Concerns on Science and Mathematics Education in India

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The year 2011, may mark a new beginning, it’s the year which marks the end of two decades of economic reform started in 1991. Economic reforms brought reforms in every sphere. In broader scenario whole world has witnessed phenomenal changes over last 20 years and India has been no exception. In India NREGS (national rural employment guarantee scheme) NRHM (National rural health mission) SSA (Sarv Shiksha Abhiyan) they are three revolutionary steps for improvement of livelihood, nutrition & health and education. Education is no exception. Government successfully implemented SSA in India; and made earnest efforts to improve access. Now 97% villages have a primary school. Government has made significant improvement on infrastructure. Digital learning, distance learning increasing literacy rate are many terms which are quite popular, but it’s true our Indian education system is not in good health. A person at lower level of social ladder feels that education as a major force which can improve one’s status in society and it can promote him by fetching a good job and consequently respectable position in society. But all dreams shatter when they find that there’s no change on their social position which compel them to question on the education. It shows the ASER (annual status of education report) (2011) conducted by Pratham shows that nearly 47% class V students cannot read class II text, while over 63% of class III students cannot subtract. Another report Wipro EI Quality Education study 2011 released on Dec. 2011 of India’s elite schools on-

Student performance in Class IV, VI, VIII in Science, Social Sciences, Mathematics and English on following aspects

- student attitudes and values
- learning environments & organizational aspects of the school - structure, decision making, leadership's vision and thinking, classroom practices etc
- co-scholastic areas - perspective and facilities provided
Report shows that students in top schools exhibit rote learning. It says Students in Top schools of India performed lower than the international average. While they performed on par at class 8 level. Report says that - The improvement in class 8 level was due to the higher performance observed on procedural questions. That means questions that require straight forward use of learnt procedure and it is because of rote learning.

And the most shocking results of the programme for international student assessment (PISA)³, PISA (Programme for International Student Assessment) is an international study which began in the year 2000. It aims to evaluate education systems worldwide by testing the skills and knowledge of 15-year-old students participating from 74 countries/Provinces. It tries to find that “Are students well prepared for future challenges?” Can they analyze reason and communicate effectively? Do they have capacity to continue learning throughout life? The OECD (organization for economic co-operation and development) Programme for International Student Assessment answer these questions through its survey of 15 year olds in the principal industrialized countries.

PISA assesses how far students near the end of compulsory education have acquired some of the knowledge and skills that are essential for full participation in society. In all cycles, the domains of reading, mathematical and scientific literacy are covered not merely in terms of mastery of the school curriculum, but in terms of important knowledge and skills needed in adult life. According to PISA “Mathematical literacy is an individual’s capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgments and to use and engage with mathematics in ways that meet the needs of that individual’s life as a constructive, concerned and reflective citizen.” and "Scientific literacy is the capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity.”

PISA Results of this year 2012 shows that while shanghai ranks no.1 in reading ,science literacy and math ,Tamilnadu and Himachal Pradesh are at the bottom ,Better only than Kyrgyzstan. In science, Kyrgyzstan beats Himachal. It means there is something which is severely wrong. Especially science and mathematics foundation are very pathetic. It is essential
to revamp our education system it’s time to ponder how it’s shaping and what actually we want it to shape it further.

UNESCO science report 2010 \(^4\) says about trends in human capital that in terms of number of science researcher China is on the verge of overtaking both the USA and EU (European union). These three countries each represent about 20% of the world’s stock of researcher. If add Japan’s share of 10% and 7% of Russia; it highlights that these five countries has 35% of world population but three quarter of all researcher in science. India even with such a big population has only 2.2% science researcher.

**Background of Science Education in India**

In 1857 universities of Bombay Calcutta and Madras were established and the foundations for basic science were laid. Some of the well known scientists of this era were M.N.Saha, C.V.Raman, Birbal Sahni, J.C. Bose, P.C.Mahalanobis, S.N.Bose, P.C.Ray and S.Ramanujan. They were inspiration for many.

After independence it was the vision of Jawaharlal Nehru that science and technology can drive India towards economic growth. It was felt that we need to produce more and better scientist. This thought gave the direction to school science education programme. Science education in schools as well as higher science education received great emphasis and the pragmatic policies followed over the years ensured that the country came to possess one of the largest and one of the most diverse science education infrastructure. To impart science education and training there came up several national institutes, the Indian Institutes of Technology (IITs), more than 200 universities, and over 12,000 colleges. This infrastructure has successfully produced one of the largest scientific manpower in the world. But today, while in the emerging global scenario it is being realized that the only way to improve the nation's competitiveness is through better science and technical Education. In Science and Engineering education, it is also being felt that the science education system, as it stands today, needs a drastic makeover for the nation to really derive any competitive advantage in the years to come

**Problem in Science and mathematics education**
At School Level-

Since independence emphasizing science education in schools led to science curriculum laden with content and factual information. It is common practice that students of class 6 to 8 learn the definition of science without understanding the concept behind that. Teacher never opens the mesmerizing vistas of scientific world; possible reason that the teacher may be himself the product of rote learning. Demonstrations are rare, laboratories are not well equipped and syllabus is not supported with activities. This led to memorization of facts only. Consequently students find science as a boring and difficult subject.

India science report says that Science teaching in Indian schools needs a radical overhaul to stop students losing interest. Over 60 percent of science post-graduates are unemployed. And it is vital to strengthen the quality of science teachers, their teaching methods, and the education infrastructure in schools. Amitabha Mukherjee\(^5\) says very true that the syllabi and textbooks of the last 40 years suggest that the (unstated) aim of school science education has been to produce scientists. Hence syllabi are dominated by the disciplinary demands of different branches of science, and there is a relentless downward pressure to cover more content in earlier classes.

At Undergraduate level-

In India undergraduate research is unknown phenomenon, in US it is quite popular but in our country these things are very much restricted. Need Of the hour is quality revolution in education or amplify the level of performance. In present study main thrust is on how to bring qualitative changes in science and math’s education at school level.

Methodology-

Present study was carried out by qualitative method. Eminent people around 30 in number from various fields of education were invited, which included two officers of Indian Administrative services dealing with Education, principal of DIET, Professors from Physics, Chemistry and Mathematics department, professor of Education Department and all those who are concerned with present system of education. It started with a brief presentation on PISA report afterwards they were allowed to dispense their feelings regarding present state and how things can be improved. Each individual had equal opportunity to express their views and the chairperson of
the session tried to get maximum output from each individual. This session was purely voluntary. Proceedings of this session were recorded properly. Few participants were approached further for their views. It was successful Brain storming session which was quite helpful for emerging out hidden agendas in peoples mind. The PISA report was criticised by some analysts, who said that sampling methods were inadequate but it ignited the discussion over our present educational scenario. After the session following problems emerged.

Discussion over Science and Mathematics education brought peoples concern over our education system also. While discussion various problems emerged.

Problems in Present education system-

- In our schools quality of teaching learning is very poor. Teachers have Poor understanding of educational aims as well as how children learn. Classroom teaching is not interactive.
- Insufficient teachers and infrastructure for students seeking in admission in science stream. Students are several times more than facilities. This led to half hearted science education.
- Archaic administrative methods do not allow teachers to introduce some innovative practices. Beaurocratic upper hand rather than educationist or technical hold is also a problem.
- Teachers do not have mastery over the content. There is very little accountability of teachers, and little attention on talent of teachers. Teachers are choosing it as profession for easy money not out of interest, or for honestly serving the nation. Irregularity of teachers is also due to other government duties in government schools.
- Emphasis on literacy rather than capacity building. Overall development of child is lacking. Emphasis on obtaining good marks in examination is the criteria of good school. Less emphasis on development of concept learning. Less emphasis on cooperative learning.
- Global context is lacking from our education system
- Lack of proper guidance and counseling programme restrict many students to opt the subjects.
Everyone wanted that it is essential to bring liveliness in our education system back and that’s not possible without the commitment of our nation’s human resources; and that is teachers of this nation. Government is paying handsome salary everyone wants to be teacher but only few are interested in teaching. There are ways in the system by which one can draw salary without fulfilling his or her duties. Qualified appointed teachers put someone for performing their duties. This third person gets little amount for which he or she only hold the children for certain period. They are least interested in teaching. This corruption is dwelling from top to bottom. At top level those who have authority to regulate even they are not performing the task sincerely. Be it Basic siksha Adhikari or Block Resource Centre in charge or DIET in charge. All are enjoying the benefit of absenteeism of these teachers. Even teachers want job and salary but not duties attached with the position.

**How to bring changes**-

**General**

- Emphasis on holistic development of child to arouse the curiosity among children Which motivate them for further tapping of the knowledge
- Invoke the thrust for knowledge
- Ignite the fire for learning
- Connectedness between teacher and student.
- Students should know effective learning strategies
- Despite of consistent suggestion teachers rarely adopt play way method or heuristic method for learning
- Education is more important than mere literacy, in our education system understanding and application of knowledge is not encouraged.
- Teacher should take the responsibility as agent of social change. And take it as passion or social service rather than means of livelihood.
- Teachers personality influences a student a lot teacher should consistently work over his/her strength and weakness
- Teaching learning process should be more energetic and vibrant.
- Workshops and development programmes for teachers is quite essential
Regular feedback from students and parents for continuous upgradation at primary level

Emphasis on group projects rather than competition till class 10th.

Holiday and vacations timetable needs reconsideration. How long it should be and separate activities for child in these vacations with changing climatic conditions. There should be one month allotted for any kind of project in school timetable. It will foster creativity and increase team spirit among the students.

Time to ponder over education of gifted child and provide them more enriching atmosphere.

Counseling of the parents should also be the part of the curriculum.

Incentives and increments to teachers

School complex scheme—middle school accountable for 5 primary schools. Likewise one secondary school should be accountable for 5-8 middle schools. One higher secondary school accountable for 5-8 secondary schools.

Paradigm shifts from urban based to rural based. Head offices in remote rural or tribal areas and district education officer and basic siksha Adhikari must have permanent station in remote areas.

Public and private schools to be made accountable towards the disadvantage group. In present context government decisions is quite welcoming but some solid strategy need to be formulated.

Resource centre at clusture, block and district level and real sense they work for training and consultancy.

Resource centers to conduct refresher courses, seminars, exhibitions, dialogue sessions etc.

Assessment at all levels in classroom

Play grounds should be essential part of schooling. Play time may inculcate many life skills among children.

Continuous and transparent recruitment policy of teachers should be evolved.

Urban–rural divide, public–private institutional divide

Quality of education should be main concern
• Evolving distance education mode in a better way so without burdening resources can be utilized
• Accountability of the teachers should be ensured

**Specific for Science and Mathematics education**

• Content of the science books need to be revised
• Need of the hour is to change the course of science, if our schools are not able to bear the infrastructure of laboratories change the curriculum with those experiments which can be carried out easily and correlated to everyday science.
• Interesting methods of imparting knowledge at school level. Bookish knowledge should be little.
• Quiz games sports, demonstration expert discussions should be introduced as mode of teaching learning.
• Problem solving should also be integral part of the teaching learning process, providing information should not be only motive.
• Emphasis on understanding of concepts rather than memorization of the definition only. That means practical and conceptual knowledge.

**Suggestions for teacher education** -

• Place of subject knowledge of teachers is very essential.
• Teachers during teacher training must undergo internship period
• It is essential to train pupil teacher to design their subject material transaction in innovative manner. try it out and evaluate its impact on student learning.
• Content mastery must be ascertained at B.Ed. and B.T.C. level
• Creativity and originality must be nurtured by the teacher through their respective subject areas.
• School subject specific teacher preparation programmes be designed in place of simple regular B.Ed./B.T.C. for all prospective teachers.
• Freedom with accountability of teachers.
• Science and math’s teaching should be fun and activity based.
It is essential to prepare the child for future challenges. Thrust area should be to enhance their reasoning analytical and communication ability. According to national curriculum framework 2005 it is high time to give our children some taste of understanding, following which they would be able to learn and create their own version of knowledge. That’s why it is important to break the shackles of rote learning from our education system and bring some vibrancy in the system. Main challenges for Indian education system is to inculcate healthy environment and shift from rote method to vibrant method of learning. Education is not a physical thing; it is nourished through proper interaction of parent, teacher and fellow students. Ultimate measure of any education system is not how many children’s are enrolled but how well they learn, how much healthy their learning environment is. Here healthy environment means safe, protective, stimulating and gender sensitive.

Endnote:

- 2 Quality education study, educational initiatives of Wipro retrieved from www.wiproapplyingthoughtinschools.com
- 3 www.pisa.oed.org
- 4 UNESCO science report 2010
- 5 Amitabha mukherjee, the Hindu, Online edition of newspaper, aug.16,2007.retrieved from www.hindu.com