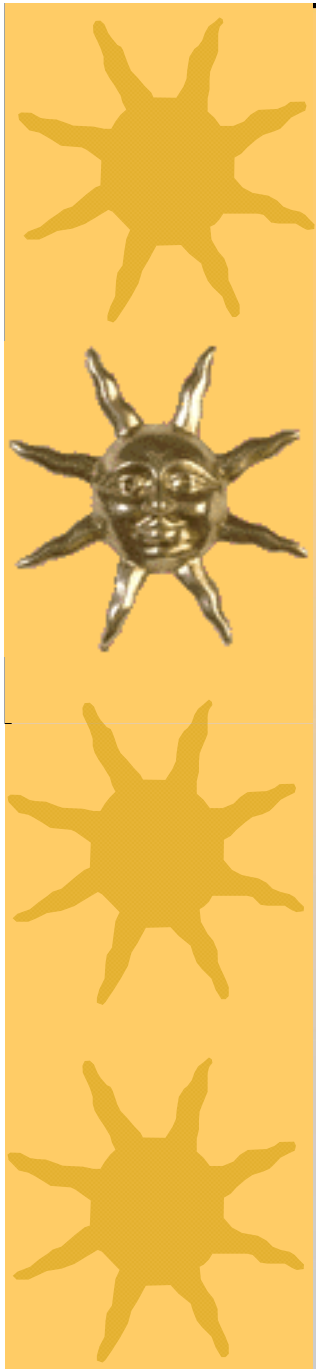

Teaching Science - Challenges and Opportunities

Dr. Sudip Chaudhuri

M. Sc., M. Tech., Ph.D. (Sc.) (SINP / Cal), M. Ed.

CSIR-UGC NET, WBCSC SLET, I.I.T. GATE

Assistant Professor-Stage-3 / Reader

Gandhi Centenary B.T. College, Habra, India

Honorary Researcher, Saha Institute of Nuclear Physics, Kolkata

chaudhurisudip@yahoo.co.in

Every Child is a Scientist

- I say Every Child is a Scientist.
- How do you answer the focused question – how was I born? Wherefrom did I come?
- What's our answer? We got you from God, etc. The greatest question of molecular biology was not answered. We believe God is not a materialist; we generally teach our children not to be materialistic. The pursuit of science gets its first jolt.
- There are many teachers here. Sir, how will you answer the question raised by the child?

Magic Slate

- A salesman was selling magic slate.
- He was asking parents not to buy papers for their children for practice.
- Instead, they can buy a magic slate. Every time there is a mistake, the same can be erased.
- The society does not allow children these days to make mistakes. Since there is no mistake, there is no review of mistake.
- Does this promote scientific spirit?

Study Nature

- All work and no play make Jack a dull boy.
- There is only study and no play, no observation.
- Mugging up does not promote science.
- The attitude of questioning has to be developed.
- We are afraid of asking questions.
- Perhaps our social and political culture are responsible.
- Even the great Einstein said his greatest quality was his curiosity.
- Does the gap between a teacher and student affect development of curiosity?

Hands-on Experience

- We Indians like abstractions.
- Unless there is synchronization between head and hands, things cannot be made.
- We are good in developing theories, but using them to make instruments does not come to us naturally.
- Sir J. C. Bose made his instruments. Perhaps he was the most skilled one in this respect.

Hands-on Experience (Contd.)

- The west can teach us a lot on this.
- Can students be asked to make models?
- Are village people better than city people in indigenization and ingenuity?
- Is distraction due to our inability to pull the appropriate string?
- Is the social choice in matter of jobs responsible?
- Are we averse to hard work?

Role of Ethics

- Newton was a great scientist, but it appears that he was not a modern man in terms of feelings towards women or students.
- An ethical society considers others as equals.
- Perhaps this leads to better scientific development.
- Morality is more with self, ethics is more with inter-relationship.

Ethics (Contd.)

- If the ethical status of the other is in any way negated, it does not matter how much scientific progress a society may achieve at any point of time, it will be short-lived.
- Where social relationships are not governed by this in-built respect for others, science cannot sustain itself in the long run.

Ethics (Contd.)

- Ethical relationships are exceptions in a society, as in India, where there are vast economic disparities between classes.
- In societies that are generally middle-class, as in Western Europe, the chances of viewing the other as an ethical equal is very high.
- With 15% of the world's population, over 85% of scientific journals and about 96% patents are produced in the west.

Ethics (Contd.)

- It will be incorrect to conclude that bright minds are produced in the western hemisphere.
- Countries like India fall behind in scientific production because we lack the basic ethical quotient necessary for being modern.
- A science teacher must understand these points.
- A teacher's failure is not only his; it is an overall sociological output.
- GURUKUL Culture is perhaps not good for teaching science.

Western example again

- As writing poetry is a culture even in not so educated people here, doing science or more aptly technology by the so-called uneducated people is typically a western trend.
- School/college drop-outs exhibit extra-ordinary creativity in making things.
- Ordinary people like taxi-drivers and sweepers are interested in science and technology.
- In this part of the world, even renowned scientists justify the divine power of idols of Lord Ganapati drinking gallons of milk.

Attitude of science

- We need to develop an attitude of science in this social structure which is indeed a difficult task.
- Students opt for science for building better careers and ultimately get lost in management jobs.
- It is difficult to stick to science because it needs tremendous personal discipline (not early to bed and early to rise type discipline).
- It needs real sacrifice. Read Marie Curie's life.

New teaching methodologies

- Can we come out of text books?
- What about field trips / audio-visual programs?
- What about doing small experiments?
- What about arriving at principles from debate and discussion (essential for interrelationship)?
- What about giving more credit for creativity rather than reproduction?
- What about creating a mind that questions rather than answers?

Teaching through analogy

- Newton's Law of Gravitation and Coulomb's Law of Interaction of charges have analogous forms. How to teach students this inherent power of analogy?
- Why does analogy fail?
- Basic Definitions. Students often are not aware of materials they are handling, their properties.
- Students know what Physical and Chemical Properties are; they do not know what the word Property means.

Teaching through games

- Throw a ball up.
- Why does the ball stop at a certain height and starts falling back?
- Kinetic energy and Potential energy
- Laws of Pendulum.
- Archimedes Principle.
- Static electricity.
- Optical properties.

Physics and Mathematics

- For teaching application of first principles, Physics and Mathematics are more powerful as compared to Chemistry.
- In Physics laws come first and then they are checked against observations.
- In Chemistry observation is more important and theories are adjusted to suit the observations.
- Physical Chemistry is more like Physics.

Teaching Chemistry

- Myth that Chemistry has to be memorized.
- Faulty Examination system is responsible for that.
- Allow a student to consult the Periodic Table. Let him then bring out the properties of the elements himself. Let him apply the power of analogy. When analogy fails to predict, extend your helping hand.

Play Hide and Seek

- Ghost of the moon, Phantom stars are more beautiful than the moon and the stars.
- Distance lends enchantment to the view. Be friendly, but maintain safe distance.
- Do not say everything to students. Empower them. Tell them that they are as gifted as you are.
- Occasionally give them chocolates for solving difficult problems.
- Punish them with difficult problems. Punishment must bring improvement quickly and surely.

Motivation

- Please tell your students to follow their passions.
- In this country a boy willing to be an artist ends up in being a chemist.
- Ask students to come out of the conventional thought process.
- They must enjoy what they are doing or will do.
- That's the only way to achieve perfection.

Conclusions

- I think I have raised more questions rather than giving answers.
- I am against the concept of teaching teachers, I am for debate and discussion.
- Perhaps it will take some more time before the scientific culture is ingrained in our minds. Acharya P. C. Ray's comments about the excellence of our people in law makes sense.