

## Case 2

Children who take on Chemistry at the high school level generally do take it with Math, however, there is still a lot of apprehension in solving of the numerical. Also, there is a common misconception that if the answer is wrong they would lose the credit for the whole question.

So as a teacher my first task was to familiarize them with the system of assessment in the final examination. They had to be made aware that the answer to a numerical carried the least mark while it was the steps that would be more important, the logic being that focus was not on the end result alone, but on how well the concept had been understood. In the following way, I went about helping the children tackle the numericals effectively and with reasonable success:

- My first suggestion to them was to complete all the descriptive questions and multiple choice questions before attempting the numericals.
- The first step of solving a numerical was to read it a minimum of three times. The reading for the first time would not strike a chord at all in how to solve it. The second and third readings would provide some idea as to what has been asked.
- The next step would be to write down all the data which is given in the numerical along with the

relevant symbol and also what has been asked to be calculated. This can be enclosed into a box (square or rectangle) – say Box 1

- The student could then (in the working column) write all the formulae which she thought could be applied here. One by one she can then eliminate and finally choose the right formulae. Once this is done the formula is then written and also put into a box – say Box 2
- The student then substitutes the values which she has identified in Box 1 in the formula written in Box 2. This substituted formula is then put into Box 3
- The student then performs the calculation and writes the answer with the relevant unit in another Box 4
- To cite an example for this, I would like to refer to a solved numerical in the NCERT Chemistry text of Class XII (Page 72, example 3.3)
- The standard electrode potential for the Daniel Cell is 1.1V. Calculate the standard Gibbs energy for the reaction:



On having read this the child lists the data given in

$$E^0_{\text{cell}} = 1.1\text{V}$$

From the ionic equation the student finds that the electron change is 2

$$F = 96487 \text{ C mol}^{-1}$$

Box 1

$$\Delta_r G^0 = -nFE^0_{(\text{cell})}$$

Box 2

$$\begin{aligned}\Delta_r G^0 &= -2 \times 96487 \text{ C mol}^{-1} \times 1.1\text{V} \\ &= -21227 \text{ J mol}^{-1}\end{aligned}$$

Box 3

$$\Delta_r G^0 = -212.27 \text{ kJ mol}^{-1}$$

Box 4

Box 1 and the formula to be used in Box 2.

How does this process help?

- For one, it is systematic and the child does not miss out on any step and hence also no marks are lost
- Even if the child goes wrong in the calculation she is bound to be valued for the earlier steps written
- In numericals, with multiple steps this provides a logical flow to the calculation
- From an evaluator's point of view it is easier to mark such meticulous presentation

### Case 3

The inorganic portion of the grade 12 chemistry syllabus is the most dreaded as it is made up of description of metallurgical processes and preparation and properties of metallic compounds. This is another part that is difficult to learn and also remember. In fact, many of my students used to skip parts of this portion as they did not want to and also did not know of a better way of learning it other than rote learning it. Moreover, the textbook listed selected properties and explained them briefly, while the reference books dealt with each property in detail. This was another aspect of the challenge as the students, mostly if not always, considered learning all the possible information from the reference books. This wasn't really necessary. With the help of my students we devised a method to tackle this issue. To take an example – in chemical properties of metallic compounds, the students had to learn the properties of compounds like potassium permanganate, potassium dichromate, sodium chloride, sodium carbonate and so on. We went about it like this:-

- The students were divided into groups with at least five members and the groups worked entirely

during class hours. None of this work was carried home.

- Each group was assigned the compounds of one particular metal.
- The group had to first make sure that each member had a copy of the textbook and a set of at least two different reference books.

How did the groups work?

- Each group would record their information in A4 sized papers and generally a student with a legible handwriting would take on this responsibility.
- The whole group would then read about the compound from the textbook. They would note down the methods of preparation and the chemical properties shown by the compound.
- After this the reference books would be used to get the maximum information about the methods of preparation and the chemical properties.
- This would be done for the compounds which were allotted to the group and written in brief in the sheet in a format like this:

Name of compound	Preparation method/property	Chemical equation involved	Specific use of property	Type of property (oxidizing, reducing etc)

- What we focussed on here was to look at only the methods mentioned in the textbook and talk about them in detail.
- Also many of the properties which they noted were easily observable in the laboratory and therefore we would then go to the lab and carry out the experiments.
- After each group compiled their information about the compounds, this would be shared with the rest of the groups wherein the other groups would make photocopies of the information.
- With the information culled out in this manner, it was then an individual effort to map common properties across compounds, eg. compounds which showed reducing properties. Some students would create flow charts or mind maps about the comparative properties and share them with the class.

In all the three cases above I have shared the practices that I followed for almost two decades. They sustained for this long a period primarily because they appealed to the students and it made work easy for them. I got constant feedback from them and other than a few minor changes these were used. In fact, just a year back in one of the social networking sites my students had a conversation about the flash cards and how they are still reminded of them!! To me as a teacher, I learnt much more than the books I referred to and over the twenty odd years I hope that I have been of some help to my students.



CHANDRIKA works at the Azim Premji Foundation and is a member of the Uttarakhand State Institute. She comes with a previous experience of twenty years as a Science practitioner at the high school level. She can be contacted at [chandrika@azimpremjifoundation.org](mailto:chandrika@azimpremjifoundation.org)

**21**

## When A Teacher Facilitates

**Nisha Butoliya**

I worked as a Primary teacher for six years in two private schools for three years each. In both these schools, all the teachers were given appropriate inputs to follow Theme Based Teaching- Learning process<sup>i</sup> under the guidance of Shri Rasik Bhai Shah, Educational Consultant, Mumbai.

Though the whole idea of theme based learning is innovative and the activities that we planned were always exciting, there is one particular experience which is extremely thrilling and that I would like to share with you all.

My class III children were working with the theme 'Myself'. It was the beginning of February 2009 and I had to cover the topics mass, volume and length in mathematics along with the other topics of Language and EVS. The concepts of Language and EVS were easy to cover since I could plan numerous activities based on this theme. I was getting tense, since the activities which would bind all these subjects – EVS, Language and the above-mentioned concepts of Mathematics - were tough to find.

I thought a lot...looking at these words (mass, volume and length), constantly the picture of a weighing balance danced in front of my mind's eye; but what to do? Should I take my children to a shop, where they would see how things are weighed, how liquids are measured? But they see this every day. What could be done to make this experience a new and an exciting one? And only looking at the shopkeeper is not that exciting. Will he allow my children to touch the balance and use it for weighing? But how many children can actually use it - all 30 students? Every time repeating the same thing?...Boring.... These were the thoughts that passed through my mind.

This is the point at which this interesting idea struck me – what if my children make a weight balance, weights, containers to measure liquids? Great!

I told my children that we shall set up shops two days later and sell things to the teachers and students of the other classes. They started asking me a lot of questions, answering some of their own questions and giving me ideas on how this can be done.

We decided to take small steps – they all knew kilogram (kg), gram (g), litre (l) millilitre (ml), millimetre (mm), centimeter (cm) and metre (m). After a kind of recapitulation we went out to collect stones which they were going to use as measures of weight. After that we sat in a big circle in the playground. Each one of them displayed the stones. They labeled the stones – 1 kg, 500gm, 250gm, 50gm etc. I kept a watch on the size of stones – very soon they realised that the relative size of their stones and the quantity it depicts should match. They learnt from their peers, helped each other, corrected themselves, searched for smoother stones.

We went back to the class. Together, we thought about the ways of making a balance. We exchanged ideas...all were great! They suggested the use of mud plates, steel plates, cups, paper plates, leaves, sticks, iron rods, threads, etc.

I asked them to think about the items they wish to sell: one item could be repeated only once. Here, some said that they would sell oil. I said I need rope, is anyone interested in selling it? Immediately 5-6 hands sprang up. Here was the opportunity for me to discuss the difference between length, mass and volume and how we measure them. We all thought about the ways. Containers for measuring liquids

were chosen and we had metre scales to measure length.

Then we discussed how we could make this activity interesting for the children and teachers of other classes? We thought that we'll advertise for the items that we were going to sell. Again there were ten different ideas on advertisements – slogans to be written on paper, slogans to be spoken aloud repeatedly, some models, etc.

The next day, we all prepared for our shops. I helped them with small things like arranging tables, decorating their slogans, pasting their advertisements and was following their suggestions.



The day after, we all came to the school, ready to set up our shops.

All the tables were arranged along the walls. In front of the tables, I saw beautiful slogans and advertisements – ‘Buy 2 kg pulses and get 1 kg free’, ‘Oil for hair, for cooking, for skin; buy and be healthy’. They were original, their own. Some of them also prepared paper bags, because they said we need to keep our environment clean.

My cute little children looked so enthusiastic; setting up their shops, they were so busy, new ideas were buzzing and I stood there watching them, absolutely speechless!

Now the other teachers came one by one with their students. They asked them to give 3 kg potatoes, they

bargained, asked for change and my little children again got busy in calculations. Yes, they also made money with papers! Classes came, teachers asked questions on money, mass, volume, conversions, uses of carrots etc. How much is 1kg rice? What If I buy 1kg and 250 gms.?



Some of my children looked puzzled, some confident - but nobody left the ground. They went on responding to the ‘customers’ queries.

One of the teachers praised my children for their communication in English. She said that they were fluent. I felt happy and proud! But I was wondering if the children who used to fumble had, all of a sudden, become fluent because they got a context to talk in?

At the end of about 2 hrs., when almost all the Primary classes were done visiting, we displayed the board of SHOP CLOSED. My children looked tired, but enthused.

We all saw that the grains of pulses, cereals were spilled all over the floor. What to do? We started thinking. Then I threw an idea – should we collect and throw them in the dustbin? All of them shouted, ‘No!’ (We had discussed about the ‘food we eat’ in the previous theme). Then we all decided to do something which would be useful. One of them suggested that we collect the grains and carry it back home. While pondering for some time, we decided that we will sow the grains in the garden. All of us started

collecting the grains lying on the floor, went to the park, dug the ground, sowed the seeds, and used our water bottles to water the plants.

Every day we used to expect that something will come out and one day, it did. That was a real achievement!

After sowing the grains, when we went back inside the classroom, I suggested that all of us write about the activity - how we planned, what preparations were made, how it was done, experiences of interacting with people and what they felt about the activity overall.

Children wrote 2 to 3 full-page reports – class 3 children! I was absolutely surprised! When they were asked to write based on other given topics they used to write a paragraph or two, but today they went on writing.... in their own words....not in very fluent English...but, believe me, it was an original, perfect reflection of their plans, preparation and their hard work. They asked me several questions – mainly translations of Hindi and Gujarati words and sometimes sentence constructions. I realized that my children were great; it was I who was at fault. I hadn't given my children proper context to write about.

### Assessment

We used to follow continuous and comprehensive evaluation (CCE). My children were always aware that their teacher would definitely keep recording. I didn't mind sharing my observations with my children.

I had the reports of my children to evaluate various aspects of English language – vocabulary, grammar,

spellings, handwriting, creative writing and I also kept a record of observations when they were having their conversations with the other teachers and students.

For mathematics, I went to each of the tables and asked them pertinent questions on conversions of kilogram into gram, meter into centimeter, liter into milliliter and similar other questions.

For EVS, there was not much scope for questions and answers, but I could make my observations on their environmental sensitivity aspects.

**Note** – All these criteria of assessment are as per CBSE norms.

### Reflection

When I sat and thought about this whole experience, I wondered what had I done? What had my part in all this been?

My children had prepared the weights, they set the shop, they had raised questions, they had asked my help, they had thrown out ideas.

They had learnt everything – more on money, mass, volume, length, uses of cereals, pulses, vegetables. They created slogans, they interacted in English with the teachers and students, they understood the questions that were asked by the people, they wrote reports, they realized the use of paper bags instead of plastic, we cleaned the class and we grew some saplings.

Math, EVS, Language - I felt it was a perfect class!

Yes, I supported and encouraged them. I gave them opportunity. They did all the work, I just ignited the fire, I had facilitated!

### Footnote

i In theme-based learning, concepts and skills are woven around a theme, so the whole curriculum revolves around the specific themes.

NISHA is currently part of the Language team at Azim Premji University, Bangalore. She was a primary school teacher and an academic coordinator for several years. She worked on theme-based teaching-learning processes for a long time. Her interest areas include developing curriculum, understanding teaching learning process and interacting with students and teachers. She can be contacted at [nisha@azimpremjifoundation.org](mailto:nisha@azimpremjifoundation.org)



# 22

## Innovative teaching of some Concepts in Geography

Tapasya Saha

### The meaning of 'innovative teaching' to me

What do I understand by 'innovative teaching'? Innovation is not invention or discovery; it's a way of looking at the subject or concept that I want to teach, focusing on two things. First, **what** is it that I am trying to communicate to the children and secondly, **how** am I going to do so. This 'how' part should have **a qualitative element of awe, a surprise of the concept dawning upon the student.** The teaching must necessarily be contextual to the child and a little challenging. The teacher should give enough space to the child.

### The unique situation

The Azim Premji School, at Mandwa, has a small courtyard not more than 30 ft. by 15 ft. It is the only place in school where all the forty children can be together; this place is not big enough for all of them to run around as much as they want without going out of another's reach. Without being conscious of it, they were quite close to each other. I wanted to use this space for multilevel, multi-grade and peer-learning.

The children have been given admission according to their age (as per the Right to Education Act norms). Children in class 1 have never gone to school, some children in classes 2 and 3 have gone to school, some are drop outs and some have come to school for the first time; so the academic levels of the children were not very different, though their ages varied.

I wanted to take this opportunity to enable all the forty children to learn something together.

### Topic No. 1

#### How are seasons caused?

#### Objectives

1. Students will see for themselves that the sun is moving towards the south, away from the courtyard and this is connected to the chillness in the air.
2. The movement of the earth round the sun (revolution) causes summer and winter seasons.

#### Activity

The activity was spread over a period of 29 days between 10th September and 8th October. Children made 8 observations on September 10th, 14th, 17th, 20th, 26th, 28th and October 3rd & 8th.

Children marked the sun rays entering the courtyard at a particular time on those days when it was bright and sunny.

#### Steps

- A mixed group of children from all the three classes marked the rays of the sun entering the courtyard at 8.12 a.m. with white oil paint.
- All children saw the marking of the rays. The mark being in the courtyard, the children could always see it without effort.
- A teacher would record the date and the time of observation in a chart which is stuck on the wall of the courtyard.
- Teachers and children measured the distance on the last day of the observation.

#### The final transaction

- The teacher asked the children if mornings were

a little colder these days and asked for the reason. They agreed on the coldness but could not come up with reasons.

- As we observed together, children found the marks on the ground becoming more and more slanting by every passing day and a big difference of 28 cm. between the first and the last mark.
- Teachers and students went to the door to see the position of the sun, and comparing it with the direction of the rays of the sun, children realized that the sun was moving towards the south.
- All agreed that the slanting rays are caused by the sun's southerly transit.
- All could visualize that in a few days' time there would be no sunrays entering the courtyard.
- All observed and understood that when the sun moves towards the south, the season is winter and when it moves towards the north it is summer.
- All accepted that the movement of the sun causes seasons.



Seasons - Showing the movement of the shadows

## Topic No.2

### “Why are the Lines of Longitude and Latitude drawn?”

This activity was designed for students of classes VI and above.

Prior to the activity, I asked children about latitude and longitude and found that they had some prior knowledge of latitude and longitude, but they were confused about:

- i) Why these lines are needed?
- ii) How are these lines of latitude and longitude read?

#### Objectives:

- i. Reading of latitudes and longitudes.
- ii. To understand that these lines are co-ordinates not on a plain sheet of paper (two dimensional) only, but also on a sphere i.e. Globe.
- iii. To understand that latitudes and longitudes help us to find an exact location of a place.

#### The background

This activity was done with various school children who belonged to class VI, VII, and VIII during a ‘Bal Mela’ in Sheoganj Block in Sirohi District.

#### Activity 1

##### “Where am I?”

#### Materials

1. Two balls of wool of contrasting colours - yellow and maroon.
2. Set A consisting of 8 pairs of cards, of which 4 pairs have the numbers 1-4 written on them

1	2	3	4
2 Cards	2 Cards	2 Cards	2 Cards

The other 4 pairs of cards have A, B, C, & D written on each pair respectively.

A	B	C	D
2 Cards	2 Cards	2 Cards	2 Cards

3. Set B consists of 4 cards, each with pictures of a cloud, a tree, a flower and a bird.

Cloud	Tree	Flower	Bird
-------	------	--------	------

#### Steps

1. The students were divided into 4 groups.
2. Clear instructions were given to each group.
3. Group A had 16 students each holding the cards of Set A and positioned them as in Fig 1. The students with the same number/alphabet stood

facing each other and also held a woolen thread of a particular color, so that all alphabets are in yellow and all numbers are in maroon. Thus the field looked like as in the Figure 1.

- The students of Group B held cards with the picture of “cloud”, “tree”, “flower” and “bird”, and stood at any intersection of woolen-lines, of their choice.

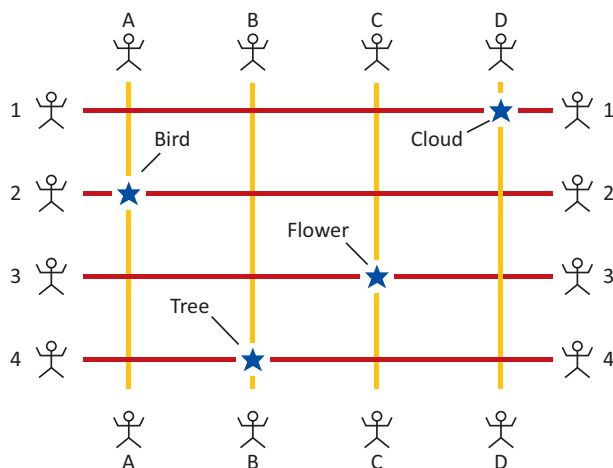


Figure 1

- Students of Group C asked where each of these “cloud”, “tree”, “flower” and “bird” is located.
- Students of Group D answered the questions after looking at the co-ordinates carefully and consulting with each other.

With the help of a volunteer I explained how to find the location and which coordinate to be mentioned first.

## Activity 2

### “Destination”

#### Materials

- Two balls of woolen thread of contrasting colours green and blue.
- Set A of 10 pairs of cards consists of 10 cards, out of which:
  - 2 pairs of cards representing  $0^\circ$

- 8 pairs of cards representing  $1^\circ\text{N}$ ,  $2^\circ\text{N}$ ,  $1^\circ\text{S}$ ,  $2^\circ\text{S}$ ,  $1^\circ\text{E}$ ,  $2^\circ\text{E}$ ,  $1^\circ\text{W}$  and  $2^\circ\text{W}$  (2 cards representing each)

- Set B cards consist of 4 cards with pictures of “Mountains”, “City X”, “City Y”, and “Desert”.

#### Steps

- Students were asked to arrange themselves in the field using the Set A cards, with latitudes and longitudes just the way they did with number cards and alphabet cards. Some atlases were kept for use, if the need arose.

Here the students of Group B replaced the number and alphabet cards with the latitude and longitude cards. The positions of students are now as shown in Figure 2.

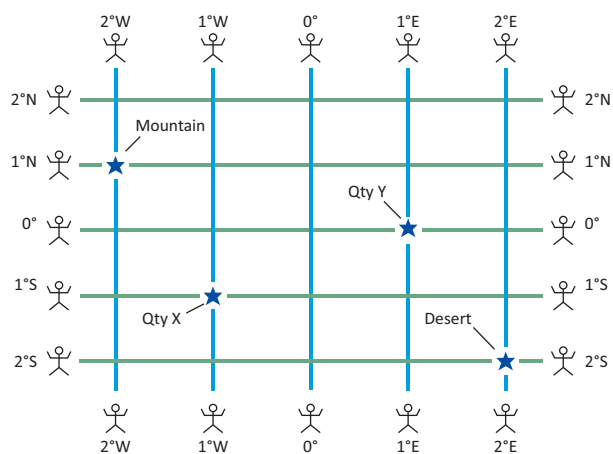


Figure 2

- Students of Group C stood at any position of their choice with the picture cards of “Mountain”, “City X”, and “City Y”, and “Desert”.
- Students of Group D asked the locations of each items and students of group A consulted amongst themselves and answered the questions.

With the help of a volunteer I explained:

- How the latitude and longitudes are numbered
- Which coordinate (latitude and longitude) is to be mentioned first while giving the location of a place



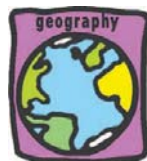
Understanding latitude and longitude

[Though I am mentioning this in the end, actually once the grid (network of vertical and horizontal lines) was formed I explained the whole thing with an example]

### Observations

- As it was a mixed group of boys and girls from different schools and of different grades (Classes VI, VII, VII), ‘learning from each other’ was happening organically.
- As it was not a common classroom transaction, children were free from any burden. They were happy and curious to find out ‘What kind of game it was, with the latitude and longitude lesson, in the open ground?’

- Children in higher grades understood the instructions clearly and this in turn helped the younger ones to understand as well. This is because instruction was accompanied with actual demonstration.
- Though not explicitly expressed, there was an underlying competition amongst the students of different schools. The good thing that I observed was that it helped each other in understanding the problem/question.
- They wanted to continue with the game after all the cards were exhausted.
- Students could understand the instructions completely and could play the game on their own.



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## New Season of Learning

**Yamini Jha**

If as educators we come to the classroom as believers in holistic education, we know that it was the symphony of the harmonized development of the head, heart and limbs that created meaningful education. We, at Shikshantar School, believe in creating an environment of joyful learning for children and evolve our curriculum as per the group need. My group last year was a remarkably intelligent thinking group. Most of the seven year olds seemed to enjoy activities which needed to search facts from encyclopedias, play quizzing games at meal times, loved making riddles, sharing opinions on almost everything, and in science, trying to make hypotheses. It seemed to be a class that any teacher would love to belong to.

Since most of the children were strong in their cognition or thinking abilities, our task was to identify the other areas that would need developing. I found it striking that, on a theme in science, of light and colour exploration, most of the activities that children enjoyed were related to acquiring facts, e.g. how are rainbows formed, speed of light is 300,00 km/second, etc. What we needed at that age was to just admire the light and colours around us, explore how sunlight affects us, how it makes us feel, how it brings a change on the ground around us, how it changes the colour in the world around us, etc. It was only when we “felt” what we “did” that we could “think” in our own way and enable discovery.

This ability of being able to manage the complete integration of the realm of thinking with feeling and doing, which we often philosophize in theory, was integrated in action for me in my classroom when I got introduced to the Dr. Rudolf’s View in Education

by a fellow colleague, Mrs. Ameeta Shetty Kapur. One such integration is illustrated below.

As winter approached, we attempted a thematic integration with the world around. Winter as a theme was explored, where we started by seeing what makes us realize that winter is there. Discussion in circle time on “Change of season” brought in the much needed directions for the projects that we had planned in the coming two winter months. ‘Temperature change’ brought focus on clothes and yarns, where we felt the different textures, and brought in first steps of knitting in the classroom. The knots were learnt, need for wearing shoes got integrated with learning how to tie our shoe laces. This activity was explored by making a cut out of shoe flaps with punched holes, and children learned, through step-wise demonstration, how to tie laces in them.

Next, dexterity in fingers was challenged by their knitting the wool. This project was demonstrated by us to children in the form of a story which could be repeated, as the sequence required to finger knit. There was a small pond (here we make a loop with the wool, right side up), a kingfisher bird felt hungry and dived in (we can demonstrate how we put our finger in) and from the water brought out a fish to eat (pull the thread in a loop). The pond was calm again (loop is back in same size again). Different children were able to achieve this to different levels; the important thing was that their attempting, and continued practice. Therefore this was made as a corner activity which children could continue doing in the classroom in their free time. This definitely kept them engaged if they finished their work ahead of time. Even the ones who mastered these were encouraged

to try knitting with needles. Though for a facilitator, it required a lot of material organizing and demonstrating skills, besides keeping loads of patience with children getting stuck at each step and individually addressing each one at their level, it is worth the effort when you see how many skills the children have learnt. I was facilitating this activity alone, but it would certainly be useful to have another person helping out for hand-work in case it is being done for the first time.



Next, the theme of 'Food' was explored and projects like making methi chapatti were learnt from start to finish. The children, as a collective group, learnt to cut the methi, add spices, knead the flour: when twenty-six children take turns at kneading, the flour is really well done! They were handed small balls of dough at each table which they tried to roll out as chapattis to their liking. They also took their chapatti to the kitchen and if they felt confident, under supervision of the facilitator, also cooked it themselves.

The theme of 'Season' was further explored in the next dimension when the focus went from Man to nature, in the next theme - 'Trees/plants in Shikshantar'. The first day of the project was marked by a visit to the first tree planted in the school and we realized why the school had a banyan tree as its logo. For all of us, it was discovering our roots in the school as each child put up their feelings as a leaf on the banyan tree displayed and created a



class tree for the month. Next day, each child had a tree/plant they chose after their nature walk and throughout the week they were near that tree - feeling it, drawing it, taking the leaf imprints, bark imprints, checking facts like what changes the tree underwent over the year, fruits, flowers, seeds, age height (how many storeys, steps, hand spans, etc.). Most of their research was guided by the caretaker of the garden, our Maali Bhaiya. As facilitators, this was a theme which needed minimum managing as each child was settled in different corners of the school, near a palm tree or a mango tree or bamboo plants or a tulsi plant, etc. They were even motivated to finish other work in the classroom before time so that they could discover a new thing about their tree. They were so engaged that they forgot to talk to each other even if they were sitting beside one another under the tree. Finally, a beautiful booklet emerged as a result of this relationship with nature, which was unique with each child's thoughts - a story or a heart-felt poem, hand/feet measured facts, etc. Each drawing was also indicative of the relation that the child had built with their tree. A bamboo grove could look like a plant with hands reaching out to touch the sky or a mango tree could make us feel it needs to shelter itself from snow and have pointed leaves. This was complete 'learning-by-doing' in action.

The journey on the theme of 'Season' went on when these trees turned into homes for our birds. The trip

to a Bird Sanctuary, that houses migratory birds, led to an integration of the 'Season' in totality. The children, in groups, observed and created three different habitats of birds, which were modeled out of Papier-mâché. The kingfishers' tunnel was dug near the make-believe lake in the sand area next to the classroom. We could find a peacock hiding between the tall bamboo groves with a nest there. The details just kept enriching us as adults, for it was visible how keenly children had observed the birds.

All of these themes had certain essentials - The age appropriateness of content; the circle time setting direction of the day; blackboard drawings, in one corner, lending teachers interpretation of that day on the theme that changed every day; verses with or without movement; stories to highlight the sensitive areas; mind mapping to provide closures on themes.

The classroom had a lot of singing, poetry, art and what we saw at the end of three months was the love of children towards poetry, music and art. Even in word-lists, some children had an image next to the word or sentence they wrote, as they had silently absorbed and deeply felt!

Children need to learn more and be creative, but it is us who need to be creative first. We all need to feel, then create in thought, and perform in action.

As teachers, we actually need the maximum learning and not from books alone. We need a journey inwards where we step back, include child-like wonder in our life, relook at nature and the world around us, to feel and do things naturally. This makes all our work just fall in place, and immerses the child in learning. This alone changes our perception, makes us aware and prepared as a teacher.



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## A Feelings Approach to Science Teaching

**Srinivasan Krishnan**

Science is commonly perceived as being a collection of facts and procedures. However, it is this perception that many children react to while learning it which can lead to an aversion for the subject that is rather unfortunate. In this article, I will discuss the approach to science teaching adopted in the school I teach where an attempt is made to create a suitable atmosphere in the classroom that is beneficial to both the teacher and pupil.

The basic skills that science attempts to inculcate are data collection, depiction of this data in suitable forms like tables and graphs, simple analysis and writing a suitable report. Other skills include the ability to make deductions or predictions, to see mathematical relationships in the collected data, to construct working models and so on. Now, to ensure that children engage in perfecting these skills in a science class, it is necessary to get them interested in some topic. That is possibly where the challenge of managing the class begins. For them to take interest in something requires a sufficient degree of emotional connection, both with the teacher concerned and with the topic itself. This is clearly influenced by factors ranging from physiological issues (like tiredness, aches and pains, etc.) to various kinds of pleasant and unpleasant emotional distractions. In what follows, some issues that I encounter in my classroom are discussed. The examples given are mostly gleaned from physics and chemistry since these are the subjects I am most comfortable with.

One source of stress and distraction that happens in a science class occurs while children are learning to work with units. Children above 12 years of age are

familiar with algebra where quantities such as  $x$ ,  $y$ ,  $a$ ,  $b$  (which are abstractions of numbers and are either variables or constants depending on the context) are manipulated and used to solve equations. Now, in the description of physical phenomena, students learn about quantities such as mass, time, length and so on which are measured in terms of units such as the kilogram (kg), second (s) and meter (m). These units are also algebraic in nature in the sense that 10kg is actually 10 multiplied by kg and 19.3m/s is 19.3 multiplied by m and divided by s. Further manipulation of such units is carried out using the usual rules of algebra. However, units are not abstractions of numbers in the way  $x$ ,  $y$ ,  $a$ ,  $b$  are since in any given math problem these quantities are meant to be equal to actual numbers. In a science problem however, we cannot set kg or m equal to any number. They are actually algebraic names that follow algebraic rules and so are abstractions of the sort dealt with in branches of higher mathematics like group theory. If this is not frequently clarified, I find that many children find it difficult to automatically associate complex combinations of units with complex phenomena like, for example, force with  $\text{kgm/s}^2$  or pressure with  $\text{kg/ms}^2$ . Frequently students mistake one quantity for another. Consider this statement, where a student describes the change in acceleration as a ball is tossed up. “The acceleration decreases as the ball rises till it reaches zero when the velocity is zero and the ball is at its highest position”. Clearly, velocity and acceleration have been regarded as the same thing. It is much harder to see acceleration than it is to recognise velocity. Familiarity and teacher pressure might make students use units blindly but

generally a niggling uncertainty as to its meaning can persist which tends to promote avoidance at an early stage itself and of course later too.

Another frequently encountered issue is the unwanted display of emotions and feelings. Whenever focussed attention is demanded of a group of students, distractions of all sorts that undermine learning can arise. These distractions can take the form of students talking among themselves, teasing, both subtle and open, of one's fellow students or the teacher, physical restlessness or resigned passivity. For the class teacher, clearly, a highlighting of this sort of behaviour in a way that encourages indulgence has to be avoided. The usual solution which involves the use of fear of punishment and other punitive measures is a quick way of dealing with such problems. But this does not solve the long term objective of learning since most students generally switch off especially when such measures are applied regularly. So, is there any other way of dealing with it?

One interesting observation about a child (till possibly the age of 18 or so) is that any particular feeling usually lasts for a short time before changing over to some other feeling. For example, when trying to learn about different kinds of indicators for testing acids and bases, the colour changes can be very engaging for a while but can change to boredom once the novelty wears off. This could then change to curiosity if a general principle about the concentration of  $H^+$  ions is mentioned which can possibly lead to a need to want to do an experiment rather than using the intellect. Taking measurements might be a possible response. But after some time, the children may completely lose interest and may only be interested in chatting in a general way. And so on and on it goes throughout the class. In such an ever changing scenario, the important thing to be noted is that, if significant communication cannot happen during the time when interest is shown by the children, it is not likely to be a very productive class. This is in marked contrast to an adult, where he/she is capable

of supporting an interest for longer time periods with greater focus. Adults are also capable of learning under varied emotional conditions unlike children who have limited capacities in this regard.

One of the ways we adopt in school to deal with this issue of inattention is for the teacher to start with being clear about what he/she wants in a manner that can be articulated in specific implementable steps i.e. implementable by the students in the class. Though students have feelings that change relatively rapidly, the teacher can decide what he/she wants to support. Such directed action does tend to minimise the time that students spend in unnecessary activities. Inappropriate thoughts and feelings cannot be wished away but their expression in students can certainly be modified to more acceptable behaviour. If a student has, say, begun teasing other students, a short walk outside class may be prescribed or another activity can be suggested. What generally works is usually a demand that can be fulfilled easily by the student. Another technique that helps is to be able to set goals that are simple to achieve. For instance, if students are doing problems in a topic they find difficult to comprehend like, say, the law of moments, one can demand focussed attention till about five to ten problems are done well in some prescribed manner. Such clear demands and small goals can give a sense of achievement that goes a long way in ensuring that communication links are strengthened and errant behaviour be discouraged without pointedly lecturing on the topic. In one 9th standard class, students were asked to carry out the lever law experiment after designing and making suitable mass holders out of wire. Though simple, difficulties do arise if one wishes to make a good holder (for example, a holder which can be moved easily across the meter ruler and yet not slip when loaded). Their initial efforts had frustrating moments which were accompanied by complaints and a general dip in interest. But when they were told to pay more attention to what they were doing they finally did come up with some good

workable products. If their fledgling efforts had not been supported continually, they might well have given up or not made an effort to bridge the gap between thought and product.

Finally, I would like to make some remarks regarding some kinds of demands that could be made on children which are not comprehensible by them. For example, asking for focussed attention till a law is understood or to ask that an innovative idea or solution come about in a specified time period are demands chil-

dren cannot emotionally empathise with. It is easy to see why since, logically, not even a teacher or any other adult can fulfil the above demands in a finite time since the act of learning and understanding is not exactly procedural. However, such demands may be made on adults since their brain processes can and do produce results that are satisfactory. But asking students to fulfil such demands can, over time, lead to emotional distress and disruptive behaviour that may prove difficult to correct.



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## Value in Project-based approaches to Learning Science

Priyanka

Students had returned to their classrooms with extra zeal and vigour after the play-time. Some of them were still in a fun mood, a few were trying to relax, whereas a handful of students were waiting eagerly for their teacher. One of them, who was continuously peeping outside, announced that the teacher was heading to the classroom. As soon as the teacher entered, each student was trying to tell her something. But soon they herded in groups in conference style, started chatting, arguing and counter-arguing. The teacher also joined one of the groups and assured the others to join them soon. Is this the scene of usual classrooms in schools or is something going on differently here?

Shortly, it was evident that these students were engaged in a learning task designed around the theme – “Save Electricity”. They had planned the task along with the teacher and were working on it since the previous month. Once in a week they used to discuss their project that comprised series of interesting learning activities like-

- Decoding the current electricity bill of their houses with the help of the teacher (power consumption and the amount to be paid)
- Recording meter readings at certain intervals with parental/family support
- Preparation of an inventory of electric appliances in their houses viz. lights, fans, cooler, mixer, press, etc., stating their volt and watt specifications with parental/family support
- Replacing bulbs and tubelights of the house with CFL (required conviction and support from parents)

- Following power saving practices like switching off lights and fans promptly, when not in use; removing plugs from the socket after switching off TV, Computer, mobile charger, etc.
- Maintaining a record of daily consumption time (approximation) for various appliances for 1 month. eg. 3 lighting device of ‘x’ watt for ‘y’ hour; 2 fans of ‘m’ watt for ‘n’ hour, iron-box of ‘a’ watt for ‘b’ hour and so on. (Dependency on family members to inform them of the consumption while they were away from the home)

BANGALORE ELECTRICITY SUPPLY COMPANY LTD.			
1520302: BPT SUB DIVISION			
Assistant Executive Engineer (Ele.) - (Commercial, Operation & Maintenance)			
<b>Name &amp; Address :</b>	Rdg Date :	01/05/2009	
MANAGING PARTNER	RR No :	8F753	
11, KIADDI	Tariff :	LTS(C)II	
11, KIADDI	Billing Month :	May-2009	
IVRS ID : 1520302032625	Bill Due Dt :	16-05-2009	
Sub Division : BPT SUB DIVISION	Bill No :	3231	
Description			
MR Code	AE2	Sanct. Ld HP + KW	64.00HP + 0.00 KW
Present Reading	8839.1	Total Load	0.00
Previous Reading	8707.1	MD Recorded	0.38
SKWH	132.00	MD Load	0.00
Constant	10.00	Recorded PF	1.00
Consumption	1320.00	Instl Status	1
BILL DETAILS			
Fixed Charges 1st	Units	Rate(Rs)	Amount(Rs)
1st Slab	64.00	35.00	2240.00
2nd Slab	0.00	0.00	0.00
3rd Slab	0.00	0.00	0.00
Energy Charges			
1st Slab	500	3.30	1650.00
2nd Slab	500	3.80	1900.00
3rd Slab	320	4.05	1296.00
4th Slab	0.00	0.00	0.00
5th Slab	0.00	0.00	0.00
6th Slab	0.00	0.00	0.00
PF Penalty			0.00
BMD Penalty			0.00
Other Penalty			0.00
Debit			0.00
Tax			355.02
Arrears			0.00
Interest			14.38
Arrears + Interest			14.38
Bill Amount			7455.00
Exbate			0.00
Credit			0.00
Total Amt Payable			7455

- Sharing records and observations with peers and teacher at regular intervals
- Computing monthly consumption and estimating electricity charges based on their recording sheet
- Comparison of electricity bill of the next month with the electricity bill of last month, analysis and reflection on parity or disparity and discussion on issues like-
  - Was there any difference or similarity in calculated units and billed units?
  - If yes, what might be the probable reasons?
  - Was the bill amount less or more than the previous one?
  - Did they face any difficulty in following saving practices?
  - What were those difficulties?
  - Would they continue to follow these practices? Why or why not?
- Calculation of average electricity consumption per household per day
- Compilation and presentation of report (group-wise and for the class)
- Exchanging and comparing their findings in terms of per capita consumption and practices with children working on similar project in other schools (also in other countries)

One may ask or argue – What was the need to do all this? The same message might have been given by simply comparing two bills. How did students (12-14 years old) acquire knowledge of terminology, laws and principles and concepts of electricity through such an exercise? Let us ask ourselves a few questions differently

- What would have been the learning objectives behind this task and what learning outcomes should one expect from this exercise? Is the learning process in harmony with the nature of science, the purpose of science education and the aims of education?

Consider a few practices that are/can be followed in the classrooms for this topic

1. Textbook reading followed by writing answers of chapter-end exercises
2. Answering few other questions like – List 5 practices that you can follow to save electricity.
3. Preparing a chart/poster/power-point presentation on “Save electricity” by students and discussion in the classroom
4. Showing a movie/video clip on energy crisis or electricity generation and saving
5. Visit to a hydel/thermal power plant followed by a talk by teacher/expert
6. Weaving required discussion points in the form of a story or using a real case study as discussion trigger and moving ahead with the help of questions ensuring learners engagement
7. A task comprising replacement of few of the high energy-consuming devices with energy saving ones; and comparing electricity bills before and after, followed by a discussion

8. Following energy-saving practices for a month, sharing and discussing in groups frequently, critically analysing and reporting

Considering that this list is not exhaustive and there are many other ways of teaching learning depending upon resources, context, teacher characteristics and other factors; which of these practices



- can provide joyful learning in a real life like situation
- can promote construction of knowledge meaningfully
- would give learners ownership and responsibility for their learning
- would refine their scientific skills like estimating, measuring, data recording, analyzing, interpreting, designing, etc and support them to achieve mastery
- would succeed in nurturing observational, inquiry and thinking abilities of the young learners
- would be able to transform their attitudes, habits and sensitivity towards pressing issues of our daily lives
- would enable them to experience group learning and shape their group behaviour

Let us explore the feasibility of few other learning strategies for students of upper primary or higher grades, learning crop production-

1. Frequent interaction with farms and farmers in the vicinity; observing farming practices for the entire cropping season (different students groups might focus on different crops); comparing difference in practices at various stages; recording their observations at various stages; reporting and sharing with their peers



2. Exchanging farming practices and cropping pattern among students from diverse geography
3. Groups of 4-5 students cultivating different crops like cereal, beans, vegetables or flower (or same crop using different biofertilizers or biopesticides) in small plots, say 4m x 4m; with necessary support from the teacher, school and community both in terms of local knowledge and resources; sharing practices maintaining records and reporting at the end of the season.

Project-based approaches are not new and history of project-based learning can be traced to Dewey (1933). Projects usually involve a specific situation; demand students' initiatives and involvement; necessitate a variety of teaching-learning activities; most often result in a visible end product like report, plan, model, etc and extend for a considerable time period with teacher support.



### What Value Do We See in Project-Based Learning?

Project approach focuses student attention on a practical meaning and gets at the heart of the science learning process. It offers students ample opportunity to explore, experience and learn at own pace with ownership. It prompts learners to reflect upon “what you know, what you need to know, and how you are going to know.” In Table 1, an attempt has been made to highlight the values embedded in project based approach of science learning.

**Table 1**

Value of project based learning	Implications for teaching learning processes
Engaging children’s minds meaningfully	<ul style="list-style-type: none"> <li>• Caters to and nurtures innate curiosity of children</li> <li>• Encourages meaningful construction of knowledge</li> <li>• Fosters scientific skills, including reporting and reflection</li> <li>• Connects learning in school to children’s real lives</li> <li>• Motivates to examine and analyse everyday experiences</li> </ul>
Valuing and addressing children’s preconceptions	<ul style="list-style-type: none"> <li>• Students’ preconceptions (formed through observation and interaction with the world) form basis for learning</li> <li>• Helps resolve mis/alternate conceptions during knowledge construction</li> </ul>
Nurturing abilities and supporting metacognition	<ul style="list-style-type: none"> <li>• Facilitates independent learning, critical and logical thinking, problem solving and inquiry</li> <li>• Ownership of learning leads to awareness of what one knows and what one doesn’t</li> <li>• Nurtures joy of learning and crops lifelong learners</li> </ul>
Learning to learn	<ul style="list-style-type: none"> <li>• Task based experiential learning</li> <li>• Learners engage with tasks since beginning from deciding learning goals and strategies</li> <li>• Nature of environment facilitating project work leads to acquisition of social learning skills, respect for diverse perspectives, objective outlook, spirit of scientific inquiry and humanism</li> </ul>
Learner at the centre of the learning process	Teacher merely facilitates <ul style="list-style-type: none"> <li>• Access to learning resources</li> <li>• Refining of scientific skills</li> <li>• Conducive learning environment</li> <li>• Validation of work</li> <li>• Presentation of report to authentic audience</li> </ul>
Extended and permeable boundaries of the classroom	<ul style="list-style-type: none"> <li>• Learning extends beyond school boundaries to the community</li> <li>• Learning process and outcomes diffuse to the community</li> <li>• Learning beyond classroom transformation of students into responsible citizens</li> </ul>

### Assessment for Learning and Development & Project-Based Learning

The trend in contemporary schooling has moved away from term-end summative assessments to continuous and comprehensive assessments. This move has followed the paradigm shift wherein assessment ceased to be viewed as an evaluation of learning to assessment for learning and development. Project-based learning lends itself beautifully to this perspective of assessment. In project-based learning, it is not only the end product that is assessed like most of conventional forms of assessment. Teachers get an opportunity to assess the child for learning, during

the process of learning, without any fear and stress. Purpose of assessment goes far beyond assigning scores or grades and helps re-strategise and ensure the learning process for development of the child and also to shape their attitude, social behaviour, belief and value system. It offers the teacher, opportunity to map a developmental plan for the child based on evidences gathered. Immediate and formative feedback received by the students from their peers and teachers/mentors forms foundation of self assessment and helps them to learn gaps in their conceptual and procedural knowledge, think critically, reflect upon shortcomings and build upon further process.

*Teachers need to employ a variety of learning practices, depending upon curricular objectives, content, infrastructure, learners' need, local context and also their own competence and comfort. No single method can help teachers and learners achieve all curricular objectives. An effective science teaching learning thus needs to be a judicious mix of approaches, project based learning being one of them. The goal of project-based learning is to investigate real life problems that are of interest, relevance, value, and worth*

*to students and teachers, over a sustained period of time. This may be done through series of activities including classroom discussion, gathering information from media, leveraging upon knowledge resource in local community, and carrying out simple investigations predominantly by the students under teachers' mentorship. Value of this approach lies in construction and ownership of knowledge by students, fostering scientific abilities and values and most importantly learning in real life like situation.*

(Author acknowledges DLF Public School, Ghaziabad for sharing this practice and appreciates their effort to nurture global citizens)

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26

## Let's Experiment

Experience of an Innovative  
Science workshop for teachers

**Sharanagouda, Ramesh &  
Parimalacharya S Agnihotri**

### About the workshop

A workshop on science education for high school science teachers was conducted at Center for Learning\* (CfL), Varadenahalli, Bangalore, from 1st to 4th Sep, 2012. 30 members participated in the workshop. The theme and modules of the workshop were conceived and developed by the teachers of CfL. The Azim Premji Foundation District Institute members of Yadgir conducted a study on the status of science teaching in the schools of Yadgir District. The analysis of science textbook was done by CfL resource persons as preparation for this workshop.

The objective of the workshop was to generate interest and spirit about science education.

### Our Assumptions

As participants, we were not, initially, serious about the workshop, as previous experiences had influenced our thoughts. The only advantage was the location, i.e., Bangalore city. Our presumption about the focus of the workshop, 'science education', was a few presentations followed by some discussions about the nature of science education by resource persons.

### Our Surprises

With the above assumptions we landed in Bangalore and the first pleasant surprise was the venue itself, 35 km away from Bangalore, in 22 acres of lush green land. The second was the community-based self-service culture at CfL, though we were treated as guests.

### What was in it for us?

As participants and learners we appreciated the very design of the workshop.

The blend of formal and informal spaces in the schedule of the workshop really helped us a lot. The sessions were a good combination of hands-on experience and discussions with experts. We had discussions about science and education. We were divided into groups according to our subject of expertise - physics, chemistry and biology - for the first three days. The fourth day was devoted to feedback and winding up. We also liked the timings of the sessions and the way they were organized to give us ample time for interaction and informal discussion. Old friendships were renewed with these discussions.

The theme of the workshop was Learner-centered i.e., 'Let's Experiment', which enabled us to have a taste of experiential and inquiry-based learning. The contents selected were not new to us. Most of us who participated in the workshop were from North East Karnataka; we either "received" or "transformed" the information in science, we rarely experienced them. This self-experience of basic science concepts was new to us. Inquiry-based learning was a totally new concept for us. Our perception about the complexity and cost of basic science experiments was totally shattered by the simplicity and low cost materials used for the experiments. Our imagination of big sophisticated laboratories at CfL completely changed when we were introduced to labs with a built-up area of 10x10 sq.ft. or 15x15 sq.ft., with requisite low-cost equipment and raw materials. The lab infrastructure was replicable anywhere. For Biology, Nature itself served as a lab for most of the experiments. The resource persons were well qualified and competent. The second session of each day was meant for our expectations and needs - a challenge to any resource person. But the facilitators were so



Nature is our lab

resourceful that they met every demand put forth by us, much to our appreciations.



Resource persons - Yasmin Jayathirtha, Srinivasan K and Thejaswi Shivanand

This session was actually different from what we had previously experienced. The main focus of this session was to quench the learner's quest. This fact actually created interest about science education among us in the workshop.

Some of the experiments we conducted were:

**Physics :** Ray box, Ray diagrams, lenses image formation, multi-meter handling, bread board usage, different electronic components and basic electronic circuits.

**Chemistry:** Electrolysis, conductivity meter, Hoffman apparatus, small-scale chemistry - chlorine preparation and volcano – a spectacle of ammonium dichromate crystal's decomposition.

**Biology:** Photosynthesis, study of ecology - Quadrant method, DNA extraction, observation of stomata-leaf and observation of mitosis.

Each of the above experiments was designed so that they triggered an explosion of questions in our mind. Through these experiments we were exposed to 'experiential learning' and 'inquiry-based learning'

For example, Thejaswi Shivanand facilitated the tour of biology experiments for us. A brief discussion about photosynthesis was held in the beginning to assess the participants. Then he detailed the experiment and the controlling factors in it. Then all of us were supplied with a beaker, water, sodium carbonate, liquid soap and a syringe. All of us prepared a very dilute solution of sodium bicarbonate.

Then we added one to two drops of a liquid soap. After this some leaves of a tree with optimum thickness and age (for the control) were collected.



Photosynthesis

Then again for size control, these leaves were cut into small, round pieces with the help of punching machine. These pieces were put into the syringe by removing the piston. And the piston was placed back. Then the Sodium carbonate solution in the beaker was sucked in to the syringe with the help of piston. Then the contents in the syringe were mixed gently and allowed to settle. Within a minute all the pieces of leaves settled at the bottom. Then some of us kept our syringes in the darkness and others in direct sunlight. While we waited, the following questions came up:

1. Why was sodium carbonate added?
2. What was the function of liquid soap?
3. Why did the leaves sink to the bottom?

All the possible physical causes were discussed and we concluded that:

1. The sodium carbonate facilitated photosynthesis by providing the carbon dioxide essential for the process.
2. Liquid soap reduces the surface tension; hence the air bubbles on the surface of the leaves disappeared.
3. As leaves have higher density, they sink to bottom of the syringe.

Our discussion and the conclusion we arrived at was the essence of the objectives of the very workshop on ‘science education’.

Another interesting incident occurred in the Physics lab. We were involved in the construction of basic electronic circuits using a bread board.

The task was to build a usable electronic circuit to indicate water level in water tanks to avoid overflow. Every one tried their hand and succeeded in constructing the desired circuit. But one of us failed miserably. He tried constructing the circuit several times but the buzzer did not beep. He then dismantled the one constructed by his friend, tried to reconstruct the same and succeeded in it. Then again, he tried with the components supplied to him but again he met with failure. He checked each component for its working and found that the buzzer was not working.

So he used his friend’s circuit for replacing each component in a working circuit to detect the faulty component. Then he replaced the buzzer with a new one but the result was the same - he failed again. He replaced the buzzer twice but got no result. He then came to the conclusion that it was not the buzzer at fault but the circuit itself. Again he constructed the circuit, from scratch, with due care to each connec-



tion; but the end result was the same – failure. Finally, frustrated, he decided to give it a last try by putting in a new buzzer. At last his circuit worked with a beep!

This whole episode is the example for ‘experiential learning’ and ‘inquiry-based learning’. The process enabled him to identify the four faulty buzzer devices, though it was not his objective at all.

### **Our mind during the Workshop**

As a learner when we are subjected to these kinds of learning environment, we find ourselves fully involved in the learning process. Every moment during the workshop, our mind connects and recon-

nects, not so much to the content of the workshop alone, but to the process carried out in the workshop as well, and how we could use it in our own classroom transactions. For example, while Dr. Yasmin was dealing with “Micro Chemistry in classroom”, we were thinking about our apprehensions about using chemicals in the classroom. Then, when we tried Micro Chemistry and became convinced about its safety features, we knew we could use it in our classroom. We were least worried about the content - “Preparation of Chlorine”.



#### Footnote

\*Centre for Learning is a charitable society registered under applicable laws in India. It is a community of around seventy students and twenty adults; they are a semi-residential school outside Bangalore City at Varadenahalli.

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RAMESH is a science teacher at the government high school at Konkall, Yadgir Taluk & District.  
PARIMALACHARYA S. AGNIHOTRI is a member at the District Institute, Yadgir, Azim Premji Foundation.

## Insights

1. As learners, all of us appreciated the process of ‘experiential learning’ and ‘inquiry-based learning’, which will definitely be effective in our own classroom.
2. Just as we enjoyed the blend of formal and informal spaces here at the workshop, the same is true for our students also.
3. As we appreciated the depth in knowledge of resource persons here, the same is true for us also.
4. Meeting the needs of the students, sufficient time for hands-on and guided inquiry-based teaching and learning are crucial while transacting in the classroom.
5. Integration of lab into the classroom is essential.
6. Inquiry-based and experiential learning coupled with guidance in classroom transaction for science education is the need of the hour.

## Conclusions

Surely, science education has no meaning unless it stimulates the spirit of enquiry to understand the world around us. Nature and its subtleties are a challenge for a seeker to understand them. The four-day workshop on science education was an attempt to stimulate interest and spirit about the same. The resource persons and their meticulous planning of the workshop were the key factors in the success of the workshop. The venue, ambience, arrangements and immaculate coordination ensured comfort of all the participants. Let’s also try to, in our classrooms, make the learning from this workshop a grand success!

Centre for Learning has been in existence for over twenty years. As a school, we had a free hand to explore what learning meant in our subjects. Also, though we were kindly supported by many organisations and individuals, availability of money played an important role in our pedagogical explorations. Since moving to a permanent campus in 2000, CFL has been involved with the local schools, informally at first and then with class –class interactions. We at CFL have also been wondering how to extend these interactions in sustainable ways i.e. something that is not one-off and energy consuming.

Among the organisations that have supported CFL consistently and from the beginning has been the Kumari L. A. Meera Memorial Trust (KLAMMT). They have given grants for books, laboratory materials and equipment like ticker timers, ray boxes etc.

In 2012, KLAMMT offered a grant to CFL to use to host a conference /workshop. Earlier, CFL had hosted a meeting of the local government school teachers in the Magadi area, where the school is located. The teachers meet monthly with the Curriculum Development Officer, and during this particular meeting, we had explored the issue of discipline and learning. We had also met with teachers in the afternoon and demonstrated some of the science material that had been created, both of which had been well-received. The teachers had suggested that it would be useful to repeat or continue with it. So, among the ideas considered was a meeting on discipline and classroom management, teaching of English as a second language, and development of science teaching material. The last was decided upon and we were on.

The first thing to be considered was, would such a workshop be useful? The second, who would the workshop be aimed at? Third, when would be the best time to hold it and for how many days? To discuss these questions and get feed back, we talked informally to Shri Umashankar Periodi of the Azim

Premji Foundation (APF). He was very encouraging and suggested that a minimum of three to four days would be needed to really make it meaningful. He also kindly offered to have a survey done by the APF if we wanted it. Azim Premji Foundation also offered to cover the costs not met by the KLAMMT grant and this allowed us the freedom to plan our workshop they way we wanted to.

It was decided that we would hold the workshop mainly for high-school science teachers of the 8th, 9th and 10th standards, because science becomes more academic and perhaps more difficult to demonstrate and find real life examples for. We felt that a survey would be very useful, to determine what teachers find difficult, what materials are available for use in the class- rooms and what are the topics that are covered in these classes.

We decided on September 1st to 4th, beginning with a weekend. The final list included about 30 teachers, from Magadi area, Yadgir District (the area covered by Azim Premji Foundation), Chamrajnagar and from schools run by NGOs in Tamil Nadu, Andhra Pradesh and Karnataka.

The work of preparation for the meeting involved two or three main themes:

First was to determine what the curriculum needed and to figure out what we could cover. This entailed looking through the state text-books and making a list of topics and experiments mentioned in the texts. Fortunately, one of the senior students of CFL had just finished his exams and could read Kannada, so he took on the task of making the summaries. He had studied science for his 12th standard and also knew the school labs, so his write-up included experiments that could be done and apparatus that could be used. As an aside: students in CFL do optics experiments using a ray box, so he said, 'the book says you can determine angle of refraction using pins. I don't

know if it will work.’ I had to point out that all of us had done precisely that when we were in school and college and that it works very well!

The next job was to decide what we should cover in the time we had with the teachers. It was very clear to us that there should be a balance between what the text books covered, some modern topics and what we felt the teachers would enjoy, since science to all three of us has been a highly enjoyable activity. We also felt there should be time for the participants to suggest what they wanted to see and do.

The third was to structure the day so as to give time for all that we considered important. The idea of a residential workshop was to give ample time for interaction and allow the participants to enjoy the campus. So the structure of the final day reflected these considerations. After a very brief informal introduction on the first day, there were three parallel sessions in the morning punctuated by a short tea break. Three groups of teachers went to the physics, chemistry and biology labs. In the afternoon, after a long lunch break, they came to the labs to share their experiences with each other. The evening was left free for

walks and interactions. After dinner, we had an hour long discussion on general aspects of teaching, the nature of science and so on. The next two days followed a similar structure with one of the afternoon sessions being a climb to Savandurga. The final day had a feed back session and a group photograph.

The feedback was very valuable to us. We had deliberately kept the sessions limited and did not try to cover too much. This was to give time for informal sharing and deliberation and to make things oneself rather than just watch a demonstration! This was noticed and appreciated. They did suggest that we could have sent the topics we were covering to them earlier so that they could have studied it and come. The other suggestion was that the subject teacher should have stayed with their subject rather than all doing the three labs. I would not agree with this because I feel the sciences should be integrated.

One memory I carry is that of the participants testing their conductivity meter. Their smiles when the LED lit were really lovely!

– Dr. Yasmin Jayathirtha  
Teacher, Centre for Learning, Bangalore





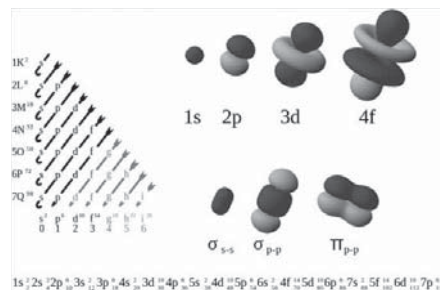
# 27 Hello Didi!

Neeraja Raghavan

Hello Didi\*,

I was a student at Rajghat. You introduced us to quantum mechanics using the analogy of an architect's building that is upside down. Despite being weak in chem I don't forget that introduction. It is so nice to find you here. Kindly add me to your network. Regards, MST

This mail that flew into my LINKED IN INBOX a year ago was a reminder of an innovative teaching practice that I had adopted – after reading it in some book (there wasn't any Internet in those days) – when I first taught Chemistry.

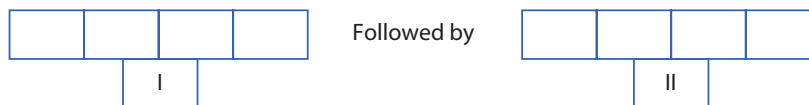


Electronic configuration is a tough concept for students to absorb: where electrons occupy successive shells around the atomic nucleus with a maximum occupancy of  $2n^2$  (where  $n$  is the number of the shell), and with *single occupancy* of orbitals until and unless a higher shell has to be occupied. This book had suggested the use of the analogy of a building built by a mad architect. Mad, because he proposed to have  $n^2$  rooms in each floor: and each room could have a maximum of only two occupants. With the result, that the first three floors of the building looked like this:

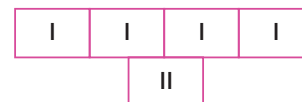
This 'upside down' building that resulted now had to be occupied by tenants: but only two could be housed in each room. Being fussy people, they refused to double up until and unless it meant that their only alternative was to climb up another floor!



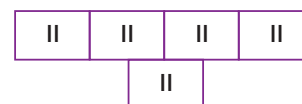
This implied that the floors got sequentially occupied (a vertical line I denotes a tenant) thus:



And then, since the ground floor was full, the next four tenants would spread themselves across the four available rooms on the first floor, thus:



and doubling up only when all rooms were singly occupied, thus:



The analogy would extend to the higher floors in a similar manner, and students in the class would themselves draw the pattern of occupancy, using the simple principle that no one shares the room unless faced with a tougher option: of climbing another floor!

From this e-mail, I realized that this was a simple yet powerful innovation to teach electronic configuration.

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\* Didi is a form of addressing a teacher in some schools, meaning elder sister



## SECTION C - VOICES OF LEARNERS





## 28 Innovative Teaching Style

Maitreyi

In a world today where there are so many things we can learn through a number of ways, I feel it is extremely important for us, as individuals, to find the right way to go about learning whatever it is. It might be about learning how to do a math problem, how the telephone works, or even why leaves are green. I feel everyone has a different learning style, and once we figure out what exactly our strengths are, we can use that to our advantage and learn whatever it is. I have found that when I am faced with different things, the way I go about learning each of them is different, and at times, it has been a challenge to figure out in what way I can go about learning it best.

A large part in the process of learning of course is the teaching method or style that is used. In a school like Centre for Learning (CfL) where I practically lived for seven years, I was given the time and space to learn at my own pace. Being in classes that had students ranging from just three to a maximum of eight students; discussions and questions could be handled one at a time, clarifying everyone's doubts etc. Due to these structures, the relationship between the student and the teacher was one characterized by discussions, questioning and learning. I used this structure to my full advantage, both in my academic and non-academic work.

There were a few projects that we did during the course of our 11th and 12th in school which I feel used a different approach to learning and teaching, both in terms of the role of the student and the teacher. We did two projects, one related to land and the other related to human rights. Both these were unique because of the approach through which we went about studying these areas.

The human rights project was part of our general studies project. 'General studies' is a part of the syllabus in the 12th grade, where a different topic is taken each year. Topics could be about anything social, environmental, etc that we can connect to and study in depth.

Through the human rights project, we aimed to study The Universal Declaration of Human Rights and The Declaration of the Rights of the Child. The project was planned such that we had both a theory as well as a practical component so that we actually see what we are able to study, feel it physically. At first, even before we looked at the declaration, the teachers encouraged us and joined in a discussion where we discussed what we considered as important for us as humans, what we feel we are entitled to as humans. We were asked to imagine that we had to build a society/community. "What kind of rights would your people have? What would they be entitled to?" These were the questions we tried to answer. Following this, we read through the declaration and read it article by article and found that most of what we considered as important for a society did figure in the Declaration itself.



A class in progress - Sharing and discussion

If one looks at this approach to go about learning, I feel it helps one think about things at a deeper level. As we thought about the things that we considered as important, one statement led to another and we had major discussions, right from whether water should be available for free, to whether there should be reservations at schools/colleges etc. There were so many tangents we went off into, and we found that it was quite hard to come to a common consensus about what every individual would be entitled to in our ‘new’ society. This process of discussion, agreeing and disagreeing allowed for a space wherein there was no ‘right’ or ‘wrong’ answer. I feel this whole process of discussing in a space also helps you to think on these things and articulate your view-points clearly.

Another part of this project involved actually talking to people and asking them a set of questions to see whether they were aware of the rights they had, whether the things they were entitled to were being met, etc.



Exploring and discovering

In this approach, the teachers used to make us understand what we were studying by making us go ‘out there’ and find answers. We had to go out and see for ourselves whether the rights that people were entitled to were actually being met or not. There were two parts to this. The first one involved meeting people and going on field visits. We visited one or two slums in Bangalore and spoke to people who were living

there in an attempt to understand what their situation was, the kinds of issues they were dealing with in terms of what they were entitled to as citizens, etc. I feel my greatest learning in this project came from this. The second part involved us to talk to one person whom we met on an everyday basis and asking them a set of questions that we came up with in class. All of us spoke to either those who came to work in our homes, the vegetable vendors, or the watchmen in our apartments. Through this exercise we learnt that while there are what we consider as the most basic rights such as the right to sanitation, shelter, education etc, and people were still denied those rights. The fact that we listened to people tell us this and show us their homes etc, only made us more convinced of the reality of the situation people are in. If I were to read of this in a textbook, I’m sure this would have had less impact on me.

I feel this experience of learning something really did make such a difference to me, and certainly my friends. The fact that you learn something through experience, I feel makes such a difference because that is how we experience things. We see, we listen and understand what is going on around us, and when you’re taught or learn something through this way, it makes a big difference.

Another example of a project where we experienced what we were learning is the land project that we were involved in at school. Here, a large part of the process of learning was through plain observation, documentation and sharing. Again, we were encouraged by our teachers to learn about the land that we lived in through these methods.

The CfL campus is situated on a large area of beautiful land in the outskirts of Bangalore. With school buildings concentrated in one part of the campus, the rest is left to grow with minimal tending. Therefore we have a large list of flora and fauna. As part of the syllabus at the school, engagement with the land is a vital part- whether it means engaging through

gardening, clearing invasive plant species, bird watching, or simply walking through the land on the nature trail that the students have created.

Using observation as a key way of learning about something that's around you, we engaged in this project and learned about the land we live in, the plants that grow there, the birds of different seasons, etc. This approach was extremely interesting because we students were left alone to observe different parts of the campus with minimal guidelines.

“Just observe, and note down what you see, smell, hear and feel” we were told in the beginning. From there we were on our own for a while to learn about what we saw. After a few hours of being by ourselves in our spots, we would come back and look up in books or on the internet to try and identify and match our observations. Along with this, we would share our observations with our teachers and friends, and this way, everybody benefitted, and

it became a process in which everyone was learning something new- teacher and student!

I feel this approach in letting children find out for themselves what there is to find out is very interesting. Because of the fact that people would observe by themselves and share what they saw, I feel we learnt a lot more than what we would have if we were to simply sit down and read a book about what flora and fauna might be found here.

These are two strong examples of how students can learn topic in untraditional fashion. The traditional method of the teacher lecturing students with set and planned notes can be changed into a method where the student and teacher are actively involved in the process. I personally found it very beneficial.

As a person who is interested in getting into education, I believe that with the right settings and atmospheres, both the teacher and the student are learners, and it can be an exciting journey.



Ready for an evening walk



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29

## My experience of a Geography Class

Tapasya Saha

I was in class 5, in St. Mary's Convent, Kolkata, in the year 1965. It was our Geography class. Mrs. Shanti Nandi was our Geography teacher. We addressed all our teachers as 'teacher', in that school. Objective of that particular class was - Map Drawing

How it was taught:

It was one of the weekly 'Map drawing' classes; we all took out our map drawing book, atlas pencil and eraser. (Free hand map drawing was compulsory in those days).

Her classes used to be always exciting; her stories from around the world, bringing 'Chop stick' to the class, a prize of 'one paise copper coin' were some of the things I could remember of her classes.

On this very day it was entirely a different thing; as she settled down in the class room, she talked about the war between India and Pakistan which was being fought along the north western border in India, somewhere in Kashmir for the past 2 months. We all knew about this, as at home we have cut strips of newspaper and my didi (elder sister) had pasted on the glass window pane to avoid casualty in case of bombing by the Pakistani Planes; We knew about curfew and blackout during those days. But teacher talked about something we have not ever thought of, she asked us to take out the atlas and turn to the page showing both the countries of India and Pakistan and pointed to the border, between these two countries.

### About the teacher

She has been to many parts of the world, her husband being a FRCS doctor during the post WWII, who travelled to many places and finally settled down near our school at Tollygunge in Kolkata. She did a course in teaching the deaf and dumb, and later was a teacher of the 'Deaf & Dumb School' in Kolkata.

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I just visualized the war as she has described the physical features of this region, for a moment I felt like I was not a distant listener, but was already transported there in my imagination.

What she told next was very exciting. She told us to write a letter to the 'Jawans' at the border. "write whatever you want to", she said, "remember its cold mid-September up in the Himalayas, the Jawans are all out in the bleak, barren cold snow covered mountains far away from their hearth, far away from their families". We all sat down to write, I remember addressing the Jawan as 'Dear Jawan Dada.....'

Along with the letters teacher decided to send magazines as well. I just remember picking up few 'Illustrated Weeklies' that we used to subscribe at home, and took to school for the purpose.

Whatever may have been the objective of my teacher for that class, on that day, one thing for sure is that she jolly well drove the concept of 'Space and human relationship' into our intellect forever.

*"The emergence in human geography of a more relational conception of space corresponds to the increasing awareness of the role of the social in human geography, including the ways in which space is conceptualized."* - David Harvey

I studied 'geography' all my life, and am very passionate about the subject till today.

**30**

## Experience of a Dissection class in Biology

**Ananya Ramgopal**

What started off as just another ordinary Biology class was quickly turned upside down as news of the dissection spread. The excitement that filled the class was palpable. An actual dissection! My current career obsession at the time had been to become a surgeon and this seemed as good a time as any to take my first whack at it. The thought of holding the heart of a dead goat in my hands- though mildly repulsive also seemed unbelievably cool. As if the circulatory system wasn't interesting enough already.

The days ticked on as we patiently awaited the dissection. Procuring 15 goat hearts proved to be quite the challenge for our teacher but her local butcher finally came through and the day of the dissection arrived.

Walking into the lab that day, I was filled with such excitement there was an obvious bounce to my step. After boasting about how I would be dissecting a heart to all my friends it was finally here. The first thing that hit me was the smell. It was the clear, distinct smell of blood. It almost made me want to run out the door and forget all about the dissection. I stood my ground, though and walked up to the heart. It was a dark red maroonish colour and smaller

than I would have imagined it to be. With tiny white tubes poking out of it, it was quite the sight. Three people were to work on a single heart and I quickly joined forces with a few friends. We were all handed surgical gloves, scalpels and surgical scissors and were told to get to work. Decked in the gloves and holding the heart I could just about picture all the glorious surgeries I would perform in the future. The smell receded and I got right down to the cutting. The heart was slimy to say the least. Slimy and very, very slippery. We were instructed to find the Aorta (one of the many white tubes leading out of the heart) and cut right through the heart along it. Finding the Aorta wasn't a very easy feat, after much poking and prodding with what looked like a drink-stirrer though probably had a scientific name, the Aorta was found and the very first incision made. It was quite a rush. I was about to see the inside of a heart.

I don't know what exactly I expected to see. Cutting into the heart was not as easy as I hoped it would be. Holding it in place was tricky business to begin with but getting that scalpel right through proved to be a herculean task. Once I was finally able to lay the scalpel down the heart was all but massacred. I was still unbelievably proud though. The inside of the heart looked surreal. Filled with blood clots, blood vessels tough ligament and thick walls. It was hard to believe that something so simple looking could fulfil such an incredibly complex purpose.

For a girl who, a few weeks before couldn't imagine herself in the same vicinity of an exposed heart to go to opening one up and looking through it was a HUGE accomplishment, it also seems to have been the first milestone in my cardio-thoracic fantasy.



As amazing as my biology teacher is and as interesting as the circulatory system seems to be, opening up the heart and taking a good look at it was an almost otherworldly experience which I don't think could have been replaced by anything. Only a truly amazing teacher would go above the call of duty and work as hard as mine did to receive those hearts. She

could easily have finished the chapter the traditional way- through the textbook but instead she went one step further and provided me and all my friends with a once in a lifetime experience. I don't think I have ever seen my class as thoroughly interested in a concept as we were that day in the lab. Just goes to show that a little initiative can go a very long way.



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# EXCURSION

## Reports

by students of  
Ganapathy Iyer Girls High School,  
Chennai

Ganapathy Iyer Girls High School - Gopalapuram  
Report for Excursion - Tamil - T. Dhivani 2018

This Excursion was the first excursion in my life. I enjoyed this Excursion. It is very valuable for my Education and General knowledge. I took many Information in this excursion.

First we went the flying train station. That station is at mylapore. That station is not clean. After, the train came we all entered the train. We all were sit silently for a few minutes and after we started singing. On the way to velacherry after 5 stations. We across my teacher's college. In the Journey period we came across 14 stations. Next we returned to mylapore. Again we started our travel with Dancing and singing. On the way to Egmore museum and Library we crossed Marina Beach; Sathome church; Sindhathi petal Railway station; Egmore Baby Hospital. We saw many statues on the Marina Beach. We entered the entrance of Egmore museum and Library. This museum was built by Britishers before independence. First in the entrance we saw the Fossil trees. This tree was changed into stone before two hundred and lakhs years. Next we saw different types of stones in different galleries. They are

- \* Aquarium Gallery.
- \* Coins Gallery.
- \* Statues Gallery.
- \* Bronze Gallery.
- \* Gold, silver Gallery.
- \* That Galleries are very useful and we took more information. In the Excursion "We learnt more and wondered how many things are in the world to learn. Next, we went to kannimona library. In the library we learnt how they arrange the book according to topics, authority, language etc. There is one section called reference section. In that many reference book are kept to refer. In Library, I read a poem written by Jowl Marugan one of the poem which is inspired me is as follows.
- \* Clock Gallery.
- \* Children Gallery.
- \* zoological Gallery.
- \* Biological Gallery.
- \* Mammals Gallery.

In each section there are many people sit & look now and read the books slowly seeing this it was surprised me to learnt more books. The travel time of Excursion is very short, but the information I took learnt was very large. This was very enjoyable and Educational too. I thank the teacher for arranging this type of excursion. The last I want to mention is that the place is visited was clean & Green. So I want my school also like that place.

GRANAPATHY IYER GIRL'S HIGH SCHOOL.

REPORT FOR EXCURSION

S. Mahalakshmi  
VIII B1

On 2<sup>nd</sup> July I was very surprised in the morning because, in my school I went an excursion with my friends and teachers. It was a great gift to me. My surprise was continued. It was started in Mylapore Railway station. We wait for a flying train. After a few minutes we heard a sound of the train. The train came speedily. The train was stopped in the place and we were went inside the train. With in a few minutes the compartment was full. The train moving slowly and picked up a great speed. on the way that we were very happily saw the so many beautiful places. Next we went to museum. It was a valuable and important place. we saw so many great and valuable things, we saw the model cave temples and so many paintings they classified the items according to the different topics. we saw so many machines and paintings represent various cultures. (20)

we saw old governor's vehicle. we were very very happy.

Finally we came to our school. From there I proceeded to my home. After took rest I shared my excursion with my family members about my excursion.

I am very happy and the trip was very useful and informative.

HAPPY ENDING.....

by  
S. Mahalakshmi.  
VIII B1



## SECTION D - REVIEWS



# BOOK *Review*

By Indumathi S.



## **Ideas for the Classroom:**

Selections from the Journal of the Krishnamurti Schools; East West Books (Madras) Pvt. Ltd. (571, Poonamelle high road, Aminijikarai, Chennai - 600029); Pages: 191; Price: Rs.200

‘Ideas For The Classroom’ is the compilation of selected articles from the first nine issues of Journal of Krishnamurti schools. The book “provides a wide-ranging sampler of work of teachers who straddle the middle ground between philosophy and practice. Many are a practical recounting of ideas or course-work that were tried and worked in classrooms. Some are in the nature of reflections on practice that have a direct bearing on what we might do or not do with our students. Others describe alternate kinds of curricula or new kinds of learning environments. Together, they represent green shoots breaking through the brown scrubland of the educational landscape.” (Introduction-page viii)

The book has not left untouched any aspect that teacher would come across. It has variety of articles on the content (science, mathematics, history, geography, economics etc), on assessment and specifically reporting, field trips, observation, nature walks, media literacy, arts, library and so on. It not only has samples from the classroom experience, but also articles on curriculum, reflections on education, how children learn etc. Most of the articles are reflective in nature and clearly describe what was appropriate, what went well in the classroom and what did not work. The pieces also portray the

teachers/ authors as one of those who use their ‘agency’ to present the content lending to deeper enquiry, develops resources and support material and draw up their own curriculum based on the locale of the school. The book also serves as an example for teachers of primary to secondary level. There are a lot of examples from teaching middle school level which are definitely wanting, as most of the experiments and innovations tend to happen (in Indian context especially) at the primary level.

The articles, for example, ‘The Chemistry of Everyday Life’ and ‘Observing the Universe’, would definitely create a sense of curiosity to immediately try and test in the classroom and ‘Understanding The Media’ may help realize why it may be important to do a project of that sort. Similarly ‘Reporting on the Kindergarten Child’ and ‘Reporting on the Junior School Child’ would make the teacher feel, “and finally I found a good example of reporting after all this CCE training on rubrics, tools, etc.!” ‘On the nature of a walk’ and ‘Learning through Birds’ give important guidelines for planning a nature walk and observations that children could make.

The article, 'A Science Curriculum in the Making' is an example of a curriculum developed by teachers. The curriculum is simple, it clearly articulates the objectives, core experiences and skills that children would learn and carries a brief note on evaluation. What is interesting is that it conveys what it has to in a few pages, and does not run into pages like any other curricular document. It is simply evident that it has been developed by teachers, for teachers, to use the same and test what would work and what might not.

The author's claim, "All the activities and ideas mentioned here are equally possible in a large school. The important thing is for us to realize that when we trust children, we give them the freedom and space that they need, they grow in responsibility and discover the joy of reading" in the article, 'Any Takers for the Open Library' (118), points to the fact these innovations and ideas can be tested in any kind of schools and tries to break the perceived myth that these are possible only in alternative small schools. Most of the articles can be tried irrelative of the classroom size with appropriate planning or by making students work in small groups.

The organization of the chapters can be explained in the book. Some are examples of teaching – learning process whereas some articles like competition and its educational consequences, curriculum for an inquiring mind are those which throw some perspectives. Hence some categorization of articles would help the readers quickly help choose what they want to read or focus on. Also some articles may not be immediately relevant to teachers like Teaching History- learning to look into the mirror as it may be difficult to draw out the implications for classroom. Some articles have illustrations- pencil sketches and that makes it real. More illustrations and other forms of presenting the text could have been explored.

Considering the number of such resources available for teachers this book is a good start and an early initiative (considering it was published in 2007). More of such resources are necessary for teachers and this book hence serves a good example of compiling teacher's work and reflections. I would thus recommend this book not only for teachers but also for educators as it dwells on various aspects like curriculum and gives a broad perspective on teaching- learning processes, classroom management, assessment, school processes, etc.



INDUMATHI is part of the Teacher Education team, Azim Premji University. She has experience of working as a science teacher, curriculum developer and resource person in various organizations. She holds a Master's degree in Education from Tata Institute of Social sciences. She can be contacted at [s.indumathi@azimpremji.org](mailto:s.indumathi@azimpremji.org).

# ಎಲೆಯ ಇತಿಹಾಸಿಗಲು



## YOUNG HISTORIANS

*A documentary film by Deepa Dhanraj in Kannada with English Subtitles,  
an Education Development Centre and DSERT, Bangalore Production*

### Film Review – by Thangam George

After reciting a few couplets in Kannada, the teacher asked, “Why are you laughing?”. “Well we didn’t understand anything though it was Kannada”, replied the students listening to few lines of a famous poem in Kannada. “True, you wouldn’t understand it. It is archaic Kannada, you don’t use it now”, replied the teacher in an accepting tone. So take a guess - Was it to learn about history or literature? Connecting society, literature and culture with time and its evolution has been interwoven seamlessly in the film, ‘Yeleya Itihasigalu’ (Young Historian).

Storytelling is something which attracts everyone; then why has hi(s)-story been one of the most boring subjects among children? Perhaps it’s not put forth as His(/her)- story, but more as a bunch of events which followed a chronology which has to be learnt by heart even without a wee bit of heart to do so!

The film Yeleya Itihasigalu (Young Historian), catches attention as history is usually associated with old and ancient. So then what is Young Historians about? It is a short film with 20 students and a teacher trying to learn history in an innovative way. The attempt is to help students acknowledge the link of the present with the past. There is a need to step out of the classroom, look around, discuss with experts, observe and question.

Each snippet has been well thought out and methods adopted accordingly. For instance, to talk about Buddhism, the story of Buddha with emphasis of his childhood, followed by Jataka tales have been the point of introduction. Use of stories and animated pictures helped to hold the interest longer. The use of puppet to create an imagery of Huen Tsang’s travels and the reception given to such travelers those days in India was interesting. Reiteration of his travelogues being a rich source of information of history motivated the students to write their own travelogues of the places they have visited. They saw meaning in it and did it willingly. It is noteworthy that while sharing their travelogues, no additions or deletions were made by the teacher. They were given freedom to write in their own style.

The setting for each theme was selected aptly. For instance, to discuss about archaeology and sculptures dating back to early man and Stone Age, the students were taken to an archeological site. They also met with an archeologist who answered their queries. It was an impressive attempt to allow students to become archeologists. They were given antique artifacts then asked to think about who its owners would have been and think about their lives. Similarly, to learn about trade and history, coin collection and inferring history though it was brilliant.

This created room for discussion on aspects like the currency system, money value, language, political system, economic system, trade & commerce. To learn about sea routes, introduction to the different seas in the world and building curiosity on directions for sailing, opened up a whole new world of information about wind directions, constellations, compass, light house, need for sea routes and the spirit of adventure to sail on the seas. The awe of boat building was a big eye opener for them.

Vachanas - the revolutionary poems upholding human dignity - were sung by young artists of the same age. This steered a lot of discussion about the lives of the poets, society in those times, oppression and so on. This discussion by students also brought forth discrimination existing in present society. The connection between history, literature, social system and its influence to the current times has been addressed brilliantly. As part of understanding the Golden era of Kannada literature, a poem was recited in archaic Kannada. The students laughed out, as they did not understand it. It clearly shows the comfort level with the teacher. An interesting discussion about portraits of historical heroes, their features and their proximity to reality helped the students understand how art influences our imagination. Music and rhythm attracted them a lot.

As a method to transact history, this is an exemplary attempt. There is a clear plan for each topic. Crisp, interesting introduction, followed by fact finding, storytelling, team work, application of the new information, discussion, questioning has been in-built judiciously into each theme. For instance, to discuss trade & history, the story of chilly not being of Indian origin is shared. Something as ordinary as chillies,

a daily household item, immediately captures complete attention. Each topic has been thought through in detail. The lesson plan has taken into account the time available for each topic, interesting and appropriate methods to make the experience memorable and educative. It makes a child confident to think freely with a scientific temper. The need to touch and feel has been lavishly used in this approach. The attitude and warmth that the teacher shares with this group can be inferred by the patient response that the teacher gives to a chain of questions. Teacher is only a facilitator in the learning process. Creativity coupled with planning and networking has been done well. Each snippet ends with a simple conclusion and encourages teachers to attempt similar activities in their class.

It gives ample choices to a teacher; to be inspired to create new methods. If not all, if even one of them is attempted, it would make a difference. The possibility of various approaches to each topic is prudently illustrated. It is evident that students become interested to understand the influence of history in one's life, society, country, culture and customs.

Some obvious questions which come up while watching these methods could be:

Is it possible to do similar activities with larger groups?

How much time should one invest to teach one subject?

It would be interesting to know from the teacher about his/her preparation to make this happen; to know if this was his regular style of teaching.

The eight snippets in the film are of the following themes:

1. Our village history
2. Archeology and Sculptures
3. Jataka tales and Buddhism
4. Jainism and Gometeshwara
5. Learning history from inscriptions
6. Sea routes
7. Trade and History
8. Vachanas



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# RESOURCE **KIT**

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This resource kit has been compiled from Issues XII, XIII, XIV and XV of the Learning Curve on the themes of Science in School Education, Language in School Education, Mathematics in School Education and Social Science in School Education, respectively.

This resource kit is not by any means an exhaustive one. It has been put together with the help of several individuals who work in the field of education, all of whom we would like to sincerely thank for their time and effort.



## Some Resource Books that help make Science Fun

1. The Third Book of Experiments, Leonard De Vries, Carousel Books
2. Science Works, Ontario Science Centre, Ontario
3. Toying Around with Science, Bob Friedhoffer, Franklin Watts, New York
4. The Science Explorer, P. Murphy, E. Klages, L. Shore, An Owl Book
5. 700 Science Experiments for Everyone, Compiled by UNESCO, Doubleday
6. 100 Amazing Science Fair Projects, Glen Vecchione, Goodwill Publishing House, New Delhi
7. 365 Simple Science Experiments with Everyday Materials, Richard Churchill, Sterling Publishers
8. The Book of Experiments, Leonard De Vries, Carousel
9. Joy of Learning, (Standards 3 to 5), Center for Environmental Education, Ahmedabad, India
10. Experiments for You, John Tollyfield, Evans Brothers, London
11. How to Turn Water Upside-Down, Ralph Levinson, Beaver Books, London
12. Experiments with Everyday Objects, Kevin Goldstein-Jachson, Granada Publishing, New York
13. Simple Science Experiments, Batstord, Hans Jurgen Prees
14. Let's Discover Science, David Horsburgh, Oxford University Press
15. Chai Ki Pyali Mein Paheli, Partho Ghosh & Dipandar Home (Hindi) National Book Trust, New Delhi 110016
16. UNESCO Source book for Science in the Primary School, Harlen & Elstgeest, National Book Trust, New Delhi 110016
17. Soap Bubbles, C.V. Boys, (Eng/Hin), Vigyan Prasar, C-24 Qutub Institutional Area, New Delhi 110016
18. The Chemical History of a Candle, Michael Faraday (Eng/Hin), Vigyan Prasar, New Delhi, info@Vigyanprasar.gov.in
19. Science in Everyday Life, J.B.S. Haldane, Vigyan Prasar, New Delhi, info@Vigyanprasar.gov.in
20. VSO Science Teacher's Handbook, Andy Byers, Ann Childs, Chris Lane (Hindi) Eklavya, Bhopal, pitara@eklavya.in
21. Environment & Self-Reliance, Yona Friedman, Eda Schaur (Eng/Hin), Vigyan Prasar, New Delhi
22. Energy & Self-Reliance, Yona Friedman, (Eng/Hin) Vigyan Prasar, New Delhi, info@vigyanprasar.gov.in
23. The Story of Physics, T. Pammanabhan (Eng/Hin) Vigyan Prasar, New Delhi, info@vigyanprasar.gov.in
24. On the Various Forces of Nature, Michael Faraday, Vigyan Prasar, New Delhi, info@vigyanprasar.gov.in
25. The Insect World of J. Henri Fabre, Vigyan Prasar, New Delhi, info@vigyanprasar.gov.in
26. The Autobiography of Charles Darwin, Vigyan Prasar, New Delhi, info@vigyanprasar.gov.in
27. The Bicycle Story, Vijay Gupta, Vigyan Prasar, New Delhi, info@vigyanprasar.gov.in
28. Aakash Darshan Atlas, Gopal Ramchandra Paranjpe, NCERT, Sri Aurobindo Marg, New Delhi 110016
29. Preparation for Understanding, Keith Warren, illus. by Julia Warren, UNESCO
30. Resonance Journal of Science Education, Indian Academy of Sciences
31. Bal Vaigyanik, Eklavya, Bhopal

Courtesy : **Aha! Activities, Eklavya, Bhopal**

## Websites & E-Resources for Middle and Primary School Science

1. LET'S DISCOVER SCIENCE PART I By David Horsburgh (out of print but downloadable as a pdf file from the link: <http://vidyaonline.org/arvindgupta/david1.pdf>)
2. LET'S DISCOVER SCIENCE PART II By David Horsburgh (out of print but downloadable as a pdf file from the link: <http://vidyaonline.org/arvindgupta/david2.pdf>)
3. LET'S DISCOVER SCIENCE PART III By David Horsburgh (out of print but downloadable as a pdf file from the link: <http://vidyaonline.org/arvindgupta/david3.pdf>)
4. LET'S DISCOVER SCIENCE PART IV By David Horsburgh (out of print but downloadable as a pdf file from the link: <http://vidyaonline.org/arvindgupta/david4.pdf>)
5. LET'S DISCOVER SCIENCE PART V By David Horsburgh (out of print but downloadable as a pdf file from the link: <http://vidyaonline.org/arvindgupta/david5.pdf>)
6. LEARNING ABOUT LIVING PART ONE By David Horsburgh (out of print but downloadable as a pdf file from the link: <http://vidyaonline.org/arvindgupta/D6.pdf>)
7. LEARNING ABOUT LIVING PART THREE By David Horsburgh (out of print but downloadable as a pdf file from the link: <http://vidyaonline.org/arvindgupta/D7.pdf>)
8. THINKING AND DOING By David Horsburgh (out of print but downloadable as a pdf file from the link: <http://vidyaonline.org/arvindgupta/thinkanddo.pdf>)
9. SMALL SCIENCE for Classes I to V (with the accompanying Workbooks and Teachers' Books) Homi Bhabha Centre for Science Education, TIFR, Mumbai. <http://www.hbcse.tifr.res.in/smallscience>.
10. <http://www.arvindguptatoys.com/> contains an enormous list of books on enlivening science learning, rated by Arvind Gupta. Many of them can be downloaded for free.
11. LOW COST EQUIPMENT FOR SCIENCE AND TECHNOLOGY EDUCATION - Vol. 1 - Compiled by UNESCO <http://unesdoc.unesco.org/images/0010/001023/102321eb.pdf> Provides ideas on how to make school science equipment using inexpensive materials.
12. LOW COST EQUIPMENT FOR SCIENCE AND TECHNOLOGY EDUCATION - Vol. 2 - Compiled by UNESCO - <http://unesdoc.unesco.org/images/0007/000728/072808eb.pdf> Provides ideas on how to make school science equipment using inexpensive materials.
13. <http://www.exploratorium.edu/> is a fascinating website with tons of resources, activities and continuous updating to reflect the latest developments in the field.
14. <http://www.johnkyrk.com/> has links to animations of cell structure, cell biology, DNA, etc.
15. [http://www.bbc.co.uk/schools/scienceclips/ages/8\\_9/circuits\\_conductors\\_fs.shtml](http://www.bbc.co.uk/schools/scienceclips/ages/8_9/circuits_conductors_fs.shtml) has an interactive tutorial on conductors.
16. <http://www.primaryschool.com.au/scienceresults.php?kla=Science%20and%20Technology&unit=Switched%20On> has links to several interactive lessons like the one above.
17. <http://www.juliantrubin.com/bigten/pathdiscovery.html> allows the user to simulate online repetitions of famous experiments or inventions.
18. <http://www.freeindia.org/biographies/greatscientists/> has biographies of Indian scientists.
19. <http://www-gap.dcs.st-and.ac.uk/~history/Indexes/Indians.html> has info on ancient Indian mathematicians.
20. <http://www.calcuttaweb.com/people/snbose.shtml> has some more biographies of Indian scientists.
21. <http://www.shodor.org/succeed/curriculum/FOR/observation.html> contains an interactive module to test one's observation powers.
22. [http://www.scienceclass.net/PowerPoints/NOSO\\_Test\\_Review.ppt](http://www.scienceclass.net/PowerPoints/NOSO_Test_Review.ppt) contains a PPT that talks of the nature of science.
23. [http://www.scienceclass.net/PowerPoints/NOS\\_Test\\_ReviewGT.ppt](http://www.scienceclass.net/PowerPoints/NOS_Test_ReviewGT.ppt) contains a second such PPT.
24. [http://www.scienceclass.net/Teachers\\_Lessons.htm](http://www.scienceclass.net/Teachers_Lessons.htm) contains many valuable links to lessons on science topics for middle school level.
25. <http://www.science-class.net/TAKS/taks.htm> has many links to PPTs that elaborate specific concepts for middle school.
26. <http://teachers.net/lessons/posts/1228.html> (a website leading from [http://www.curriki.org/xwiki/bin/view/Coll\\_rmlucas/LabClassificationofShoes?bc=;Coll\\_rmlucas.10](http://www.curriki.org/xwiki/bin/view/Coll_rmlucas/LabClassificationofShoes?bc=;Coll_rmlucas.10) Classification) describes an activity wherein children have to classify shoes, so as to understand the importance of classification. (Useful in all branches of science, particularly chemistry and biology.)
27. [http://www.encyclomedia.com/videoarctic\\_food\\_chain.html](http://www.encyclomedia.com/videoarctic_food_chain.html) has a video on the arctic food chain.
28. <http://www.kbears.com/ocean/octopus/index.html> has a presentation and info on the octopus.
29. <http://magma.nationalgeographic.com/ngexplorer/0309/articles/mainarticle.html> contains rich info on underwater life.
30. <http://www.seaworld.org/animal-info> has a plethora of links and info on animals.
31. <http://www.seaworld.org/funzone/coloringbooks/pdf/emp-penguin.pdf> has a colouring page for kids to have fun, when learning about animals.
32. <http://kids.nationalgeographic.com/Animals/CreatureFeature/> is a superb site where you can click on an animal to find out more about it. The 'more' includes facts, a video with sound, a map of places where it can be found, etc.
33. Resources for Teaching Middle School Science (1998) - [http://books.nap.edu/catalog.php?record\\_id=5774](http://books.nap.edu/catalog.php?record_id=5774) (ISBN 0309057817) National Science Resources Center of the National Academy of Sciences, National Academy of Engineering, Institute of Medicine, and the Smithsonian Institution
34. Resources for Teaching Elementary School Science (1996) - [http://books.nap.edu/catalog.php?record\\_id=4966](http://books.nap.edu/catalog.php?record_id=4966) (ISBN 0309052939) National Science Resources Center of the National Academy of Sciences and the Smithsonian Institution
35. <http://www.exploratorium.edu/explore/handson.html> contains many online as well as hands on activities for children of this age group and younger.

36. <http://fi.edu/tfi/activity/act-summ.html> contains many online as well as hands on activities for children of this age group and younger.
37. [http://www.bbc.co.uk/schools/scienceclips/ages/10\\_11/science\\_10\\_11.shtml](http://www.bbc.co.uk/schools/scienceclips/ages/10_11/science_10_11.shtml) contains activities listed alphabetically, topic wise.
38. [http://www.bbc.co.uk/schools/scienceclips/ages/9\\_10/changing\\_sounds.shtml](http://www.bbc.co.uk/schools/scienceclips/ages/9_10/changing_sounds.shtml) contains simple sorting and tabulation exercises for Class V and below.
39. [http://www.bbc.co.uk/schools/scienceclips/ages/10\\_11/forces\\_action.shtml](http://www.bbc.co.uk/schools/scienceclips/ages/10_11/forces_action.shtml) contains more complicated tabulation and interpretation exercises for Class VI/VII.
40. [http://www.bbc.co.uk/schools/teachers/ks4/bitesize\\_chemistry.shtml](http://www.bbc.co.uk/schools/teachers/ks4/bitesize_chemistry.shtml) contains chemistry assessment worksheets for Classes VIII and IX.
41. <http://www.bbc.co.uk/schools/gcsebitesize/chemistry/classifyingmaterials/> contains exercises for assessing classification of matter, atomic structure, bonding and formulae/ equations for Class VIII and above.
42. <http://www.bbc.co.uk/schools/gcsebitesize/physics/electricity/> has some thinking-type questions for Class VIII and above.
43. <http://www.bbc.co.uk/schools/gcsebitesize/physics/forces/> has excellent questions for Classes VII, VIII and above.
44. <http://cse.edc.org/products/onlinecurr/catalog.asp> has an online catalogue of web-based resources for middle and elementary school science.
45. <http://www.explorelarning.com/index.cfm?method=cResource.dspView&ResourceID=491> has a beautiful animation of the photoelectric effect, can be shown to Class VIII.
46. <http://www.explorelarning.com> has a number of interactive simulations to learn science, appropriate for this age group.
47. <http://cse.edc.org/products/onlinecurr/WBMSearchResults.asp> has a complete list of topics and the modules available therein, for students of this age group and a little older as well.
48. <http://www.blupete.com/Literature/Biographies/Science/Scients.htm> has links to biographies of scientists.
49. <http://www.juliantrubin.com/bigten/pathdiscovery.html> is a website with a collection of links for discovery and invention.
50. <http://www.fordham.edu/Halsall/science/sciencesbook.html> is an Internet Sourcebook for the History of Science.
51. <http://www.middleschoolscience.com/tunefork.htm> has a good activity for learning about the tuning fork and sound vibrations, suitable for Classes VII and VIII.
52. [http://www.pbs.org/benfranklin/exp\\_shocking.html](http://www.pbs.org/benfranklin/exp_shocking.html) has a lovely interactive simulation of the kite experiment performed by Benjamin Franklin.
53. <http://www.pbs.org/teachers/sciencetech/> has grade-wise, topic-wise lesson plans for middle and primary school science teaching.
54. <http://www.learner.org/resources/series90.html> has a set of videos on the science of teaching science.
55. <http://www.outlookindia.com/scriptur11w2.asp?act=sign&url=/full.asp?fodname=20050328&fname=Science&sid=1> has NobelPrize-Winning Science Discoveries made palatable for children.
56. [http://www.teachernet.gov.uk/teachingandlearning/subjects/science/science\\_teaching\\_resources/](http://www.teachernet.gov.uk/teachingandlearning/subjects/science/science_teaching_resources/) provides links to a number of e-teaching learning resources for primary science.
57. <http://www.firstscience.com/home/> is a leading online popular science magazine featuring articles on important breakthroughs, the latest science news, video clips, blogs, poems, facts, games and a whole lot more science-related content.
58. Chakmak: Science magazine for children [http://www.eklavya.in/go/index.php?option=com\\_content&task=category&sectionid=13&id=57&Itemid=84](http://www.eklavya.in/go/index.php?option=com_content&task=category&sectionid=13&id=57&Itemid=84)
59. Sandarbh: A resource bank for teachers [http://www.eklavya.in/go/index.php?option=com\\_content&task=category&sectionid=13&id=51&Itemid=72](http://www.eklavya.in/go/index.php?option=com_content&task=category&sectionid=13&id=51&Itemid=72)
60. Srote: Science and Technology features - [http://www.eklavya.in/go/index.php?option=com\\_content&task=category&sectionid=13&id=56&Itemid=81](http://www.eklavya.in/go/index.php?option=com_content&task=category&sectionid=13&id=56&Itemid=81)
61. <http://www.gobartimes.org/20090315/20090315.asp> is a bi-monthly children's magazine highlighting news and views on environment and development through comic strips, cartoons, quizzes, essay competitions and interactive pages. It also serves as a useful teaching aid in classrooms for teachers.
62. <http://edugreen.teri.res.in/index.asp> is a website for children that makes environmental learning fun
63. <http://www.nuffieldcurriculumcentre.org/go/Default.html> provides links to websites of various science projects that undertake to enliven science teaching
64. <http://www.exploratorium.edu/ifi/resources/workshops/teachingforconcept.html> provides a link to the paper "Teaching for Conceptual Change: Confronting Children's Experience; Watson, Bruce and Richard Kopniczek; Phi Delta Kappan, May 1990".
65. <http://teachone.tripod.com/biology/> - compendium of resources on biology
66. <http://www.nabt.org/websites/institution/index.php?p=38> - compendium of resources on biology
67. <http://surfaquarium.com/NEWSLETTER/biology.htm> - compendium of resources on biology
68. <http://www.accessexcellence.com/> - link related to biology and health issues
69. <http://physicsworld.com/> - news, views and information for the global physics community
70. [www.iop.org](http://www.iop.org) - A website from the Institute of Physics, it also has collections of resources, activities, for teachers at school and college level
71. [www.physics.org](http://www.physics.org) - a guide to physics on web, this one website has the data base of more than 400000 physics websites and is still growing.
72. Time Life's Illustrated World of Science (1961 - 2003), Hong Kong: Time Life Inc. For details on all the Time Life Encyclopedia series of books visit the webpage: <http://www.librarything.com/author/timelifebooks&all=1Thos>. This covers a range of topics across disciplines: a visual treat for learners from multiple age groups, especially a school-going child.

### Some Books containing Activities & Games in Science

Class	Topic	Class	Topic
<b>Little Toys, Arvind Gupta; National Book Trust, New Delhi</b>		<b>Understanding Science - Level Two, Peter Clutterbuck; SCHOLASTIC</b>	
V	Trees (Pg.33) [See also "My Book of Trees" by Nimret Handa], Area (Pg. 37), Volume (Pg.37)	V	Plants, Animals, Food Chain, Seeds, Vertebrates/Invertebrates, Habitats
VI	Area (Pg. 37), Volume (Pg. 37), Colour (Pg. 33), Pressure (Pg. 9), Siphon Action (Pg. 11), Pump (Pg. 13), Wind Energy (Pg.19), Sound/Vibration (Pg.15)	VI	Gases, Liquids, States of Matter, Force & Motion
VII	Pressure (Pg. 9), Siphon Action (Pg. 11), Pump (Pg. 13), Wind Energy (Pg.19), Sound/Vibration (Pg.15), Static Electricity (Pg. 47), Friction & Gravity (Pg.31), Conversion of Potential Energy into Kinetic (Pg. 25), How Engines Work (Pg.21), Gear Wheel Motion, Circular and Linear Motion (Pg.17), Archimedes Principle (Pg.53)	VII	Sound, Light, Energy, Digestive System, Respiratory System
VIII	Conversion of Potential Energy into Kinetic (Pg. 25), How Engines Work (Pg.21), Gear Wheel Motion, Circular and Linear Motion (Pg.17), Archimedes Principle (Pg.53), To understand flight (Pg. 41)	<b>Super Science Crosswords, Katherine Burkett; SCHOLASTIC</b>	
		V	Plants, Seeds, Vertebrates
<b>Ten Little Fingers, Arvind Gupta; National Book Trust, New Delhi</b>		<b>Penguins Swim but Don't get wet, Melvin &amp; Gilda Berger; SCHOLASTIC</b>	
V	Volume (Pg. 22), Weight (Pg. 13), Shape (Pg 11), Size (Pg. 12)	V	Animals
VI	Volume (Pg. 22), Pulleys (Pg. 25)	<b>The Usborne Internet Linked Library of Science: Earth and Space, Howell, Rogers &amp; Henderson; SCHOLASTIC</b>	
VII	Pulleys (Pg. 25)	VI	Earth Science
<b>Toy Bag, Arvind Gupta; Eklavya, Bhopal</b>		<b>The Usborne Big Book of Experiments; SCHOLASTIC</b>	
VII	Centripetal Force (Pg. 13)	V	Plants & Animals
<b>Predator: The Forest Food Chain Game; Ampersand Press, Washington</b>		VI	States of Matter, Gases, Expansion & Contraction, Light & Sound, Plants & Animals, Forces & Motion
V	Food Chain (to be adapted to Indian animals and vegetation)	VII	Acids & Alkalis, Everyday Chemicals, Light & Sound, Electricity and Magnetism, Forces & Motion
<b>Science Fair Projects Energy, Bob Bonnet &amp; Dan Keen; SCHOLASTIC</b>		VIII	Electricity and Magnetism
V and VI	Energy	<b>My Book of Trees, Nimret Handa; SCHOLASTIC</b>	
		V	Trees
		<b>Scholastic Encyclopedia of Animals, Laurence Pringle</b>	
		V and VI	Animals

Class	Topic	Class	Topic
The Illustrated Encyclopedia of Science; Pentagon Press VI & VII	Changes, Everyday Materials, Earth Science	100 things you should know about Science, Steve Parker; Miles Kelley Publishing	VI Forces & Motion, Light & Sound, Everyday Materials
The Illustrated Encyclopedia of Earth; Pentagon Press VI & VII	Animals, Earth Science	Sharing Nature with Children, Joseph Bharat Cornell	V & VI Food Chain, Plants, Animals, Birds
Kingfisher Young Knowledge Materials: Liquids, Solids, Gases; Clive Gifford	VI Everyday Materials, Changes	Simple Nature Experiments with Everyday Materials, Anthony D Fredericks	V & VI Plants, Animals, Birds, Insects

### Some Important Organisations in Science Education

Sl. No.	Topic	Topic
1.	Agastya International Foundation	Address : Kataria House, 219 Kamaraj Road, Bangalore - 560042 Phone : 080-25548913-16 Website : www.agastya.org E-Mail : maagastya@vsnl.com
2.	Avehi-Abacus Project	Address : Third floor, K.K. Marg Municipal School, Saat Rasta, Mahalaxmi, Mumbai- 400 011 Phone : (022)2307 5231, (022)2305 2790 Website : http://avehiabacus.org E-mail : avcab@vsnl.com
3.	Bangalore Association for Science Education (BASE)	Address : Jawaharlal Nehru Planetarium, Sri. T. Chowdaiah Road, High Grounds, Bangalore-560001 Phone : 080-22266084, 22203234 Website : http://www.taralaya.org E-Mail : taralaya@vsnl.com
4.	Bharat Gyan Vigyan Samiti/ Indian Organizations for	Address : Basement of Y.W.A. Hostel No. II, Avenue - 21, G-Block, Saket, New Delhi-110 017. Phone : 011-2656 9943 Learning and Science Website : http://www.bgvs.org E-Mail : bgvs_delhi@yahoo.co.in, bgvsdelhi@gmail.com
5.	Center for Environment Education	Address : Nehru Foundation for Development, Thaltej Tekra, Ahmedabad - 380 054, Gujarat Phone : 079-26858002 Website : http://www.ceeindia.org E-Mail : cee@ceeindia.org
6.	Center for Science and Environment	Address : 41, Tughlakabad Institutional Area, New Delhi-110062, INDIA Phone : 011-29955124/25, 29956394, 29956401, 29956399 Website : http://www.cseindia.org E-Mail : cse@cseindia.org
7.	C.P.R. Environmental Education Centre (CPREEC)	Address : The C. P. Ramaswami Aiyar Foundation No.1, Eldams Road, Alwarpet, Chennai Tamilnadu, India. PIN - 600 018 Phone : 044-24337023, 24346526, 24349366 Website : www.cpreec.org E-Mail : cpreec@vsnl.com, ecoheritage_cpreec@vsnl.net
8.	Eklavya	Address : E-10, BDA Colony, Shankar Nagar, Shivaji Nagar, Bhopal - 462 016 Madhya Pradesh, India Phone : 0755-267 1017,255 1109 Website : http://eklavya.in
9.	Eklavya Institute of Teacher Education (EI)	Address : Eklavya Education Foundation, Core House, Off. C.G. Ellisbridge, Ahmedabad-6 Phone : 079-26461629 Website : www.eklavya.org E-mail : eklavya@eklavya.org
10.	Homi Bhabha Centre for Science Education	Address : Mr. H C Pradhan, Tata Institute of Fundamental V.N. Purav Marg, Mankhurd, Mumbai, 400088 Phone : 022-25554712, 25580036 Website : www.hbcse.tifr.res.in E-Mail : postmaster@hbcse.tifr.res.in

Sl. No.	Topic	Topic
11.	Indian Science Congress Association	Address : 14, Dr. Biresb Guha Street, Kolkata - 17 Phone : 033-2287 4530 Website : http://sciencecongress.nic.in E-mail : iscacal@vsnl.net
12.	Kalpavriksh Environment Action Group	Address : 134, Tower 10, Supreme Enclave, Mayur Vihar, Phase 1, Delhi 110 09 Phone : 011-22753714 Website : http://www.kalpavriksh.org
13.	Kerala Sastra Sahitya Parishad	Address : Parishad Bhavan, Chalappuram PO, Kozhikkode - 673 002, Kerala, India Phone : 0495-2701919, 9447038195 Website : http://www.kssp.org.in E-Mail : gskssp@gmail.com
14.	National Council for Science & Technology Communication (NCSTC)	Address : Department of Science & Technology Technology Bhavan, New Mehrauli Road, New Delhi-11001 Phone : 011-26567373, 26962819 Website : www.dst.gov.in E-Mail : dstinfo at nic dot in
15.	Navanirmithi	Address : Navnirmithi, 301,302,303, 3rd floor, A wing, Priyadarshani Apartment, Padmavati Road, IIT Market Gate, Powai, Mumbai- 400 076. Phone ; 022-25773215, 25786520 Website : www.navnirmithi.org E-mail : contact@navnirmithi.org
16.	Nuffield Foundation	Address : 28 Bedford Square London WC1B 3JS Phone : 020 7631 0566, 020 7580 7434 Website : www.nuffieldfoundation.org E-mail : info@nuffieldfoundation.org
17.	Rajiv Gandhi Foundation	Address : Jawahar Bhawan, Dr. Rajendra, Prasad Road New Delhi - 110 001, INDIA Phone : 011-23755117, 23312456 Website : www.rgfindia.org E-mail : info@rgfindia.org
18.	State Institute of Science Education	Address : S.I.S.E (Rajya Vigyan Sansthan), P.S.M Campus, Jabalpur, M.P. 482001 Phone : 0761-2625776 Website : http://sisejbp.nic.in
19.	Sutradhar	Address : 59/1, 3rd Cross, 10th A Main, Indiranagar 2 Stage, Bangalore 560038. Phone : 080-25288545,25215191 Website : www.sutradhar.com E-Mail : sutra@vsnl.com
20.	Tamil Nadu Science Forum	Address : Balaji Sampath, C2 Ratna Apts. AH 250, Shanti Colony, Annanagar, Chennai-600040, TAMIL NADU Phone : 044-26213638 Website : bsampath@eng.umd.edu
21.	Tamil Nadu State Council for Science and Technology,	Address : Directorate of Technical Education Campus, Chennai 25 Phone : 022-22301428 Website : www.tanscst.org E-mail : enquiry@tanscst.org
22.	Vidya Bhawan Society	Address : Fatehpura, Udaipur, Rajasthan 313001 Phone : 0294 2450911 Website : http://www.vidyabhawan.org E-Mail : info@vidyabhawan.org, vbsudr@yahoo.com
23.	Vikram A Sarabhai Community Science Center	Address : Opp. Gujarat University, Navrangpura, Ahmedabad - 380 009 Phone : 079-26302085,26302914 Website : www.vascsc.org E-Mail : info@vascsc.org

# MATHEMATICS



## Some Popular Publishers of Math Books for Children

Sl. No.	Name of the Publisher	Website
1	Children's Book Trust	www.childrensbooktrust.com
2	Eklavya	www.eklavya.in/
3	Flipkart	www.flipkart.com
5	Macmillan Publishers	www.international.macmillan.com
4	National Book Trust	www.nbtindia.org.in
6	National Council of Educational Research and Training	www.ncert.nic.in
7	Navnirmitti	www.navnirmitti.org/index.html
8	Pratham Books	www.prathambooks.org
9	Scholastic India Publishing	www.scholasticindia.com/publishing.as
10	School Zone Publishing	www.schoolzone.com
11	The Mathematical Sciences Trust Society	www.mstsindia.org/
12	Vidya Bhawan Society	www.vidyabhawan.org
13	Digantar Khel Kud Society	
14	Homi Bhabha Center for Science Education, Mumbai	www.hbcse.tifr.res.in

## Some Articles on Mathematics published in Sandarbh, by Eklavya, Bhopal\*

Iss. No.	Title of the Article	Author
1	I Am Afraid of Mathematics	Ganga Gupta
2	Something- From the Past	Rohit Dhankar
4	An article on statistics	Stephen J.Goold
6	Understanding of Students About Mathematics	Madhav Kelkar
10	What the Teacher Said and What the Students Understood	Venu Endle
22-23	Puzzle of a Magical Pond	Vijay Shankar Verma
28	Wonderful Geometrical Figures	Abhishek Dhar
33	Relation of Circle with Radius	Jui Dadhich
40	Pieces of Paper, Algebra and Pythagoras theorem	Prakash Burte
51	My Journey	P. K. Srinivasan
52	Teaching Negative Numbers to School Children	Jayashree Subramanian
53	Series and Infinite Series	Jayashree Subramanian
54	Making Mathematics Interesting	Pramod Maithil
54	Multiplication of Negative Numbers	Jayashree Subramanian
55	Zero + Zero + Zero + Zero + ...	Jayashree Subramanian
57	Teaching Place Value and Double Column Addition	Constance Kamii and Linda Josesh
62	My Mathematics Classes and Saurabh	Mohammad Umar

\*Original titles are in Hindi.

## Articles from magazines published by Vidya Bhawan ERC

Title of the Book	Title of the Article	Author
Construction of Knowledge	About learning Mathematics (Also available in Hindi.)	H.K. Dewan and Ashok Kumar
	Teaching of Mathematics at Primary Stage	H.K. Dewan
	About learning Mathematics	H.K. Dewan
	Mathematics: Materials and Laboratories	H.K. Dewan
Material Development for	LMT-01 series , AMT-01 series	

## Articles from "Primary Education vol.2 July-Sep 02"

SL. No.	Title of the Article	Author
1	A way to explore Children's understanding of Mathematics	Padma M. Saragapani.
2	Errors as Learning Strategies	R.K. Agnihotri
3	Reflections on Mathematics Teaching	H.K. Dewan
4	Common Errors in Primary School Mathematics?	H.C. Pradhan
5	Does the Child Know any Mathematics	H.K. Dewan
6	Intercultural Mathematics Education in Peru	Joachim Schroeder
7	How Mathematical Ideas Grow - an extract	IGNOU's AMT series
8	Why have a Laboratory for Mathematics?	Rohit Dhankar
9	Math phobia among Teachers and Children: Glimpses from a Survey	S.N. Gananath & C Srinath
10	The Metric Mela, a Celebration of Measurement in Karnataka	K.M. Sheshagiri
11	Teaching Tribal Children Mathematics Through Real Contexts	Binaya Krushna Pattanayak

\*Original titles are in Hindi.

## Some NGOs working in the area of Math Education

- Eklavya, Bhopal
- Navnirmitti, Mumbai
- Homi Bhabha Centre for Science Education, Mumbai
- Shishu Milap, Vadodara
- Jodogyan, Delhi
- Suvidya, Mysore
- Vidya Bhawan Society, Udaipur

The site [www.arvindguptatoys.com](http://www.arvindguptatoys.com) has several books / publications on Mathematics. For example, some of the books are 'Illustrated Maths Formulas', 'Geometry for Kids', 'Math Wonders' etc. We invite readers to visit the site.

## Some Web Links to make Math Learning fun

1. <http://www.mathcelebration.com/index.html>
2. <http://www.artofproblemsolving.com/>
3. <http://www.noetic-learning.com/others.jsp>
4. <http://cte.jhu.edu/techacademy/web/2000/heal/siteslist.html>
5. <http://www.cimt.plymouth.ac.uk/>
6. <http://vedicmathsindia.blogspot.com/>
7. <http://www.vedicmathsindia.org/>
8. <http://www.teach-nology.com/gold/basicword.html>
9. <http://www.mathplayground.com>
10. <http://www.math.com>
11. <http://www.mathsisfun.com>
12. <http://www.coolmath4kids.com>
13. <http://www.mathcats.com>
14. <http://www-history.mcs.st-and.ac.uk/BirthplaceMaps/Countries/India.html>
15. <http://www.teachingideas.co.uk/maths/contents.html>
16. <http://www.playkidsgames.com/mathGames.html>
17. <http://www.azimpremjiuniversity.edu.in/content/publications> - At Right Angles is a publication of Azim Premji University which is a very useful resource for school mathematics

# LANGUAGE

## Some Government Organisations Working in the Field of Promotion and Development of Languages

Sl. No.	Name of the Organisation	Website
1	Central Hindi Directorate, New Delhi	hindinideshalaya.nic.in
2	Central Institute of Indian Languages, Mysore	www.ciil.org
3	Commission for Scientific and Technical Terminology, New Delhi	www.cstt.nic.in
4	English and Foreign Language University, Hyderabad	www.ciefl.ac.in
5	Kendriya Hindi Sansthan, Agra	www.hindisansthan.org
6	Maharishi Sandipani Rashtriya Veda Vidya Pratishthan, Ujjain	
7	National Council for Promotion of Sindhi Language, Vadodara	www.ncpsl.org
8	National Council for Promotion of Urdu Language, New Delhi	www.urducouncil.nic.in
9	National Council of Educational Research & Training, New Delhi	www.ncert.nic.in
10	National Translation Mission	www.ntm.org.in
11	Rashtriya Sanskrit Sansthan, New Delhi	www.sanskrit.nic.in

## Some Non-Government Organisations Working in the Area of Language Education

Sl. No.	Name of the Organisation	Website
1	Akshara Foundation, Bangalore	www.aksharafoundation.org
2	British Council, India	www.britishcouncil.org
3	Centre for Learning, Bangalore	www.cfl.in
4	Centre for Learning Resources, Pune	www.clrindia.net
5	Digantar Shiksha Evam Khelkud Samiti, Jaipur	www.digantar.org
6	Dr. Reddy's Foundation, Hyderabad	www.drreddysfoundation.org
7	Eklavya, Bhopal	www.eklavya.in
8	Pragat Shikshan Sanstha, Phaltan, Maharashtra	www.indiaprogressiveeducation.com
9	Pratham, Mumbai	www.pratham.org
10	Rishi Valley Institute of Teacher Education Chittoor District, Andhra Pradesh	www.rishivalley.org/rvite/rvite_overview.html
11	The Promise Foundation, Bangalore	www.thepromisefoundation.org
12	The Teacher Foundation, Bangalore	www.teacherfoundation.org
13	Vidya Bhawan Education Resource Centre, V.B. Teachers College, Udaipur	www.vidyabhavansociety-seminar.org/

## List of Some Popular Children's Books' Publishers

Sl. No.	Name of the Publisher	Website
1	A&A Book Trust / Arvind Kumar Publishers	www.arvindkumpublishers.com
2	Alka Publications	www.alkapublications.com
3	Anveshi (through DC Books) - Tales from the margins a series of eight books	www.anveshi.org/content/view/172/99/
4	Bharat Gyan Vigyan Samiti (BGVS)	www.bgvs.org

Sl. No.	Name of the Publisher	Website
5	BPI India Pvt. Ltd.	www.bpiindia.com
6	Cambridge University Press	www.cambridge.org/asia/
7	Center for Learning Resources	www.clrindia.net/materials/childrenbooks
8	Chandamama India	www.chandamama.com
9	Children's Book Trust	www.childrensbooktrust.com
10	Eklavya	www.eklavya.in
11	Eureka Books (EurekaChild An AID India Education Initiative)	www.eurekachild.org/eurekabooks
12	Hamlyn: Octopus Publishing Group	www.octopusbooks.co.uk/hamlyn/
13	Harper Collins Children's Books	www.harpercollinschildrens.com
14	India Book House	www.ibhworld.com
15	Janchetna	www.janchetnaaa.blogspot.com/
16	Jyotsna Prakashan	
17	Karadi Tales Company	www.karaditales.com
18	Katha, New Delhi	www.katha.org
19	Macmillan Publishers	www.international.macmillan.com
20	National Book Trust	www.nbtindia.org.in
21	National Council of Educational Research and Training	www.ncert.nic.in
22	Navakarnataka Publications	www.navakarnataka.com
23	Navneet Prakashan Kendra, Ahmedabad, Gujarat	
24	Oxford University Press	www.oxfordonline.com
25	Parragon Books	www.parragon.com
26	PCM Children's Magazine	www.pcmmagazine.com
27	Pratham Books	www.prathambooks.org
28	Puffin Books, Penguin Group	www.puffin.co.uk
29	Pustak Mahal	www.pustakmahal.com
30	Rajkamal Prakashan Samuha	www.rajkamalprakashan.com
31	Ratna Sagar Publishers	www.ratnasagar.com
32	Room to Read	www.roomtoread.org
33	Sahmat	www.sahmat.org
34	Scholastic India Publishing	www.scholasticindia.com/publishing.asp
35	Shree Book Centre, Mumbai	
36	Tara Books	www.tarabooks.com
37	TERI Press	www.bookstore.teriin.org/childrencorner.php
38	The Learning Tree Store	www.tltree.com
39	Thomas Nelson	www.tommynelson.com
40	Tormont Publication Inc.	
41	Tulika Books	www.tulikabooks.com
42	Two-can Publishing/Cooper Square Publishing	www.two-canpublishing.com/ www.coopersquarepublishing.com
43	Vasan Publications	www.mastermindbooks.com

## Some Weblinks for Language Learning

1. [http://www.bbc.co.uk/schools/magickey/adventures/dragon\\_game.shtml](http://www.bbc.co.uk/schools/magickey/adventures/dragon_game.shtml) is a game that helps learn about a question and a question mark.
2. [http://www.bbc.co.uk/schools/magickey/adventures/creamcake\\_game.shtml](http://www.bbc.co.uk/schools/magickey/adventures/creamcake_game.shtml) is a game that helps learn rhyming words, their pronunciation and use in sentences.
3. <http://www.proteacher.com/cgi-bin/outside.cgi?id=4731&external=http://www.sdoe.k12.ca.us/score/actbank/sorganiz.htm&original=http://www.proteacher.com/070037.shtml&title=Graphic%20Organizers> contains well-delineated writing standards, level wise.
4. <http://www.lessonplanspage.com/LAK1.htm> contains a whole host of ideas for language activities
5. <http://www.col-ed.org/cur/lang.html> has a plethora of links to lesson plans for language learning, and none of them conventional ones.
6. <http://www.op97.org/ftcyber/jack/puzzles/puzzles.html> has easy, medium and hard jigsaw puzzles that are based on fairy tales.
7. <http://www.youtube.com/watch?v=2lVNi-FpEuY> has a video of the Panchatantra story about the doves in a hunter's net (collective strength) in Hindi.
8. <http://www.youtube.com/watch?v=5ODqhC-Ghlc&NR=1> has a video of the Panchatantra story "The ungrateful Mouse" in Hindi.
9. [http://www.youtube.com/watch?v=ANjO\\_VjilDw&feature=related](http://www.youtube.com/watch?v=ANjO_VjilDw&feature=related) has a video of a story on why the sea water is salty.
10. <http://www.pitt.edu/~dash/type0510a.html> contains links to different versions of the story of CINDERELLA, from around the world.
11. <http://www.darsie.net/talesofwonder/> contains Folk and Fairy Tales from around the World.
12. <http://www.rubybridges.org/story.htm> contains the inspiring story of Ruby Bridges and her teacher
13. <http://www.thepromisefoundation.org/TPFLtRB.pdf> is report of a Study on Learning to Read in Bengali, useful for language researchers in Indian languages.
14. <http://www.thepromisefoundation.org/TPFRdK.pdf> is report of a Study on Reading Difficulties in Kannada, useful for language researchers in Indian languages.

## Some Websites for Language Resources

1. [http://www.bookadventure.com/ki/bs/ki\\_bs\\_helpfind.asp](http://www.bookadventure.com/ki/bs/ki_bs_helpfind.asp) allows the user to enter the preference (level, type of book, etc.) and then generates an entire booklist, complete with title, author name, ISBN number, etc.
2. <http://school.discoveryeducation.com/> provides innovative teaching materials for teachers, useful and enjoyable resources for students and smart advice for parents about how to help their kids enjoy learning and excel in school. The site is constantly reviewed for educational relevance by practicing classroom teachers in elementary school, middle school, and high school.
3. <http://puzzlemaker.discoveryeducation.com/> allows the user to create and print customized word search, criss-cross, math puzzles, and more using his/her own word lists.
4. <http://www.henry.k12.ga.us/cur/Kinder.htm> has a host of ideas for the classroom, to improve language, science, math, art, and many other skills.
5. <http://gem.win.co.nz/mario/wsearch/wsearch.php> allows you to generate your own word maze/word search puzzle.
6. <http://georgemcgurn.com/articles/readingforpleasure.html> has a good article on reading for pleasure.
7. <http://www.atozteacherstuff.com/pages/374.shtml> for a lovely idea on getting children excited about reading.
8. <http://www.readingrockets.org/article/c55/> for another idea
9. Also, see: <http://www.bbc.co.uk/raw/campaignpartners/ideasbank/reading/>
10. <http://www.vrml.k12.la.us/krause/Reading.htm> has slide shows for reading for kids.
11. <http://kielikompassi.ulc.jyu.fi/kookit0405/seashore/mrshrimpandsammy.htm> has a film to teach pronunciation.
12. <http://www.msgarrettonline.com/descripwords.html> for descriptive words
13. <http://esl.about.com/od/vocabularylessonplans/a/characteradj.htm> for an excellent activity that develops and broadens knowledge of character adjective vocabulary.
14. <http://www.scholastic.com/ispay/play/> for a set of award winning puzzles and games that allow children to discover word associations, word play and themes that help them build important learning skills including reading.
15. [http://www.readwritethink.org/materials/in\\_the\\_bag/index.html](http://www.readwritethink.org/materials/in_the_bag/index.html) for an interactive game that builds vocabulary.
16. <http://learnenglishkids.britishcouncil.org> Simple self-learning materials for kids.
17. [www.activityvillage.co.uk](http://www.activityvillage.co.uk) There are a number of tasks leading to language learning.

18. [www.englishbee.net](http://www.englishbee.net), English video lessons and exercises
19. [www.holidays.mrdonn.org](http://www.holidays.mrdonn.org), The Diwali lesson plans and games for kids are quite innovative
20. [www.abcmouse.com/ed/activities](http://www.abcmouse.com/ed/activities) It is a full online curriculum for preschool through kindergarten.
21. [www.uniqueteachingresources.com](http://www.uniqueteachingresources.com) Free teaching resources for language teachers
22. [www.teachingenglish.org/en](http://www.teachingenglish.org/en) Free classroom materials to download short activities, lesson plans
23. <http://esltopics.com> Teachers can use the free material for teaching vocabulary to non-English speaking children
24. [http://www.azimpremjiuniversity.edu.in/content/publications - Language and Language Teaching](http://www.azimpremjiuniversity.edu.in/content/publications-Language%20and%20Language%20Teaching) is a publication of AzimPremji University focusing on issues and practices relevant to language teaching

## Some Weblinks to E-Books and Online Libraries

1. <http://worldlibrary.net/WidgerLibrary.htm> has several e-books that can be downloaded.
2. <http://www.sacred-texts.com/hin/ift/index.htm> has links to Indian fairy tales.
3. <http://primary.naace.co.uk/activities/BigBooks/index.htm> has audio-e-books for kids.
4. <http://www.vrml.k12.la.us/krause/Reading.htm> for slide shows that excite a child to read.
5. <http://www.arvindguptatoys.com/> contains an enormous list of books on enlivening language learning, rated by Arvind Gupta. Many of them can be downloaded for free.

## Books

The following books of the New Ways in TESOL series edited by Jack C. Richards present learner-centred, cooperative, communicative activities.

1. Kathleen Bailey and Lance Savage (ed). *New Ways in Teaching Speaking*, TESOL, 1995.
2. Paul Nation. *New Ways in Teaching Vocabulary*, TESOL, 1995.
3. Martha C. Pennington (ed). *New Ways in Teaching Grammar*, TESOL, 1995.
4. Richard R. Day (ed). *New Ways in Teaching Reading*, TESOL, 1995.
5. Ronald C. White (ed). *New Ways in Teaching Writing*, TESOL, 1995.

## Publications

The following publications of the Regional Institute of English, South India, Bangalore are quite innovative in their approach to English language teaching:

1. *Play and Play* : a set of 50 traditional games from across the country with language elements integrated at each level.
2. *Play with Words*: a variety of reading texts like picture cards, small books, big books and colour books to help children discover the pleasures of reading.
3. *Hello English* : a series of 20 interactive films providing meaningful exposure to the language with opportunities for children to talk, sing and play.
4. *Enact English* : a number of drama activities and songs to facilitate language learning in a natural and effortless manner.
5. *Learning English is fun*: about 25 audio cassettes involving the children and the teacher in a series of fun-filled interactive activities and songs.
6. *English in Pictures*: a number of pictures with a set of activities for each picture to help children use language in realistic contexts.

# SOCIAL SCIENCE



## Organisations that Work on Social Sciences at School Level - On Curriculum and Material Development Issues

Sl. No.	Name of Organisation	Location
1	Eklavya	Bhopal, MP
2	Uttarakhand Seva Nidhi	Almora, Uttarakhand
3	Nirantar	New Delhi
4	Khoj	Mumbai
5	Avehi Abacus	Mumbai
6	Swanirbhar, Organisation based in Noth 24 Pargana	West Bengal
7	SAHMAT, Safdar Hashmi Memorial Trust	New Delhi
8	Vidya Bhawan Society	Udaipur, Rajasthan
9	Digantar	Jaipur, Rajasthan
10	Pravah	Delhi

## Schools that have used Innovative Methods to Teach Social Science

Sl. No.	Name of School	Location
1	The School	Chennai
2	Rishi Valley School, (Social Science and History curriculum for classes 4 to 7)	Madanapalle
3	Shishu Van	Bombay
4	Center for Learning	Bangalore, Hyderabad
5	Aadharshila	Sendhwa, MP

(Most of these schools have their websites where contacts and materials can be accessed)

## Publishers in Social Sciences

- Granthshilpi - New Delhi
- Eklavya, Bhopal
- Bharat Gyan Vigyan Samiti, Delhi
- NCERT, New Delhi
- Publication Division, New Delhi
- National Book Trust, New Delhi
- Children's Book Trust, New Delhi
- Books on Social Science education by Sage Publications, New Delhi
- Books published for Children by Oxford University Press, New Delhi
- People's History Series, Tulika Publications, Chennai
- Katha, New Delhi
- Tara, Chennai
- Navayana, New Delhi

## Some Useful Books

- Samajik Adhayayan - 6, 7 and 8 - Textbooks developed and published by Eklavya, Bhopal (Hindi)
- Textbook of Social Science for class 6, 7 and 8 (English, 1994): Eklavya, Bhopal.
- Textbooks of Social Science for classes 6 & 7, developed by Eklavya for Lok Jumbish Parishad, Rajasthan, 1999/2000.
- Samajik Adhayan Sikshan - Ek Prayog, published by Eklavya

- Hamari Dharati, Hamara Jeewan, textbooks for classes 6, 7 & 8, Uttarakhand Sewa Nidhi, Almora
- Workbooks for Rajasthan textbooks for Classes 6, 7 & 8.
- Workbooks of Haryana for Class 6, 7 & 8 (2008).
- Text Book of Chattisgarh for classes 3 to 8: EVS and Social Sciences, SCERT, Raipur.
- Textbooks for Ladakh Hill Council on Environmental Studies Part II for classes 4 & 5
- Our Tribal Ancestors - Prehistory for Indian Schools, part 1 & 2, Rishi Valley Education Series
- Sangam Age and Age of the Pallavas - TVS Education Society & Macmillan
- The Young Geographer series, Haydn Evans, Wheaton - Pergamon
- Geography Direct - Collins Educational
- Khushi-Khushi for class 3, 4, 5: Eklavya, Bhopal
- Apne Aas pas, textbook for classes 4 & 5, Digantar, Jaipur
- Kuchh Karen, Vidya Bhawan Society, Udaipur
- Textbooks of NCERT for class 3 to 8: NCERT, New Delhi
- Textbooks of EVS and Social Science for classes 3 to 8, SCERT, Delhi

## Some Resource & Reference Books

- Itihas ke Srote, bhag - 1, A resource book for Teachers, published by Eklavya
- People, Places and Change: An Introduction to World Cultures by Berry and Ford
- Puffin History of India series by Puffin Books, Delhi
- Report of the seminar on Environment Studies (1995): Vidya Bhawan Society
- Social Science Learning in Schools - Documentation of the Eklavya's social science experiment, Edited by Prof Poonam Batra and published by SAGE
- Teaching Social Science in Schools - by Alex M George and Amman Madan, Published by SAGE
- Walk With Me - A guide for Inspiring Citizenship Action - Pravah, New Delhi
- Writings of Teachers Ideas for the Classroom - East West Books, Madras
- Social Studies Instruction in the Elementary School by Richard E Servey
- Learning from Conflict by Prof Krishna Kumar
- Turning the Pot Tilling the Land by Kancha ILAIAH - Navayana Books
- Different Tales Series - Anveshi and D.C. Books, Kerala

## Localised Resource Books as Models for Creation

- Our City Delhi - Narayani Gupta - Oxford University Press
- School and Society and Area Study of Mylapore - Tara Publishing

## Journals

- Sandarbh (For Teachers)
- Vimarsh (for Teachers)
- Chakmak (for children)
- Contemporary Education Dialogue
- Economic and Political Weekly
- Teacher Talk, A Journal of the TVS Educational Society
- Journal of the Krishnamurthy Schools

## Films

- The Young Historians - Series of films by Ms Deepa Dhanraj
- Bharat Ki Khoj, Tele Serial produced & directed by Mr Shyam Benegal
- Bharat Ki Chhap, films on Indian History
- Naata (on Communalism) TISS Mumbai (Anjali Monteiro)
- India Untouched - Stalin (on Untouchability in India)
- War and Peace - Anand Patwardhan
- Making of the Mahatma - Shyam Benegal
- Ambedkar
- Nanook of the North (on the life of Eskimos)

## Publishers in Social Sciences

- <http://www.neok12.com/History-of-India.htm> - has many videos on topics in social science
- Eklavya publications, <http://www.eklavya.in>
- Sangati interactive teaching learning kits, <http://avehiabacus.org/about.html><http://schools.indiawaterportal.org/>
- Me and my City - sunitha Nadhamuni and Rama Errabelli Janagraha Center for Citizenship and Democracy, [www.janaagraha.org](http://www.janaagraha.org)
- Water related projects and resources, <http://schools.indiawaterportal.org/>
- Heritage related resources The Indian National Trust for National and Cultural Heritage, <http://www.intach.org/>
- Curriculum based story books: IETS publications <http://www.ilfsets.com/solutions.asp?secid=1&menuid=3&smenuid=1&childid=1&subchildid=2&pageid=345>
- <http://www.worldsocialscience.org/>, the site of the International Social Science Council.
- UNESCO's Social and Human Sciences page, <http://www.unesco.org/new/en/social-and-human-sciences/> and Education page, <http://www.unesco.org/en/education>
- The IEA's • Civic Education Study link is, <http://www.iea.nl/icces.html>.
- Bombay Natural History Society, <http://www.bnhs.org>
- Kalpavriksha Environment Action Group, <http://www.kalpavriksha.org>
- Center for Environment Education, India, <http://www.ceeindia.org/cee/index.html>
- Down to Earth Magazine, <http://www.downtoearth.org.in>
- Center for Science and Environment, India, <http://www.cseindia.org>

## Some other Important Websites

- [www.school.discovery.com](http://www.school.discovery.com)
- [www.nationalgeographic.com](http://www.nationalgeographic.com)
- [www.incredibleindia.org](http://www.incredibleindia.org)
- [www.animalplanet.co.uk](http://www.animalplanet.co.uk)
- [www.greenpeace.org](http://www.greenpeace.org)
- [www.britanica.com](http://www.britanica.com)
- [www.arvindguptatoys.com](http://www.arvindguptatoys.com)