STUDENTS in India are through with their class twelve exams and most of the students along with their parents would be struggling to win the admission race for the top medical and engineering colleges. However, owing to the huge population and limited seats it is difficult for most students to get admission in their desired college/university.

There are certain lacunae in the education system in the country due to which it is becoming difficult to produce skilled workforce. Though, the Indian school curriculum is strong with respect to basic science and mathematics content, neither engineering nor technology is a part of the regular curriculum of pedagogy. In today’s highly competitive world, STEM or Science, Technology, Engineering and Mathematics education is in high demand with industries.

STEM is about the skills required to design processes through creativity, development of technology and discovery of need-based solutions. Increasingly, global issues such as climate change, health, biodiversity, ecological sustainability and economic prosperity have forced policy makers to take serious steps to create an interest and motivate children towards STEM education.

The Indian government too has signalled its commitment to redesign the national strategy for STEM in schools. The Indian education system has become the largest and most complex in the world, with about 26 crore children enrolled in classes 1 to 12, located in the states and union territories, 683 districts, about 7300 blocks and more than 82,000 clusters, covering more than 15.1 lakh schools; the total number of teachers functioning in the system is of the order of 80 lakhs (National Policy on Education 2016). This provides the largest network involving nearly 1/5th of the population directly in the teaching/learning process.

Government Initiatives

The National Policy on Education, as formulated in 1968, 1986 and modified in 1992, recognised education as a precondition for development and set out three critical issues – equity, accessibility and quality. Despite being robust in conception and orientation, earlier education policies failed to change the state of education in last several years.

However, the National Policy on Education 2016 during the 12th Five-year Plan recognised education as the most important tool for social, economic and cultural transformation and emphasised on innovation, critical thinking and skill development. To support and complement the education policy, the Indian government has initiated several programmes aimed at disseminating practical aspects of science and technology among the students of middle school to high school and building a skilled workforce. Here are some of these programmes.
National Children’s Science Congress (NCSC): NCSC is a nationwide flagship programme of the Department of Science and Technology (DST), Government of India initiated in 1993 and recently completed 25 years. NCSC invites open-ended scientific projects from individuals or teams of young innovators, based on different themes. It provides a platform to approximately 1 million children every year in the age group of 10-17 years to exhibit their creativity and innovation in addressing societal problems through S&T interventions. About 650 projects come to the national level every year from all over the country to participate in the NCSC (http://www.ncsc.co.in).

Innovation in Science Pursuit for Inspired Research (INSPIRE): INSPIRE is an innovative programme developed by DST in 2008 with the long-term target of attracting young talent to the creative pursuit of science as a career option and building the required critical human resource pool for strengthening and expanding the S&T system and R&D base in the country (http://www.inspireawards-dst.gov.in/UserP/index.aspx).

The INSPIRE scheme includes three components to facilitate all categories of school students to aspire to do research. Recently the INSPIRE Award-MANAK (Million Minds Augmenting National Aspiration and Knowledge) is being revamped to align it with the action plan for ‘Start-up India’ initiative launched by the Hon’ble Prime Minister of India. The INSPIRE award targets approximately two lakh school children every year in the age group of 10 to 15 years i.e., 6th to 10th standards providing them an opportunity to showcase their imagination, innovation and creativity through S&T.

Initiative for Research and Innovation in Science (IRIS): IRIS is a research-based programme to infuse the spirit of discovery, increase interest in STEM and build a robust scientific temper among the young innovators of the country. Initiated in 2006, the fair promotes and nurtures science and scientific research among young innovators and provides a platform for winning students to represent India at the Intel International Science and Engineering Fair (Intel ISEF), the world’s largest international pre-college science competition, held annually in the United States of America.

Science Express: Science Express, a mobile science exhibition is an innovative mega outreach programme of DST, with partnership of the Ministry of Environment, Forest & Climate Change, Indian Railways, Department of Biotechnology, Wildlife Institute of India and Vikram Sarabhai Community Science Centre (VSCSC) mounted on a 16-coach air-conditioned train. This unique mobile exhibition has completed nine phases which include four phases of...
National Teachers Science Congress (NTSC): DST provides a forum to teachers of the country through the National Teachers Science Congress (NTSC) to develop innovative teaching-learning methodologies in the fields of science and mathematics education. Till date, seven NTSCs have been organised with the participation of thousands of teachers as a biannual activity. The Department of Education in collaboration with NCERT also provides pre-service and in-service training of teachers in the field of science and mathematics.

Vocational Education

The Indian government also recognises the consequences of lack of vocational courses and pathways to enter into highly competitive STEM streams and is keen to implement such programmes to realise the objectives of the ‘Skill India’ programme. Now, around 21 ministries of the central government are involved in implementing skill development schemes for their respective target groups with the objective to train 40 crore people by 2022. The first milestone was attempted by these ministries and National Skill Development Corporation together through imparting training of 86 lakh youth during the financial year 2014-15 (http://www.skilldevelopment.gov.in/National-Policy-2015.html).

STEM Education and Challenges

The Indian education system is facing more challenges as compared to other developed nations due to its cultural diversity and huge population. Despite the Right to Free and Compulsory Education (RTE) Act in 2009, poor infrastructure, lack of quality teachers, overhaul of the science curriculum, and failure to identify early talent and provide them with specialised education are some key points that need to be taken care of to improve STEM education in India. There are large numbers of dropouts from the science stream at the high school level. The parallel business of tuition/coaching classes is a clear index of the lack of credibility of the school system.

India has been known to put gurus on a high pedestal. But today it needs a trained army of teachers to lead the next generation of students. There are disproportionate number of young people from the arts and social science background rather than mathematics and science coming forward to be trained as teachers. Most of the primary school teachers are not confident about their own knowledge of mathematics and science.

The quality and infrastructure of most of the educational institutions providing educational degrees to teachers are still far from satisfactory. The initial one-year bachelor’s degree with the option to get it through correspondence in education (B.Ed.) does not equip the future teachers with adequate subject knowledge and teaching skills. This has resulted in the employment of teachers with low academic and inadequate pre-service training in government schools during the last 3-4 decades.

Rigid and lesser options for numeracy are other reasons

Atal Tinkering Laboratories (ATLs): With a vision to ‘Cultivate one Million children in India as Neoteric Innovators’, the Atal Innovation Mission is in the process of establishing ATLs in schools of minimum grade 6-10 to foster curiosity, creativity and imagination in young minds and inculcate skills. ATL is designed to provide a work space where young minds can give shape to their innovative ideas through hands-on do-it-yourself modes with tools and equipment to understand the concepts of STEM. Till date, 941 ATLs have been sanctioned under this mission in different public and private schools (http://nit.gov.in/content/ataltinkering-laboratories-%E2%80%93-innovation-challenge).

Science Exhibition: The National Council of Educational Research and Training (NCERT) organises the Jawaharlal Nehru National Science, Mathematics and Environment Exhibition with a view to encourage, popularise and inculcate scientific temper among the children at the state and national level every year since 1971. The exhibition provides an opportunity to students and teachers to showcase their talents, network and listen to eminent scientists and scholars.
for the higher failure and dropout rates in high schools which can be attributed to poor performance in mathematics and science subjects. According to the recently released Annual Survey of Education Report (ASER) 2017, 57 percent in the age group of 14–18 are unable to solve a 3-digit by 1-digit division sum (https://timesofindia.indiatimes.com/business/india-business/toi-budget-2018-analysis-india-needs-more-spends-on-education/articleshow/62721674.cms).

The Indian education system does not permit the student to choose the level (higher to lower level) at which they wish to write the examination at the school level. However, the western system understands the value of numeracy and offers different levels of mathematics as per choice and calibre of the student. Recently, the committee on National Education Policy 2016 recommended two levels: Part A at higher level and Part B at a lower level in mathematics and science to provide the freedom to exercise choice. Of course, this limits the eligibility of the students to pursue future courses incorporating higher mathematics and science.

Another reason for leaving the science field is that there is no rigorous attempt to make formal linkages of vocational fields with academic accomplishments and provide avenues for horizontal and vertical mobility of students in India. Formulation of new comprehensive national policy for skill development and entrepreneurship in 2015 to envision integration of 25% of the schools with the skill development programmes by 2022 in the country showed the broad vision of the Indian government.

However, deficient collaborative network of school system, industry and tertiary education have become obstacles in fostering dignity and social acceptability to vocational training at the family level due to the high aspirations of Indian parents.

Ray of Hope
Indian universities are nowhere in world ranking as compared to the western world universities. The recent announcement of the Indian Prime Minister to provide a Rs. 10,000-crore package to transform 20 Indian varsities into world-class institutions gives a ray of hope to the future generation (https://www.deccanchronicle.com/nation/current-affairs/190717/science-technology-innovation-keys-to-indias-progress-modi.html). The PM asserted that science, technology and innovation are the keys to progress and prosperity of India and asked the officials to draw up clear goals to identify the brightest and best science talent among school students by 2022, the 75th year of independence.

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