

SAM PITRODA  
CHAIRMAN

2nd May, 2008

Dear Mr. Prime Minister,

As you have repeatedly emphasized, a strong foundation in the pure sciences is essential to transform India into a knowledge superpower. Unfortunately, as the economy grows, fewer students are opting for the pure sciences. This has led to a talent crunch, seriously impeding the development of the future generation of scientists and teachers. We are aware that this is a world-wide phenomenon, but countries like China and South Korea, having invested prudently in science education, are now beginning to reap rich dividends.

In this context, NKC carried out wide consultations with experts through a series of workshops and interviews. A working group of eminent persons was also constituted to consider all aspects of the problem. Based on these inputs, NKC has formulated a set of recommendations to attract and retain talented students in basic sciences which are summarised in the following paragraphs. More details are given in the accompanying note. We have chosen to reiterate some of the proposals which overlap with the views of other expert groups. We stress that this matter is extremely urgent and a rapid implementation is now crucial to effect a paradigm change in the field of Science education and research in the country.

***1. Invest in upgrading and expanding the existing infrastructure and promote sharing of available resources*** – University departments and leading undergraduate science colleges should be generously funded to upgrade their staff and facilities. To encourage good departments, ‘Centres of excellence’ should be identified with comprehensive review and evaluation procedures in place. To create a critical mass of scientists in each science stream **undergraduate seats should be increased in good institutes and undergraduate programmes should be introduced at institutes where only post graduate teaching is currently undertaken.** Innovative methods for sharing resources and faculty between institutes and universities need to be evolved. At the same time, university management at all levels should be made more professional and sensitive towards working in an academic and research environment to promote optimal utilization of resources.

***2. Revitalize the teaching profession to attract and retain quality teachers*** – The working condition of teachers needs to be drastically improved. Rewards and recognition should be publicized and given at all levels. Teachers at the school and college level should be encouraged to develop innovative teaching methods. Research should be promoted in colleges by building linkages between colleges and research institutions. Academic autonomy and flexibility should be encouraged. Further, a mentoring programme for young faculty members should be started in universities and colleges. Many reserved faculty posts remain vacant in the absence of innovative or flexible appointment modes to fill these posts, creating enormous practical difficulties in teaching. **There is a need to start a systematic affirmative campaign**

**to rectify this situation.** Young students who can eventually fill these posts could be selected from an early age and nurtured and trained carefully to induct them into a career in teaching.

***3. Revamp teacher training at all levels and promote development of teaching aids to retain student attention in classrooms*** – A systemic change in science pedagogy from primary and high school levels is required. There is a need to launch a large scale in-service training programme for all science teachers based on the initiative undertaken by Science academies. At the undergraduate level, the present method of faculty training conducted by Staff Training Institutes/ Centres should be reviewed and revamped. In addition, there is a need to provide a platform for life long skill enhancement of teachers. Teacher organizations like the Indian Association of Physics Teachers should be strengthened and financially supported so that they can become leaders in developing new teaching methodologies and make significant contributions to content and evaluation reforms.

***4. Restructure masters and graduate degrees to promote career flexibility after graduation*** – To bring graduate degrees in science at par with other professional streams, a four year Bachelor in Science (flexible and modular in nature) is proposed. This degree course should be aptly branded and devised so that it is significantly stronger than the regular three year programme. It should enable students aspiring for a research career to directly enter a Ph.D. programme. For others, it should provide them with measurable value additions like interdisciplinary skills, niche skills required in industry, or rigorous training in science education, science communication, etc. To ensure the success and acceptability of such programmes, the course content must be planned in consultation with diverse expert groups, and implemented at institutions with a proven track record of success. Simultaneously, the existing B.Sc. and M.Sc. courses should be reformed. The integrated five year M.Sc. programme should have the provision to be integrated with the Ph.D. programme so that the total effective time spent for a Ph.D. is reduced.

***5. Reform the science curriculum content in line with the changing world and increase research component at all levels*** – There is an urgent need to reduce information load of curriculum at the higher secondary level. Courses should be made engaging and the amount of hands-on work at all levels should be increased. Books should be written by teachers who teach the subject and not by curriculum committees. Pedagogy should be modified to impart creativity and global vision training. Avenues for research should be increased at all levels.

***6. Radical changes are required in the evaluation system to encourage scientific thinking and promote better understanding of basic science concepts*** – The system should move from examination based evaluation to more open assessment mechanisms. Memory, comprehension and creativity should be given equal importance in evaluations. Continuous assessment at the school level will reduce dependence on year-end examinations. To enable the modifications in the evaluation process, teachers need to be trained in new methods of evaluation.

**7. Promote access to quality science educational material at all levels** – There is a need to disseminate high quality science educational material and self learning aids in local languages to assist students from non-English medium education background. **One important factor which has to be kept in mind while translating into local languages is that the technical/ scientific terms should be retained in English.** This will make it easier to migrate to English medium teaching in sciences at higher level for the students. Special teaching aids need to be developed for tribal children and children from rural backgrounds to attract them towards science. Tribal schools should be equipped with teachers who are trained in pedagogical methods suited to the special needs of tribal children.

**8. Re-brand and promote careers in basic sciences** – Existing careers in sciences, namely teaching and research, should be made more attractive. There is a need to increase salaries in this field to reflect the shortage of skilled manpower and to attract students towards a career in science. Science colleges should collaborate with research institutes and industry for campus placements. More modules/ courses could be designed which prepare students for employment in industry. The four year bachelor's course offered by quality institutes should dispel the myth that science bachelors are in any way less employable than graduates from other professional streams. Research institutes should collaborate with professional streams to pursue and create more opportunities. New institutes will create a demand for quality science Ph.Ds and these career opportunities need to be publicized.

**9. Launch a massive science outreach programme aimed at students and their parents** – A science popularization programme should be launched to effectively cover children across India. This programme should bring all popular science activities under one umbrella for rapid implementation and replication of successful initiatives. A large chain of science talent cells should be created and each school should be funded to open a science club. **The effectiveness of mobile labs in reaching the rural students and teachers is very high.** Replication of the Agastya International Foundation's mobile lab programme, with possible public private partnership mode for implementation, should be considered for various states.

**10. Encourage industry participation in promoting sciences at all levels** – As research based industries flourish in India, more and more companies will need employees qualified in basic sciences, thus creating other attractive career opportunities in science. Industry should be encouraged to sponsor students for Masters and Ph.Ds in science and also internships of longer duration in industry for post graduate students. Science undergraduates should be exposed to various applications of science in industry through seminars and popular science lectures by industry leaders. Academic institutions should develop groups at each institute which specialize in developing novel funding mechanisms involving industry and explore other possible modes of industry participation.

*India has a long and rich history attesting to the high talents of Indians in science. To bring back the glory that the pure sciences once held in the minds of the students, an urgent restructuring of the entire system is needed. These recommendations are just the beginning of a systemic overhaul process, requiring great support from the government and committed individuals. The crucial ingredient for ensuring success would be an effective, mission-oriented platform for delivery. Therefore, a **National***

*Science and Mathematics Mission is proposed, the details of which are outlined in Annexure I.*

NKC could provide anchor support and coordination in the launch of the Mission. We urge you to take immediate action to launch this Mission and initiate implementation of our recommendations.

Warm personal regards,

Sam Pitroda

Annexure 1: Concept note on National Science and Mathematics mission

Annexure 2: Detailed Note on Attracting More Talented Students to Maths and Science

Dr. Manmohan Singh  
Honourable Prime Minister of India

Copy to:

1. Dr Montek Singh Ahluwalia, Deputy Chairman, Planning Commission
2. Sh. Arjun Singh, Minister for Human Resources Development
3. Sh. Kapil Sibal, Minister for Science and Technology