SCIENCE EDUCATION FOR DIVERSITY: WP2

India Report

List of Abbreviations

AISES	All India School Education Survey
CABE	Central Advisory Board of Education
CBSE	Central Board of Secondary Education
CISCE	Council for the Indian School Certificate Examinations
DIET	District Institute of Education and Training
DISE	District Information System of Education
GER	Gross Enrolment Rate
GPI	Gender Parity Index
IEDC	Integrated Education for the Disabled Children
IEDSS	Inclusive Education of the Disabled at the Secondary Stage
IIM	Indian Institute of Management
IISc	Indian Institute of Science
IISER	Indian Institute of Science Education and Research
IIT	Indian Institute of Technology
ITI	Industrial Training Institute
KGBV	Kasturba Gandhi Balika Vidyalaya
MHRD	Ministry of Human Resource Development
NCERT	National Centre of Educational Research and Training
NCF	National Curriculum Framework
NCTE	National Council for Teacher Education
NFG	National Focus Group
NIEPA	National Institute of Educational Planning and Administration
NIIT	National Institute of Information Technology
NIOS	National Institute of Open Schooling
NISER	National Institute of Science Education and Research
NIT	National Institute of Technology
NOS	National Open School
NPE	National Policy on Education
NPEGEL	National Programme for Education of Girls at Elementary Level
NUEPA	National University of Educational Planning and Administration
OBC	Other Backward Class
RMSA	Rashtriya Madhyamik Shikshan Abhiyan
SC	Scheduled Caste
SCERT	State Council of Educational Research and Training
SOS	State Open School
SSA	Sarva Shiksha Abhiyan
ST	Scheduled Tribe
UEE	Universal Elementary Education
UT	Union Territories

Introduction

The basic goals and aspirations of the people of India as enshrined in the Indian Constitution have guided the development of education in the country during the last 64 years. A number of important provisions[1] which have a direct or indirect bearing on education have been included in the Constitution of India. They address diversity, a defining feature of the second most populous country in the world (1.15 billion) and home to 17% of the world's population. The geopolitical division of the country into 28 States and 7 Union Territories (UTs) embody the country's diversity primarily in the form of class (social and economic), regional, linguistic, religious, and habitat differences—further compounded by their overlap. The Indian education system is defined in distinct ways by these dimensions of diversity, including gender.

CLASS Stratification of the Indian population occurs along social and economic lines, characterised by caste and income respectively. The origin of the word *caste* is from the Portuguese word *casta*, meaning breed, race, or kind. Castes are ranked, named, endogamous groups, membership in which is achieved by birth. There are thousands of castes and subcastes in India. Each caste is part of a locally based system of interdependence with other groups, involving occupational specialisation. There is some correlation between ritual rank on the caste hierarchy and economic prosperity. Many lower-caste people live in conditions of great poverty and social disadvantage.

Numerous groups called tribes are also integrated into the caste system. Tribes that live separately from others--particularly in the far northeast and in the forested areas of the country—are more like ethnic groups than castes. Some tribes are themselves divided into groups similar to subcastes (Heitzman & Worden, 1995). Caste and class affiliations overlap, especially in rural areas.

Backward Classes is a collective term, used by the Government of India, for castes which are economically and socially disadvantaged. They typically include the Dalits,

[1] Article 350-A states that, " it shall be the endeavour of every State and of every local authority within the State to provide adequate facilities for instruction in the mother tongue at the primary stage of education to children belonging to linguistic minority groups"; Article 46 states, "The State shall promote with special care the educational and economic interests of the weaker sections of the people, and in particular, of the Scheduled Castes and the Scheduled Tribes, and shall protect them from social injustice and all forms of exploitation";

the Scheduled Castes (SCs), and the Other Backward Classes (OBCs). In addition there are the Scheduled Tribes (STs). In 1950, by a Constitutional Order, a complete listing of castes and tribes based on the prevailing definition of Scheduled Castes and Scheduled Tribes (terms brought into use by the Government of India Act 1935 passed by the British) was made. They together comprise over 24% of India's population, with SCs at over 16% and STs over 8% as per the 2001 Census. There are over 700 notified STs spread over the country. Tribal communities live in about 15% of the country's areas in various ecological and geo-climatic conditions ranging from plains to forests, hills and inaccessible areas (National Commission for Scheduled Tribes, Government of India; Ministry of Tribal Affairs, Government of India).

As measured by the new international Multi-dimensional Poverty Index (MPI), a composite indicator made up of ten markers of education, health and standard of living achievement levels, about 645 million people or 55% of India's population is poor. Multi-dimensional poverty is highest (81.4% poor) among Scheduled Tribes, followed by Scheduled Castes (65.8%), Other Backward Class (58.3%) and finally the general population (33.3%) (Shrinivasan, 2010).

LANGUAGES The Indian Constitution lists 22 official or Scheduled Languages and another 100 are the non-scheduled languages. Of the total 122 scheduled and non-scheduled languages, 66 belong to the Tibeto-Burman, 24 to the Indo-European, and 17 to the Dravidian family of languages (Census of India, 2001). As per the Constitution, the official language of the country is Hindi.

RELIGIONS India is the birthplace of four of the world's major religious traditions: Hinduism, Jainism, Buddhism, and Sikhism. In addition to these four, Islam and Christianity are the other two major religions followed by the people of India. Zoroastrianism and Judaism also have an ancient history in India and each has several thousand Indian adherents. The Constitution of India declares the nation to be a secular republic and the right to freedom of religion is a fundamental right as per the Constitution of India. Hinduism is practiced by the majority of the people, followed by Islam (see table 1).

Religion	Percent
Hinduism	80.5
Islam	13.4
Christianity	2.3
Sikhism	1.9
Buddhism	0.8
Jainism	0.4

Table 1: Practice of major religions in India by population. *Source:* Census of India, 2001

HABITATION The geographical areas inhabited by the country's population are referred to in terms of urban, rural and tribal habitations. A town, a town group, or a city is treated as an urban area. In the Census of India 2001, the definition of urban area satisfies the following three criteria simultaneously: i) a minimum population of 5,000; ii) at least 75 per cent of male working population engaged in non-agricultural pursuits; and iii) a density of population of at least 400 per sq. km. (1,000 per sq. mile). A rural habitation is a distinct cluster of houses existing in a compact and contiguous manner; with a local name; and its population should not be less than 25 in plain areas and not less than 10 in hilly/desert/sparsely populated areas. Tribal people tend to live in "mixed' (tribal and non-tribal) rural communities and in habitations that are small in size and located in relatively inaccessible hilly or forested areas of the country.

GENDER The sex ratio (females per thousand males) is 933 for India, with the ratio being higher in rural areas (946) and lower (900) in urban areas. Gender as a category needs to be seen within the larger social and regional context. Poverty, social inequalities and gender relations intersect in different ways in different regions of the country (Ramachandran, 2009).

EDUCATION AND DIVERSITY

Until 1976, all matters pertaining to school education, including curriculum, were under the jurisdiction of the State governments. The Centre could only provide guidance to the States on policy issues. In 1976 the Constitution was amended to include education in the Concurrent List, whereby power is vested in the State and the Centre for legislative subjects contained in it.

Formal education in India is a hierarchically structured system from kindergarten to university, including institutions of technical and professional education and training and is conceived as the National System of Education[2]. It requires that up to a given level, all students, irrespective of caste, creed, location or sex, have access to education of a comparable quality. While the national system of education aims at a common educational structure, constitutional provisions, educational policies and programmatic interventions have strived to address challenges posed by diversities that characterise the country and its people. After Independence, the concerns of education articulated during the freedom struggle were revisited by the National Commissions—the Secondary Education Commission (1952-53) and the Education Commission (1964-66).

National Policy on Education (NPE) 1968

It came into being following a comprehensive review of education in the country carried out by the Education Commission (1964-66) and the recommendations it made. The principles of NPE 1968 aimed to promote national progress, a sense of common citizenship and culture, and to strengthen national integration. It laid stress on the need for a radical reconstruction of the education system to improve its quality at all stages and correcting regional imbalances in the provision of educational facilities by providing good educational facilities in rural and other backward areas. In addition to this, emphasis on education of girls to achieve social justice and accelerate social transformation; intensive efforts to develop education among the backward classes and especially among the tribal people; promotion of educational interests of minorities; and development of integrated programmes to enable physically and mentally disabled children to study in regular schools were principles enunciated by the policy. In response to the diversity of linguistic situations in the country, the three-language formula[3] was adopted.

[2] Non formal education (NFE) is conceptualized as an educational activity occurring within the framework of the formal education system. Its major characteristic in the Indian context is its flexibility in terms of organisation, timing and duration of teaching and learning, clientele groups, age group of learners, content, methodology of instruction and evaluation procedure (Mitra, 2007).

[3] The First language to be studied at the primary level must be the mother tongue or the regional language. The Second language in Hindi speaking States will be some other modern Indian language or English, and in non-Hindi speaking States, the second language will be Hindi or English. The Third language in Hindi speaking States will be English or a modern Indian language not studied as the second language, and in non-Hindi speaking States, the third language will be English or a modern Indian language not studied as the second language.

It urged for much greater attention to science and technology emphasising that the education system must produce young men and women of character and ability committed to national service and development. With a view to accelerating the growth of the national economy, it recommended that "science education and research should receive high priority. Science and mathematics should be an integral part of general education till the end of schooling."

National Policy on Education 1986

NPE 1986 laid special emphasis on education for women's equality. The removal of female illiteracy and obstacles inhibiting girls' access to, and retention in, elementary education received priority. Greater emphasis was laid on "women's participation in vocational, technical and professional education at different levels. The policy of non-discrimination will be pursued vigorously to eliminate sex stereotyping in vocational and professional courses and to promote women's participation in non-traditional occupations, as well as in existing and emergent technologies."

For the educational development of the Scheduled Castes, the focus was on their equalisation with the non-SC population at all stages and levels of education and recruitment of scheduled caste teachers. For the education of the Scheduled Tribes, priority was accorded to opening primary schools in tribal areas, establishing residential schools (*ashram shalas*) on a large scale, designing curricula at all stages of education to create an awareness of their rich cultural identity, and devising instructional materials in tribal languages at the initial stages, with arrangements for switching over to the regional language. Greater attention was paid to educationally deprived minority groups including the Constitutional guarantees given to them to establish and administer their own educational institutions (such as madrassas and maktabs for the Muslims[4]), and protection to their languages and culture. The scheme of establishing pace-setting residential and coeducational schools, *Jawahar Navodaya Vidyalayas* (JNV), for providing opportunities to talented children in classes VI-XII predominantly from rural areas was started with two schools on an ex-

[4] Maktabs provide instruction in religious as well as some secular subjects up to primary level and are often attached to a masjid (mosque); madrassas impart education generally up to the senior secondary level.

perimental basis in 1985-86. At present there are over 500 JNVs across the country except in the southern state of Tamil Nadu. Students are selected on the basis of a merit test administered annually at the block and district levels. Seventy-five percent of the seats are reserved for rural students; for children from SC and ST communities, seats are reserved in proportion to their population in the district. One third of the seats are for girls and three percent are reserved for disabled children (Navodaya Vidyalaya Samiti, MHRD).

Science education was seen as necessary "to develop in the child well defined abilities and values such as the spirit of inquiry, creativity, objectivity, the courage to question, and an aesthetic sensibility." Science education programmes to enable the learner to acquire problem solving and decision making skills and to discover the relationship of science with health, agriculture, industry and other aspects of daily life were to be designed. Every effort was to be made "to extend science education to the vast numbers who have remained outside the pale of formal education."

In 1992, the Central Advisory Board of Education (CABE), the members of which include Ministers of Education of different states and union territories and leading educationists of the country, made some modifications to NPE 1986. Access to secondary education was widened with emphasis on enrolment of girls, SCs and STs, particularly in science, commerce and vocational streams. Efforts were made towards computer literacy in as many secondary level institutions as possible so that children are equipped with skills to be effective in a growing technological world. National Policy on Education 1986 and (as modified in) 1992 proposed a national framework for curriculum as a means of evolving a national system of education capable of responding to India's diversity of geographical and cultural milieus while ensuring a common core of values along with academic components.

Section 1

GENERAL EDUCATION SYSTEM

STRUCTURE OF THE EDUCATION SYSTEM

The education system in the States and UTs of India generally follow the 8+2+2+3 pattern, which provides for eight years of elementary education, two years each of secondary and senior/higher secondary schooling, and three years of higher/university education (see figure 1). There is high degree of uniformity in the pattern of educational structure within a particular State or UT and also a broad consensus has emerged for adoption by all States (MHRD, 2000).

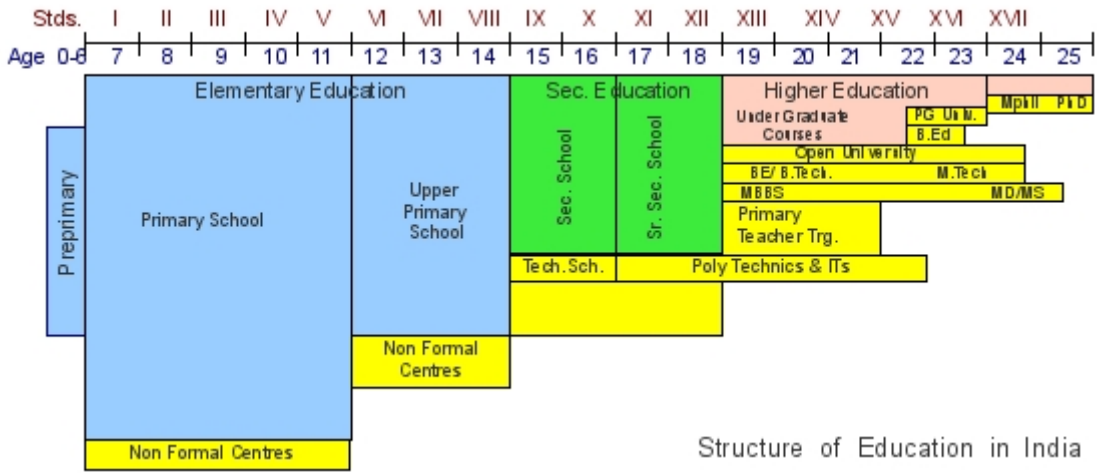

Fig.1: Stages of school education in India
Source: Development of Education: 1986-1988. National Report of India

A. SCHOOL EDUCATION

In pursuance of the National Policy on Education of 1968 and of 1986, school education consists of 12 years, commonly following the 10+**2** pattern. The 'plus two' stage refers to classes XI and XII which constitute the higher secondary stage across all 35 States/UTs. (In some states, higher secondary stage is part of collegiate education known as Junior Colleges. Of the ten years, classes I-VIII correspond to elementary education, further demarcated into primary and upper primary schooling. The primary and upper primary pattern is more commonly 5+3 years (in 21 States/UTs), or may be 5+2 (in 3 States/UTs), 4+4 (in 3 States), 4+3 years (in 9 States/UTs). Secondary education consists of two years (see table 2 for the pattern of school education).

STAGE	Age	Class/Standard
1. Elementary Education (8 yrs) • Primary School • Upper Primary	6-14 years • 6-10 yrs • 11-14 yrs	Stds. I-VIII • I-IV/V • V/VI-VIII
2. Secondary Education (2 yrs)	15-16 yrs	IX-X
3. Higher/Senior Secondary Education (2 yrs)	17-18 yrs	XI-XII/Junior College

Table 2: Pattern of school education in India.

A child is normally admitted to Class I at the age of six and is expected to complete Class VIII by 14 years of age. At this point, a child can either join the secondary school providing general education programmes or alternatively can join a vocational school or an Industrial Training Institute (ITI) which equips him/her with specialised vocational skills. A person who completes 10 years of general education has a similar choice to take up either academic courses at the higher secondary level in preparation for college education or opt for vocational courses within the higher secondary programme or through specialised institutions such as polytechnics and ITIs.

The constitutional obligation of providing free and compulsory education to all children up to the age of 14 is now legislated by The Right of Children to Free and Compulsory Education Act 2009 which came into force in April 2010. Every child in the age group of 6-14 years has the right to free and compulsory admission, attendance and completion of 8 years of elementary education in an age appropriate classroom in the vicinity of his/her neighbourhood. The Act favours a policy of “no failure” and has made it mandatory for schools to promote all students up to Class VIII.

a) Elementary Education

Elementary education aims to develop literacy and numeracy, acquaintance with the social and physical environment, creative expression, and healthy living. Sarva Shik-sha Abhiyan (SSA) is Government of India's flagship programme for achievement of Universalisation of Elementary Education (UEE) in a time bound manner. Under

SSA, special focus is on girls, children belonging to SC/ST communities, other weaker sections, minorities and urban deprived children.

SSA is being implemented in partnership with State Governments to cover the entire country and address the needs of 192 million children in 1.1 million habitations. Today, 180 million children are taught by almost 5.7 million teachers in more than 1.2 million primary and upper primary schools across the length and breadth of the country.

b) Secondary and Higher Secondary Education

Secondary education aims to develop the intellectual, social, and moral qualities essential for democratic citizenship, and to prepare young people for entry into the world of work or for continuation of academic pursuits (Secondary Education Commission Report, 1952; Report of Education Commission, 1964-66).

For secondary education, a new mission along the lines of SSA was suggested in 2005. Accordingly, a centrally sponsored scheme, Rashtriya Madhyamik Shiksha Abhiyan (RMSA) has been launched to universalise access to and improve quality of education at the secondary level. It aims at universal access to secondary level education by 2017 and universal retention by 2020 (MHRD, 2009). There are about 44 thousand existing secondary schools and the target for 2011-2012 is opening 11 thousand new secondary schools.

The centrally sponsored scheme of vocationalisation of secondary education at the +2 level is being implemented since 1988. It provides for diversification of educational opportunities so as to enhance individual employability, reduce the mismatch between demand and supply of a skilled workforce and provides an alternative for those pursuing higher education. Vocational education falls under the purview of MHRD and the All India Council for Vocational Education under it is responsible for planning, guiding and coordinating the programme at the national level. At the state level, similar functions are performed by the State Councils for Vocational Education. Courses fall under the following six disciplines:

i) Agriculture (e.g.veterinary pharmacist/technician; watershed management)
ii) Business and Commerce (e.g. taxation practices, stenography)

iii) Humanities (e.g. classical dance, entrepreneurship)
iv) Engineering and Technology (e.g. lineman, cost effective building technology)
v) Home Science (e.g. textile design, gerontology)
vi) Health and Para-medical skills (e.g. x-ray technician, health/sanitary inspector).

(Draft paper of The World Bank, 2006)

Contrary to the NPE 1986 goal of achieving 25 percent of the +2 enrolment in the vocational stream by 2000, currently less than 5 percent choose this option (National Curriculum Framework, 2005).

B. HIGHER EDUCATION

In its size and diversity, India has the third largest higher education system in the world, next only to China and the United States. Higher education in India covers all post-secondary education beyond class twelve in different subject areas including all professional streams such as engineering and technology, medical, agriculture etc. It comprises three levels of qualifications -Bachelor's or undergraduate degree programmes, Master's or post graduate degree programmes and the pre-doctoral and doctoral programmes.

Although playing a critical role in knowledge generation and promoting India's integration with the global knowledge economy and society, the enrolment rates at higher education at 11 percent are relatively small (The World Bank Report, 2009). . At present, there are 504 Universities and university-level institutions (as on 31.12.2009) - 243 State Universities, 53 State Private Universities, 40 Central Universities, and 130 Deemed Universities, In addition, there are 25,951 colleges including around 2,565 women colleges (MHRD, 2009).

Though there is no clear demarcation, the colleges mainly focus on undergraduate education while the universities impart post graduate education and conduct research. In addition, there are many institutions like the Indian Institutes of Management (IIMs) that only award diplomas. These diplomas are however equated to degrees granted by the universities. Most universities and colleges offer multidisciplinary programmes, however, there are also some that are confined to a particular

discipline only – such as agriculture, law, technology, language, medical etc. There are also open universities that offer distance education programmes only (Agarwal, 2006).

The Indian parliament has adopted major policy statements relating to higher education and science and technology (S&T) development. These developments have been largely guided by the Scientific Policy Resolution of 1958. The Technology Policy Statement was adopted by the Government in 1983, its basic objective being the development of indigenous technology and efficient absorption and adaptation of imported technology appropriate to national priorities and resources.

a) Technical Education

Technical Education has a vital role to play in human resource development of the country by creating skilled manpower, enhancing industrial productivity and improving the quality of life. There are 65 centrally funded institutions for technology and science education.

The fifteen Indian Institutes of Technology (IITs) are apex institutions for engineering education and research. The main objective of IITs is to impart world – class education in engineering and technology; to conduct research in the relevant fields, and to further advancement of learning and dissemination of knowledge. These Institutes also contribute significantly to education and research in basic sciences and humanities. The IITs offer undergraduate programmes in various branches of engineering and technology; postgraduate programmes with specialization and Ph.D. programmes in various engineering and science disciplines, interdisciplinary areas; and conduct basic, applied and sponsored research. There are four Indian Institutes of Information Technology (IIITs) to develop manpower for different areas of the knowledge economy. The seventeen National Institutes of Technology (NITs) play a vital role in creating the required technical manpower by providing undergraduate education and training in different branches of engineering & technology. They also function as pace setters and provide academic leadership to the technical institutions in their respective regions.

The oldest institute for science education, Indian Institute of Science (IISc), came into existence in 1909 in Bangalore and has been engaged in higher learning and advanced research in the fields of science and engineering. Since 2006, five new institutions devoted to science education and research, Indian Institutes of Science Education and Research (IISER) broadly on the lines of IISc have been established. These institutions are devoted to under-graduate and post-graduate teaching in sciences in an intellectually vibrant atmosphere of research and make education and career in basic sciences more attractive by providing opportunities in integrative teaching and learning of sciences (Department of Higher Education, MHRD).

There are also autonomous institutions of higher education in the field of science and technology.

SCHOOLING (AND RELATED INDICATORS)

Within the pattern of school education outlined in table 2, there is great variation in terms of the types of schools that exist in India. While no single scheme of classification can portray the complete variety, table 3 below is one of several ways of understanding types of schools: how they are managed, the geographical areas in which they operate, and the kinds of students they cater to. For elementary education enrollment by type of school, see table 4.

Type of management	***Geographical scope***	***Students catered to***
Government • Central	i) Urban (*Kendriya Vidyalayas*), ii) Rural (*Navodaya Vidyalayas*, residential)	i) Children of transferable central government employees (including defence and para-military personnel) ii) Talented rural children
• State	i) Urban and rural ii) Tribal areas (*Ashram Shalas,* residential)	
Municipal	Cities	Underprivileged children of different linguistic communities
Private • Aided (by Govt.)	• Urban and rural	• Privileged and underprivileged children
• Unaided	• Primarily urban	• Primarily children of the elite

Table 3: Types of schools in India by management, geographical scope and student population.

Percentage enrolment in schools (2008-09) CLASSES I –VIII			
All Government Managements	Private Aided Managements	Private Unaided Managements	Private Managements
70.96	**9.41**	**19.60**	**29.01**

Table 4: Student enrolment in elementary schools by management.
Source: DISE Flash Statistics 2008-2009.[5]

There are also schools run by the Central Tibetan Schools Administration[6] and public sector companies such as the Atomic Energy Commission for the children of their staff. In metropolises like Delhi and Mumbai there are schools run by international embassies. A number of children are also enrolled through correspondence courses to the National or State Open Schools (NOS or SOS)[7].

Since the advent of Muslim rule, Islamic religious institutions known as maktabs and madrassas were established in different parts of the country. There are a total of 1,823 maktabs at the primary level following the system of general education, 190 at the upper primary level, 54 at the secondary level and 18 at the higher secondary level. The corresponding figures are higher for madrassas: 4,589 at the primary level, 2,102 at the upper primary level, 651 at the secondary level, and 204 at the higher secondary level. At all levels, majority of maktabs and madrassas are in the rural areas. However, there are also maktabs (6,019) and madrassas (11,523) that do not follow the system of general education.

According to the Sachar Committee Report (2006), 1.1 million boys and just under 1 million girls attended madrassas in 2002 (p. 293), with over 70 percent of these being at the primary level. The general misconception "that a large majority of children from Muslim families are enrolled in madrassas is in part because of the tendency of

[5] The Flash Statistics: 2008-09 is based on the data received from as many as 1.29 million schools spread over 633 districts across 35 States & UTs.
[6] Central Tibetan Schools administration is an autonomous organization under MHRD, Government of India established in 1961 with the objective to establish, manage and assist schools in India for the education of Tibetan children living in India while preserving and promoting their culture and heritage.
[7] The National Institute of Open Schooling (NIOS) with current enrolment of about 1.3 million students at Secondary and Senior Secondary stage is the largest open schooling organisation in the world. To meet the regional diversity, State Open Schools (SOSs) have come up in 11 states, with 8 more states in the process of setting them up.

the general population to consider madrassas and maktabs to be one and the same. A large proportion of the children who go to maktabs to learn to read and recite the Qu'ran are also enrolled full time in regular mainstream schools" (Nair, 2009). According to the Sachar report, "Aided madrassas are often the last recourse of Muslims especially those who lack the economic resources to bear the costs of schooling, or households located in areas where 'mainstream' educational institutions are inaccessible" (2006, p.78).

CO-EDUCATION

Although no clear statistics are available, co-education schools are more in number than single-sex schools across the country.

ACCESS

Over 98% of the children are estimated to have access to primary schooling within one kilometer of their habitation, and almost 92% to an upper primary school within three kilometers of their habitation.

One of the largest groups that are still outside the general education system are children with disabilities. The Integrated Education for the Disabled Children (IEDC), a centrally sponsored scheme, is currently implemented in States and UTs in over 90,000 schools benefitting over 200 thousand children with disabilities. SSA supports inclusion of children with special needs at the early childhood education and elementary education level and therefore another centrally sponsored scheme recently envisaged for disabled children at the secondary stage is the Inclusive Education of the Disabled at Secondary Stage (IEDSS). It aims to: i) enable all students with disabilities completing eight years of elementary schooling an opportunity to complete four years of secondary schooling (classes IX to XII) in an inclusive and enabling environment, ii) to provide educational opportunities and facilities to students with disabilities in the general education system at the secondary level (classes IX to XII), and iii) to support the training of general school teachers to meet the needs of children with disabilities at the secondary level (Department of Secondary Education, MHRD).

ENROLMENT

Gross enrolment ratios have increased significantly across all social categories, drop out rates at primary level have declined, and transition from primary to upper primary stage has improved. The Gross Enrolment Ratio (GER)[8] at primary level, based on the District Information System of Education (DISE) data for 2008-09 is estimated to be 115.31 percent, corresponding to 98.59 percent of the Net Enrolment Ratio (NER)[9]. In upper primary classes too, GER has shown consistent increase; from a low of 37.72 million in 2004-05 to 53.35 million in 2008-09 (GER 73.74 percent).

At the primary level, the share of SC and ST enrolment with respect to total enrolment is 19.94 percent and 11.68 percent respectively. At the elementary level, the share of OBC is 42.26 percent; the share of Muslim enrolment is 10.49 percent, (NUEPA, 2010).

The GER at the secondary and higher secondary level during 2007-08 was 45.5 percent. In absolute terms, the secondary and higher secondary enrolment were 28.22 and 15.94 million respectively. The dropout rate is 56.8 percent by the time students reach the level of qualifying examination at the end of Class X (MHRD, 2010).

GENDER ISSUES

Gender Parity Index (GPI)[10] and percentage of girls' enrolment in primary and upper primary classes reveal that there is improvement both in GPI and girls' share in enrolment. The average of 633 districts in 2008-09 indicates a GPI of 0.94 in primary classes and 0.91 in case of upper primary classes. At the elementary level of education, enrolment of SC, ST, OBC and Muslim girls is similar, standing at 48.09%, 48.01%, 48.22%, and 49.2% respectively.

The National Programme for Education of Girls for Elementary Level (NPEGEL), a distinct component of SSA was launched in September 2003. It provides additional

[8] Total enrolment in a specific level of education, regardless of age, expressed as a percentage of the eligible official school-age population corresponding to the same level of education in a given school year.

[9] Total enrolment of the official age for a given educational level expressed as a percentage of the corresponding population.

[10] An index designed to measure the relative access to education of males and females, calculated as the quotient of the number of females by the number of males enrolled in a given stage of education (primary, secondary, etc.).

provisions for enhancing the education of underprivileged/disadvantaged girls at the elementary level through the development of model schools in clusters, gender sensitisation of teachers, development of gender sensitive learning materials, and provision of need-based incentives like escorts, stationery, work books and uniforms etc.

Kasturba Gandhi Balika Vidyalaya (KGBV), a scheme for setting up residential schools at upper primary level for girls belonging predominantly to the SC, ST, OBC and Minority Communities was launched in 2004. The scheme is being implemented in educationally backward blocks of the country where the female rural literacy is below the national average and gender gap in literacy is above the national average.

A “National Scheme of Incentive to Girls for Secondary Education” was launched in June 2008, to provide a onetime incentive mainly to eligible girls belonging to SC/ST communities to continue secondary education.

Toilet facilities for girls are available in only 53.6% of all schools; even less so in primary schools (44.37%).

MEDIUM OF INSTRUCTION

Some multilingual states have introduced as a state policy bilingual education in which a developing language in a region is used as a *partial* medium, together with English, Hindi, or the neighbouring regional language as the major medium. Tribal populations in some states have been introduced to bilingual schooling; various minority communities, particularly in urban areas, also prefer bilingual media. The policy of bilingual media is, for the most, not encouraged in 'prestigious' institutions; yet in actual practice code-switching and hybridization of two or more contact languages in informal teaching settings is common. There are also multilingual institutions with multilingual teachers catering to the needs of diverse populations in every state. Many minority institutions in every state impart education through minority languages, and/or pan-Indian languages like English and Hindi.

Though many states have a policy of promoting the use of mother tongue as medium of instruction, many students experience shift in language medium at one or another stage of their educational career, depending upon the context, domain, and channel
- *Passive and active media:* Students listen to lectures in one language and write answers in another.
- *Formal and informal media:* Formal teaching in the classroom is conducted in one language, but informal explanations are provided in another language.
- *Multi-tier media:* Elementary education is initiated through mother tongue as the *preparatory* medium, but when a student moves upward in the education ladder, he has to shift to a more cultivated medium (Khubchandani, 2008, p. 378-379.).

The mother tongue is the medium of instruction in 92.07% schools at the primary stage and 91.95% schools teach two or more languages. At upper primary stage, 90.61% schools follow the three-language formula. At secondary stage 84.86% schools follow the three-language formula. Teaching of English is compulsory in all the States/UTs, except Bihar. However, the classes in which teaching of English is compulsory differs from State to State. In general, it is compulsory in Classes VI-X in most of the States/UTs. The demand for English is rapidly increasing across the country. At the primary stage, 87.49% schools teach English and 59.70% schools teach Hindi. However, English as medium of instruction is used in only 12.98% schools at the primary stage, 18.25% schools at the upper primary stage, 25.84% schools at the secondary stage and 33.59% schools at the higher secondary stage.

LIBRARY FACILITIES

Less than a million schools (70 thousand as per the 7th AISES[11]) have a library. Of these, about 9 thousand have a full or part-time trained librarian and almost half the number of schools has less than 500 books in the library.

COMPUTER FACILITIES

Only 14.12% of all schools have computer facilities. Less than 30 percent of secondary schools have computer education, and about 18 percent have adequate number of computers. 35.56% of all schools have electricity connection.

[11] All India School Education Survey

SCIENCE LABORATORIES

Approximately 58 percent of secondary schools in the country have a science laboratory, but only about 38 percent have an adequate science laboratory.

AGENCIES RESPONSIBLE FOR EDUCATION, CURRICULUM DEVELOPMENT AND TEACHER TRAINING

The Departments of School (Elementary and Secondary) Education and Higher Education are under the charge of the (MHRD) of the Central Government. The purpose of keeping the Departments of Education as part of the MHRD is to ensure that education does not operate in isolation but functions as an integral component of the total system which has the development of human resources as the overall objective.

The organisation and structure of education are largely the concern of the States/UTs. In some of the States, local self-government bodies, namely, *Panchayat Samitis* in rural areas and Municipal Corporations in urban areas are also associated with school education in order to make the system of administration sensitive to local conditions and also to facilitate community participation. State governments continue to hold the major responsibility of administering and financing of higher education, but are, by and large, required to operate through universities and other autonomous institutions which essentially function according to the guidelines laid down by the University Grants Commission[12]. In other words, while school education is mainly a local-State partnership, higher education operates as an area of Centre-State partnership (NIEPA, 1988).

Actions related to education at the national level including planning and policy-making are guided and coordinated by CABE. There are also national level institutions specialising in particular aspects of education which assist and advise the Central Government in the formulation and implementation of policies and programmes in the respective areas. The National University of Educational Planning and Administration (NUEPA) assists the MHRD in its efforts to strengthen and improve educational planning and administration in the country. The National Centre of Educational

[12] A statutory body of the Government of India which coordinates, determines and maintains standards of university education in India.

Research and Training (NCERT) assists and advises the MHRD and State governments in formulation and implementation of policies and programmes and innovations in the field of school education and teacher education.

CURRICULUM DEVELOPMENT

There are various curriculum bodies governing school education. The States have autonomous examination boards to determine the curricula and examination pattern at both secondary and higher secondary levels. The State Council of Educational Research and Training (SCERT) are usually responsible for developing the syllabi and textbooks at the elementary level. In addition, there is:

ι) Central Board of Secondary Education (CBSE) which affiliates institutions at secondary and higher secondary education levels from all over the country for the purpose of examinations. The Board also prescribes courses and syllabi, organises orientation programmes and undertakes development and publication of textbooks, when found necessary.

ιι) Council for the Indian School Certificate Examinations (CISCE), a non-governmental board of school education.

ιιι) National Institute of Open Schooling Board (NIOS)

ιϖ) Islamic schools, whose boards are controlled by local state governments, or autonomous, or affiliated with Darul Uloom Deoband.

ϖ) International schools affiliated to the International Baccalaureate Programme and/or the Cambridge International Examinations.

ϖι) Autonomous schools like Woodstock School and Auroville.

As an apex national agency of education reform, NCERT is assigned the role of preparing and reviewing the school curriculum. Following the National Policy on Education 1968, it has prepared roughly after every decade, a National Curriculum Framework (NCF) for school education. However, NCERT is not a syllabus prescribing authority.

HISTORICO-POLITICAL DEVELOPMENT OF NCF

In 1975, NCERT brought out the *Curriculum for the Ten Year School: A Framework* which for the "sake of uniformity of standards and of national identity" strived to "develop a common curriculum within a broad framework of acceptable principles and

values." Curriculum was defined as "the sum total of all the deliberately planned set of educational experiences provided to the child by the school. As such it is concerned with:

i) the general objectives of education at a particular stage or class
ii) subject-wise instructional objectives and content
iii) courses of studies and time allocation
iv) teaching-learning experiences
v) instructional aids and materials
vi) evaluation of learning outcomes and feedback to pupils, teachers and parents."

However, its implementation remained uneven on account of two primary reasons: i) a comprehensive plan to link the curriculum changes with the processes of teaching and learning, teacher training and examination reform was lacking, and ii) there were widespread disparities in the physical and human resources necessary for effective transaction of the curriculum in schools. The mismatch between the curriculum objectives and the actual curriculum transaction in the classroom led to disparities in the levels of attainment of pupils and in the standard of education among schools in different parts of the country.

Following the document brought out in 1975, the Council's work culminated in the *National Curriculum for Elementary and Secondary Education: A Framework, 1988* (NCF 1988). A national system of education evolved, its most salient features being: provision of equal educational opportunity to all, not only in terms of access to educational facilities, but also in the conditions for success; a common 10+2+3 structure of education; and introduction of norms of minimum levels of learning for each stage of education. Some of the main thrusts of the curricular framework were broad-based general education to all learners at the elementary (primary and upper primary) secondary stages; a common scheme of studies for elementary and secondary stages; emphasis on defining Minimum Learning Outcomes for each area of learning at all stages of education; provision for flexibility in terms of selection of content/components and learning experiences which would facilitate the attainment of minimum learning outcomes laid down for each stage of school education; emphasis on child-centred and activity-based processes rather than the teacher-centred approach during the transaction of curriculum; and provision of essential

facilities for effective transaction of curriculum in all schools/non-formal learning centres.

In January 2000, a Discussion Document on *National Curriculum Framework for School Education* was released by NCERT. The new curriculum framework sparked off a fierce debate and was discussed among intellectuals, educationists, teachers, professional organisations including parent-teacher associations, and other voluntary organisations. Introduction of a spiritual quotient, education about religions, value based education, teaching of Sanskrit, an emphasis on the 'traditional' social order and its values, and a Hindutva brand of science were all seen as attempts at "saffronisation"[13] of education by the Bhartiya Janata Party, the dominant centre-right political party in the National Democratic Alliance-led government of that time. In August 2001, education ministers of nine non-BJP states came together at a *National Convention against Saffronisation of Education* to sign a statement calling for withdrawal of the National Curriculum Framework 2000.

Currently, *National Curriculum Framework 2005* guides school education. The aims of education, as stated within NCF2005, serve two major purposes; to reflect collective socio-political aspirations of the whole society and to serve a significant pedagogical purpose of providing direction to the teacher in choice of content and methods of education.

The nine main areas relevant for curricular planning are i) Language, ii) Mathematics, iii) Science, iv) Social Science, v) Art Education, vi) Heath and Physical Education, vii) Work and Education, viii) Education for Peace, and ix) Habitat and Learning. A total of 21 Position Papers—on each of the curricular areas with a focus on pedagogy—as well as on related issues such as Aims of Education, Educational Technology, Teacher Education, Gender Issues, and Examination Reforms amongst others, have been prepared by National Focus Groups (NFG) that were set up for this purpose. The NFG on Curriculum, Syllabus, and Textbooks recommends a curriculum framework which is neither a document nor a sequence of experiences, but rather a plan of facilitating learning for the child.

[13] A political neologism (derived from the saffron robes of the Hindu clerics), used to refer to the policy of right-wing Hindu nationalism (or *Hindutva*) which seeks to make the Indian state into a "Hindu nation" (Wikipedia)

As depicted in figure 2, the curriculum, as defined by NCF 2005 is more of a conceptual structure for decision making rather than details of what is to be done in the classroom. It serves as a tool to organise different elements of education and see connections between them.

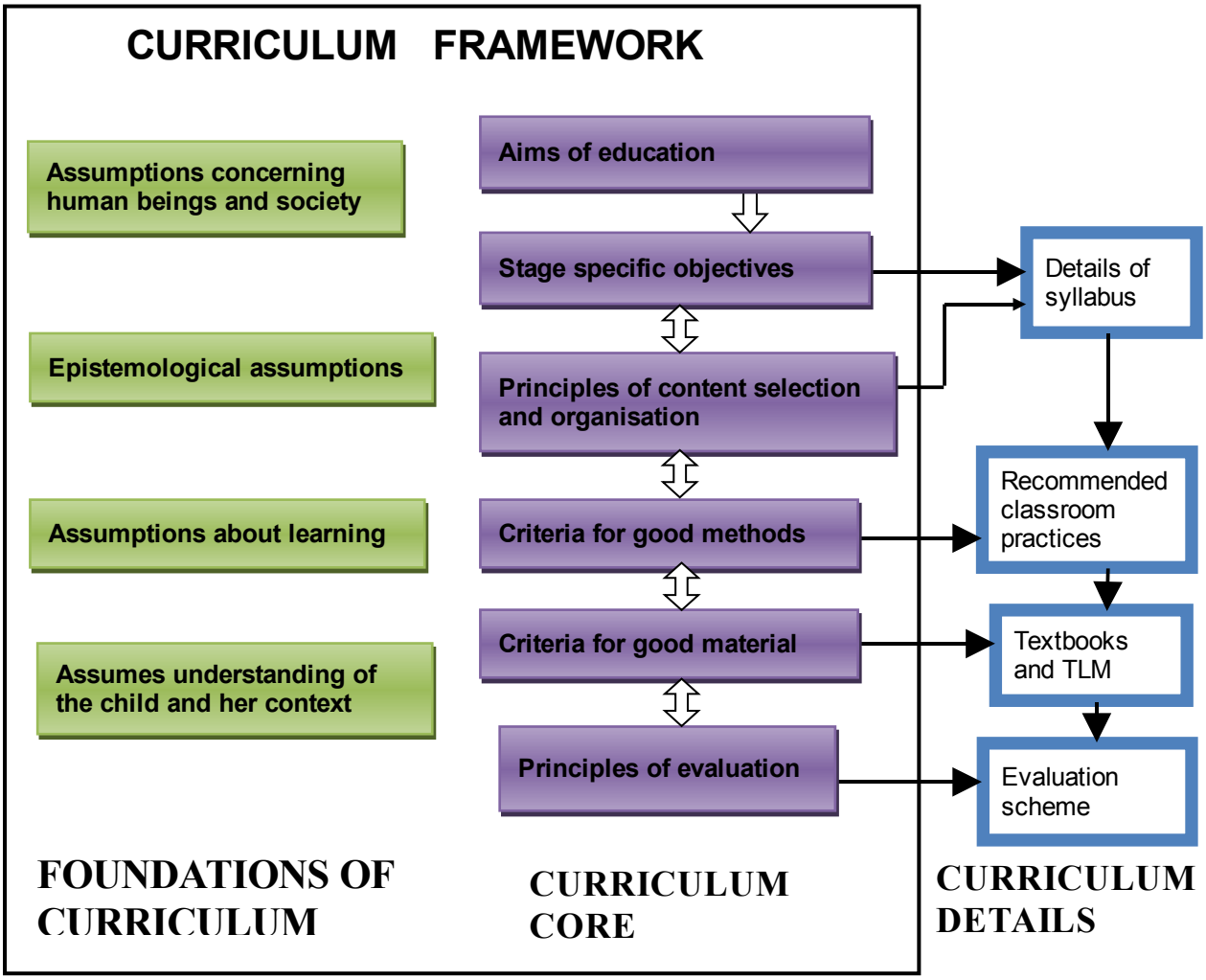

Figure 2. The Graphical Representation of Curriculum Framework.

Source: Position Paper National Focus Group on Curriculum, Syllabus and Textbooks

TEACHER RECRUITMENT AND TEACHER EDUCATION

The total number of teachers (including para-teachers) in position as on the date of reference (30 September 2002) are 5,530,269. The total number of trained teachers[14] for all levels of schooling (Primary to Higher Secondary) in urban and rural areas is 4,313,251. Of these, 60% are male teachers and 40% female teachers. Of the

[14] Trained teachers also include Deemed trained teachers.

trained teachers, 22% have studied up to secondary level of schooling or less, 55% are either graduates or have completed higher secondary level of schooling, and 23% are post graduates. The total number of untrained teachers are 1,000,569. Of these, 62% are male and 38% are female.

The National Policy on Education 1986 stated that improvement in status and professional competence of teachers is cornerstone of educational reconstruction. It emphasised the significance and need for a decentralised system for the professional preparation of teachers. The Centrally Sponsored Scheme of Restructuring and Reorganisation of Teacher Education was put in place proactively by the Central Government in the 8th plan (1992-1997) with the establishment of District Institutes of Education and Training (DIETs) for elementary teacher education, and Institutes of Advanced Studies in Education (IASEs) and Colleges of Teacher Education (CTEs) for secondary stage teacher capacity building. Since the 1990s, further decentralization has led to the formation of Block Resource Centres (BRCs) and Cluster Resource Centres (CRCs). By 2005, 500 DIETs, 87 CTEs, 38 IASEs and 30 SCERTs had been set up as teacher education resource institutions in the country.

The Centrally Sponsored Scheme of Restructuring and Reorganisation of Teacher Education of 1986 aimed at providing academic resource support to elementary and secondary teachers through training, action research and experimentation, and developing institutional infrastructure for pre- and in-service training. The implementation of the Scheme in achieving the basic objectives of Teacher Education has been uneven across States/UTs. There has been variation in quality of performance even within a state/UT. Most of the CTEs and IASEs have not been able to undertake the teacher education programme as comprehensively as the DIETs have been able to at the elementary stage (NCERT, 2009).

The National Council for Teacher Education (NCTE) came into existence as a statutory body in 1995 as a first step for overhauling the system of teacher education. It has four regional committees to look after its statutory responsibilities. The main objective of the NCTE is to achieve planned and coordinated development of the teacher education system throughout the country, the regulation and proper mainte-

nance of Norms and Standards in the teacher education system and for matters connected therewith. The mandate given to the NCTE is very broad and covers the whole gamut of teacher education programmes including research and training of persons for equipping them to teach at pre-primary, primary, secondary and senior secondary stages in schools, and non-formal education, part-time education, adult education and distance (correspondence) education courses. See table 5 for recruitment qualifications of teachers in schools.

LEVEL	MINIMUM ACADEMIC AND PROFESSIONAL QUALIFICATIONS
1. Pre-School / Nursery (For children in the age group of 4-6 years)	(i) Secondary School (Class X) Certificate or its equivalent; and (ii) Diploma/Certificate in Pre-school teacher education programme of a duration of not less than one year.
2. Pre-School / Nursery followed by first two years in a formal school. (For children in the age-group of 4-6 and 6-8 years)	(i) Senior Secondary School (Class XII) Certificate or Intermediate or its equivalent with at least 45% marks; and (ii) Diploma/Certificate in Nursery teacher education programme of a duration of not less than two years.
3. Elementary (a) Primary	(i) Senior Secondary School certificate or Intermediate or its equivalent; and (ii) Diploma in Elementary Education (D.Ed.) or certificate in basic teachers training of a duration of not less than two years. OR Bachelor of Elementary Education (B.El.Ed.)
(b) Upper Primary (Middle school section)	(i) Senior Secondary School certificate or Intermediate or its equivalent; and (ii) Diploma or certificate in elementary teachers training of a duration of not less than two years. OR Bachelor of Elementary Education (B.El.Ed.) OR Graduate with Bachelor of Education (B.Ed.) or its equivalent.
4. Secondary /High School	Bachelor's Degree in the relevant subject with Bachelor of Education (B.Ed.) or its equivalent. OR Four years integrated B.Sc. with B.Ed. or an equivalent course.
5. Senior Secondary/PUC/ Intermediate	Masters Degree in the relevant subject with Bachelor of Education (B.Ed.) or its equivalent. OR Two years integrated M.Sc.Ed. course or an equivalent course.

Table 5: Qualifications for recruitment of teachers in schools.
Note: 1) Duration of B.El.Ed is 4 years; B.Ed. is 1 year. 2) To teach science and/or math at the secondary school level a Bachelor of Science degree is essential; at the senior secondary level a Master of Science degree.
Adapted from: http://www.ncte-india.org/noti/determ.htm

The UGC, in order to ensure effective region-wise coverage throughout the country, has decentralised its operations by setting up six regional centres. Its mandate includes determining and maintaining standards of teaching, examination and research in universities. The National Educational Testing Bureau of the UGC conducts the National Eligibility Test (NET) to determine eligibility for lectureship and for award of Junior Research Fellowship (JRF) for Indian nationals in order to ensure minimum standards for the entrants in the teaching profession and research. The Test is conducted in Humanities (including languages), Social Sciences, Forensic Science, Environmental Sciences, Computer Science and Applications and Electronic Science. The Council of Scientific and Industrial Research (CSIR) conducts the UGC-CSIR NET for other Science subjects, namely, Life Sciences, Physical Sciences, Chemical Sciences, Mathematical Sciences and Earth Atmospheric Ocean & Planetary Sciences jointly with the UGC.

SCIENCE EDUCATION SYSTEM

The constitutional amendment of 1976 placed education including science and technology education in the concurrent list which implies the joint responsibility of the central and the state governments. The Ministry of Human Resource Development functions as an administrative ministry and the UGC and the All India Council for Technical Education were established to superintend the functioning of higher education in science and technology respectively.

SCHOOL LEVEL

Based on the recommendations of NPE1968, science and mathematics were made compulsory subjects, for the first time, for all pupils as part of general education during the first ten years of schooling. The next national policy on education (NPE1986) reaffirmed the need for science and mathematics to be compulsory subjects during the first ten years of schooling. The science syllabus and textbooks are prescribed by respective state curriculum agencies and therefore the content and process of teaching science varies from state to state.

The general objectives of science teaching identified for Classes I-VIII during the 1960s have guided the evolution of science education in the country, especially at the elementary level. The two major objectives have been:

1) To acquire knowledge of biological, physical and material environments including forces of nature and simple natural phenomena, and
2) To develop scientific attitudes such as objective outlook, spirit of enquiry, truthfulness and integrity, inventiveness, accuracy and precision, avoiding hasty conclusions on insufficient data, respect for the opinion of others.

SCIENCE CURRICULUM

Some of the main recommendations of NCF 1975 have had a direct bearing on the teaching of science, its syllabi and textbooks. For Classes I-V (primary level), science and social sciences are taught as a single subject, *Environmental Studies* (EVS). For Classes I and II, there is only a Teacher's Guide; no textbooks for the students. Classes I and II look at both the natural and social environment and in classes III-V these are separated into general science and social studies respectively with separate textbooks for each. For Classes I-V, concepts are introduced in a graded manner through a set of common EVS themes which allow for an interconnected understanding to develop.

At the upper primary level, the approach to teaching science is integrated rather than disciplinary to emphasise the unified nature of science. The curriculum attempts to link the teaching of scientific principles with daily life experiences of the learners; the focus is more on the process of science than product.

According to NCF 2005, a*t the primary stage* the child should be engaged in joyfully exploring the world around it. The objectives at this stage are to nurture the curiosity of the child about the world (natural environment, artifacts and people), to have the child engage in exploratory and hands on activities to acquire the basic cognitive and psycho-motor skills through observation, classification, inference, etc.; to emphasise design and fabrication, estimation and measurement as a prelude to development of technological and quantitative skills of later stages; and to develop the basic language skills: speaking, reading and writing not only for science but also through science. Science and social science should be integrated as Environmental Studies as

is at present, with health as an important component. Throughout the primary stage, there should be no formal periodic tests, no awarding of grades or marks, and no detention.

The syllabus has been developed with a child-centred perspective of themes drawn from issues in social studies, sciences and environmental education. The syllabus for Classes III-V is woven around six common themes: *Family and Friends; Food; Shelter; Water; Travel; and Things we Make and Do*. The first theme encompasses four sub-themes: Relationships, Work and Play, Animals, and Plants. The syllabus is framed within a social constructivist perspective of learning and each theme is presented as a matrix consisting of leading questions, key concepts, suggested resources and activities. See figure 3 on the following page for an illustration of this.

At the upper primary stage the focus is on students learning principles of science through familiar experiences, working with hands to design simple technological units and modules (e.g. designing and making a working model of a windmill to lift weights) and continuing to learn more about environment and health through activities and surveys.[15] Activities and experiments are the primary means for students to acquire scientific concepts. Important components of pedagogy include group activity, discussions with peers and teachers, surveys, organisation of data and their display through exhibitions, etc. in schools and neighbourhood.

At the secondary stage the students are engaged in learning science as a composite discipline[16], in working with hands and tools to design more advanced technological modules than at the upper primary stage, and in activities and analysis on issues surrounding environment and health. Systematic experimentation as a tool to discover/verify theoretical principles, and working on locally significant projects involving science and technology are important parts of the curriculum at this stage.

[15] A new feature of NCF 2000 was teaching of '*Science and Technology*' in place of '*Science*' at the upper primary and secondary stages, so as to familiarise all learners with variousdimensions of scientific and technological literacy, and offer something of value to all students.

[16] Majority of the students are not likely to take up careers as scientists or technologists and so it is important that the science curriculum is oriented towards developing awareness about the interface of science, technology and society.

At the higher secondary stage science is introduced as separate disciplines (phyiscs, chemistry, biology) and is expected to emphasise experiments, technology, investigative projects, historical development of key concepts of science, and awareness of conceptual pitfalls.

Questions	Key Concepts/ Issues	Suggested Resources	Suggested Activities
Who is attracted to flowers? Why do bees/butterflies come to flowers? How do people collect the honey from bee hives?	Honey from flowers; bee hive and basic idea of honey collection.	Film; description Illustrated narratives/discussion with beekeepers on the process of honey collection.	Observation of flowers and the insects that visit them, drawing the flowers, insects,; discussion on colour, fragrance.
Long ears or short? Which animals have ears? Which animals have hair on their body?	Some animals have external ears. They also have hair.	Child's observation, information/description and illustrations about animals.	Listing and classification of animals with and without ears; with and without hair; drawing them; feeling them.
1.4 PLANTS ***Roots of plants*** Do all plants need water to grow? Which part of the plant absorbs water from the soil? When you tug at grass, why does it not come out easily? Why do plants/trees not get uprooted when there is a strong wind? Which roots are eaten by people during famine when nothing else grows?	Plants need water, roots absorb water and hold it to the ground. Roots eaten normally by people like carrots, radish, sweet potato, and during famine. Aerial roots of some plants	Child's observation, information about the roots eaten by people; pictures/specimes of roots.	Observation, collection, drawing of roots of different types, Observing trees/plants whose roots are affected by activities like construction/paving/ plastering. Observation and discussion about swinging on *pipal/ bargad* aerial roots.
Flowers Which plants around us have flowers? Do they come only at some times of the year? How is the bud different from the	Flowering plants; seasons; observation of buds blossoming into flowers; different shapes, colours, petals, aroma, etc.	Child's, observation, stories/ poems about flowers, a visit to a garden.	Drawing flower motifs for clothes, animals, pots, etc. Making floral decorations; Observing the flowers and

Fig. 3.Framing of the EVS syllabus (primary level)
Source: NCERT

INSTRUCTIONAL TIME

Time allocation to subjects at the primary, upper primary and secondary stages was discussed by NCF 1988: the instructional time at the primary stage for math and science was 15 percent each; at the upper primary and secondary stages respectively, 12 percent to math and 13 percent to science (see figure 4). In most curricular documents, a period has been presented as a basic unit of 45 minutes of teaching-learning in a timetable. Frequently, this is compromised into 30 or 35 minutes. A period can, in general, serve as an organisational unit for many text-based lessons. The number of periods for each theme is specified in the upper primary and secondary syllabus for science (e.g. 20 periods for the theme *Food*, 26 periods for the theme *Materials*).

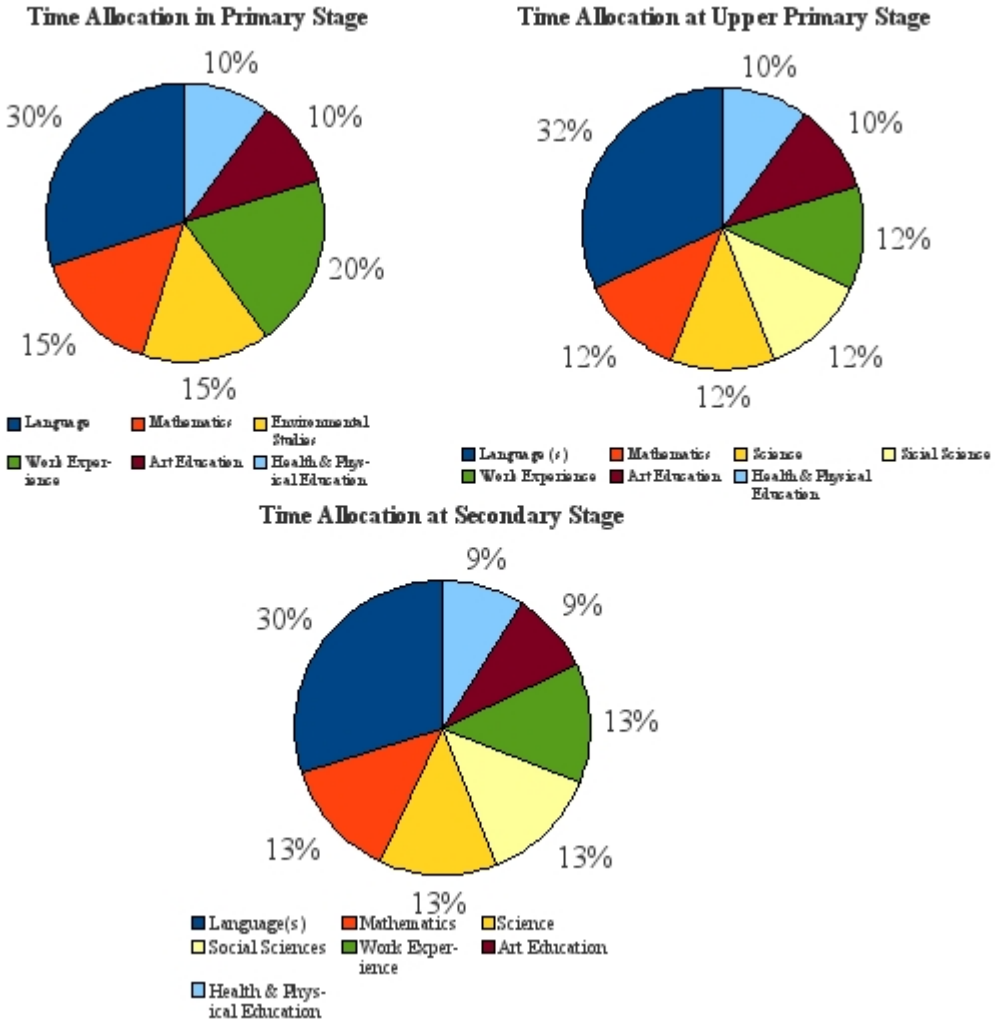

Fig. 4. Time allocation to subjects at the primary, upper primary and secondary stages of schooling. *Source:* NCF 1988. http://www.education.nic.in/cd50years/q/91/HL/91HL0405.htm

STUDENTS' ATTITUDES TOWARDS SCIENCE EDUCATION

The first India Science Report (2005, p.ii-iii)[17], reported the following on (school) students' attitude towards science education:

- Mathematics remains the most preferred subject, with a third of students in classes six to eight rating it as number one; over 21% in classes 11 and 12 rate it similarly. Subjects like Physics, Chemistry, and Biology are rated as the top subjects in classes 11 and 12 by about 30% of the students. This figure is triple that for students in classes six to eight suggesting that the attraction for science subjects increases dramatically in the higher classes in school (see table 6).
- At the class six to eight level, 22% of the students said they would like to study pure science at higher levels of education. Yet, only 13.4% of the students in class 11 and 12 wanted to study pure science at the graduate/post-graduate level (see figure 5).
- The interest in all types of science education does not decline much — 60% of the students at the class six to eight level said they wanted to pursue some science education (pure science, engineering or medicine) at a higher level as compared to 57% students in classes 11 and 12.
- Over 40% of the students, whether in classes six to eight or 11 and 12, wanted to become either an engineer or a doctor.
- While close to two–thirds of students in classes six to eight are satisfied with the quality of science teaching, this falls to just 40% in classes 11 and 12.
- About 60–70% students are satisfied with the quality of teaching of most of the subjects except computer science where just 15% of the students in government
  schools are satisfied with the teaching as compared to 23% in private schools.
- Not too many students are keeping away from science deeming it a costly subject to pursue. While ten per cent of the students cite this as the reason for

[17] This report was commissioned by the Indian National Science Academy (INSA) to National Council of Applied Economic Research (NCAER). The results presented in this report are primarily based on information collected through an all India field survey called the "National Science Survey–2004" undertaken by NCAER and supplemented by information available from various reliable secondary sources such as the Census 1981, 1991 & 2001, National Sample Survey (NSS–1993–94 and 2000-01), Department of Science and Technology (DST), University Grants Commission (UGC), and Institute of Applied Manpower Research (IAMR).

not having taken up science at the plus–2 level, 45% state they are not pursuing science because they have no interest in science (see table 7).

- Parents and teachers play an important role in the selection of courses as well as in deciding career choices.
- The three most preferred professions for students turn out to be teacher, doctor and engineer.
- There is no decline in interest in the proportion of students who wish to study science. A third of the students said they did not study science as they did not feel motivated enough and another 40% said the number of students in a class were too many for them to understand what was being taught.

Subjects	Level of education				
	6–8th	9th	10th	11–12th	Total
Physics	2.0	1.8	3.1	10.1	6.3
Chemistry	1.0	2.1	1.3	7.1	4.3
Mathematics	32.6	31.8	34.8	21.1	27.2
Biology	7.2	6.3	8.4	12.3	10.0
Humanities and Social Science	17.8	16.8	13.9	17.1	16.4
Computer Science	0.5	0.4	0.6	1.0	0.8
Other subjects	29.3	28.4	26.0	28.1	27.8
None	9.5	12.4	12.1	3.2	7.3
Total	100.0	100.0	100.0	100.0	100.0

Table 6. Favourite subjects by level of education (% of students).

Source: NCAER's National Science Survey—2004

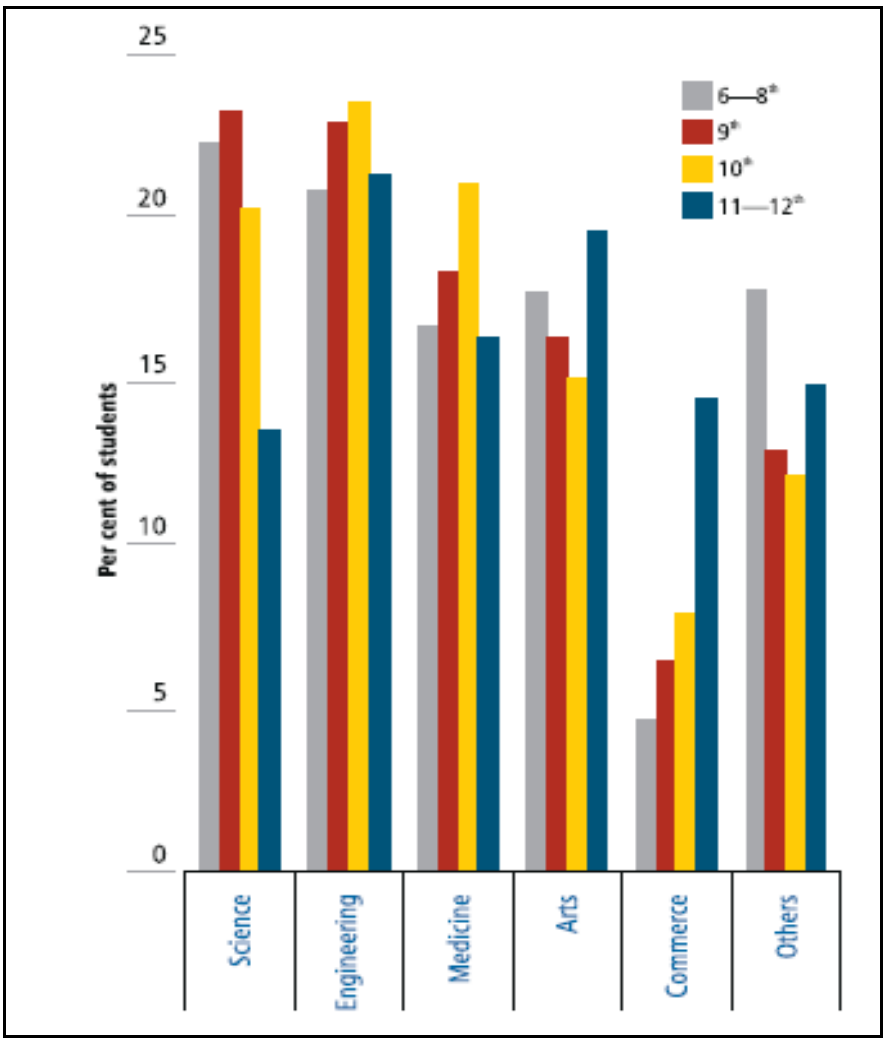

Fig. 5. Preferred subjects for higher education by level of students.

Source: NCAER's National Science Survey—2004

Reasons	% of science students (Class 11 & 12)
Interested in science subjects	66.6
Better job opportunities	20.4
Parents' desire	3.3
Interested in doing research in science	1.8
Influenced by the work of scientists	1.3
Quality of science teachers is very good	0.8
Influence of peer group	0.7
Intend to go abroad	0.2
Others	4.8

Reasons	% of non-science students (Class 11 & 12)
Not interested in science subjects	44.5
Difficult subject	20.4
Higher studies are costly	9.9
Interested in commerce	5.4
Like arts subjects	4.8
No future opportunities	2.1
No science college nearby	2.0
Difficult to get through competitive examination	1.1
Poor quality of teaching at school	1.1
Others	8.9

Table 7. Reasons for taking admission in science/not taking admission in science

Source: NCAER's National Science Survey—2004.

HIGHER EDUCATION

“The most common pattern prevalent all over the country for post-school (10+2) teaching programmes in basic sciences requires the students to go through a 3-year B.Sc. course followed by a 2-year M.Sc. course before they can join a Ph.D. programme.

The B.Sc. programmes offered in different central/state/private universities have several variations. Most of them follow the annual system, although a few have switched over to the semester pattern. The B.Sc. (pass) degree typically involves study of a pre-defined combination of three subjects in all the years, although in some cases during the third year of B.Sc., only two subjects, out of the three studied earlier, are taught. Several universities offer Honours at B.Sc.: in this case, the student studies a pre-defined set of three subjects in the first two years and only one subject in the third year for Honours (or Major) in that subject. In some universities, the Honours subject is defined in the first year of B.Sc. itself such that the student studies three subjects all through the three-year course but with greater emphasis on the subject chosen for Honours. In yet another variation, some B.Sc. degrees involve study of only one subject all through the three years.

In most of the universities, the three-subject combination at B.Sc. is compartmentalized among three major science streams, viz., the ‘Bio’ (or ‘Medical’) group, the ‘Maths’ or ‘Physics’ (or ‘non-Medical’ or ‘pure science’) group, or the ‘Geo’ group, with little freedom for the students to learn across these groups. For example, those opting for ‘Mathematics’ or ‘pure Science’ stream, study Physics, Chemistry and Mathematics or Statistics or Computer Science but nothing of Biology while those opting for the ‘Biology’ stream cannot study Physics, Mathematics, Statistics or Computer Science etc.

On completion of the B.Sc. degree, the student seeks admission to the 2-year M.Sc. (annual or semester) often with a specialization in the final year. A majority of the M.Sc. courses are also confined to one subject only, with the possibility of a student opting for a particular branch within the subject as ‘special paper’ or ‘major elective’. Barring a few cases, there is hardly any avenue available for students to learn something outside the subject in which they qualify for the M.Sc. degree. In most cases,

there is only a little component of research in the M.Sc. curricula. Some institutions have also started integrated M.Sc. – Ph.D. programme for B.Sc. degree holders, with a provision for graduation with M.Sc. degree after successful completion of the course work" (IAS-INSA-NAS report, 2008).

In 2004, about a quarter (22.3%) of the 39.2 million graduates had a background of science education; about a fifth (19.4%) of the 9.3 million postgraduates and a third of the 0.3 million doctorates were from the science stream. Of the total 'professional, technical and related jobs', 29% are educated in science. Of the total graduates who are unemployed, 22.3% have studied science. In the total unemployed postgraduates, 62.8% are with science background (India Science Report, 2005).

SCIENCE AND TECHNOLOGY PERSONNEL in R&D

Of the 1,54,827 S&T personnel engaged primarily in R&D activities as on 1st April, 2005, academic qualifications were available with respect to 75 percent of them; 47.6 percent had an engineering and technology background 29.8 percent had a background in natural sciences, 12.1 percent in agricultural sciences, 8.1 percent in medical sciences and the remaining 2.4% in social sciences.

Of the 1,54,827 S&T personnel engaged in R&D, only 12.7 percent were females: 29.9 percent of them had a background in natural sciences, 39 percent in engineering and technology, 14.8 percent in medicine, 10.3 percent in agricultural sciences and the remaining 6 percent in social sciences (Ministry of Statistics and Development, 2009).

POLICY RECOMMENDED RESOURCES/OPPORTUNITIES

Improvement of Science Education in Schools: A centrally sponsored scheme to improve the quality of science education and to promote scientific temper, became operational in 1987-88. Under the scheme 100% assistance is provided to the States/UTs for provision of science kits to upper primary schools, up gradation of science laboratories and library facilities in senior/secondary schools and training of sci-

ence teachers. The scheme also provides for assistance to voluntary organizations for undertaking innovative projects in the field of science education.

Kishore Vaigyanik Protsahan Yojana (KVPY): A programme started in 1999 by the Department of Science and Technology (DST) to encourage students of Basic Sciences, Engineering and Medicine at the higher secondary, undergraduate and graduate levels to take up research careers in these areas. The aim of the programme is to identify and encourage talented students with aptitude for research.

Learning Enhancement Programme: In 2009-2010, 28 States have been supported through SSA for this programme which focuses on strengthening science and math learning at the upper primary level.

Computer literacy and studies in schools (CLASS): A pilot project of the Department of Electronics in collaboration with MHRD initiated in the school year 1984-85 was modified and converted into a centrally sponsored scheme from 1993-94. The aims of the projects were:

- To provide pupils with an understanding of computers and their use;
- To provide hands-on experiences;
- To 'demystify' computers to young school goers; and
- To familiarise pupils with a range of computer applications.

The government initiated the CLASS 2000 programme with the aim of providing computer literacy in 10,000 schools, computer-assisted learning in 1,000 schools, and computer-based learning in 100 schools. These hundred schools were called SMART schools[18] and were designed to be agents of change seeking to promote the extensive use of computers in the teaching-learning process. As on 30th September, 2008, flash statistics for elementary education in India report that 14% schools have a computer (NUEPA, 2010).

Computer Aided Learning (CAL): Under SSA, up to Rs. 5 million is available to each district for strengthening computer aided learning in schools. Activities include providing computer equipment or labs to schools, development of computer-based e-

[18] A school in which at least one section (of 40 students) in each of the class IX-XII is fully computerized.

learning materials in local languages, and training of teachers in computer use often with the help of private sector partners. Since the inception of the programme, about 67,000 schools have benefited, including 102.61 lakh children and 1.99 lakh teachers who were provided with training in handling CAL resources.

ICT @ Schools: The centrally sponsored scheme was launched in December 2004 to provide opportunities to secondary stage students to mainly build their capacity in ICT skills and make them learn through a computer-aided learning process. The scheme serves as a major catalyst to bridge the digital divide amongst students of various socioeconomic and geographical barriers. The scheme provides support to States/UTs to establish enabling ICT infrastructure support in government and government-aided secondary and higher secondary schools. It also aims to set up SMART schools in Kendriya Vidyalayas and Navodaya Vidyalayas to act as "Technology Demonstrators" and to lead in propagating ICT skills among students of neighbourhood schools.

INSPIRE: A programme developed recently by the DST to attract talent to the excitement and study of science at an early age. It has three components, aimed at students in the age groups 10-15, 17-22 and 22-32.

i. Scheme for Early Attraction of Talent (SEATS) awards Rs 5000 to one million young learners in the age group 10-15 years for a duration of five years to study science. To experience the joy of innovations, annual winter and summer camps are planned with global leaders of science for the top 1% performers in the Class X Board exams.

ii. Scholarship for Higher Education (SHE) offers 10,000 scholarships every year @ Rs 0.80 lakh per year to talented youth in the age group 17-22 years, for undertaking Bachelor and Masters level education in Natural and Basic Sciences. The main feature of the scheme is mentorship support through summer attachment to performing researchers.

iii. Assured Opportunity for Research Careers (AORC) offers doctoral INSPIRE Fellowship in the age group 22-27 years, in the both basic and applied sciences (including engineering and medicine). It also aims to assure opportunities for post-doctoral researchers through contractual and tenure

track positions for 5 years in both basic and applied sciences areas through an INSPIRE Faculty Scheme.

Scheme for Providing Quality Education in Madrassas (SPQEM): This centrally sponsored scheme was launched in 2009 through the National Institute of Open Schooling to bring about a qualitative change in the education being imparted in madrassas and maktabs and bring them into the mainstream of the national education system. The measures include giving financial assistance to introduce science, math, social studies, Hindi and English in their curriculum so that academic proficiency for Classes I-XII is attainable for students studying in these institutions, as well as providing in-service training to teachers appointed under this scheme to teach modern subjects like science and improve their pedagogical skills. The scheme aims to cover up to 6 thousand madrassas by 2012.

Out-of-school activities have been used innovatively by government institutions[19] and voluntary organisations[20] independently and collaboratively to promote and popularise science education.

Jawaharlal Nehru National Science Exhibition: is an annual event organised by NCERT. The national level science exhibition is the culmination of a series of exhibitions organised at school, district, regional and state level every year. With a view towards improving educational facilities in rural areas and for economically weaker sections of the society, the main theme of national and state-level science exhibitions reflect the felt needs of rural India. The social aspect of science and relevance of science and technology for development also are criteria, which are given consideration in determining the themes.

Science Museums: NCSM contributes to science education of children through its four museums located at Calcutta, Bangalore, Mumbai and Delhi. It also utilises a number of regional centres situated in different parts of the country to organise activ-

[19] The NCERT, the Department of Science & Technology (DST), the National Council of Science Museums (NCSM), the National Council for Science and Technology Communication (NCSTC)
[20] Vikram A. Sarabhai Community Science Centre (VASCSC), Ahmedabad; Homi Bhabha Centre of Science Education (HBCSE), Mumbai

ities like demonstration lectures, mobile science exhibitions for rural schools, science quiz shows, science seminars, and science fairs. NCSM has set up 301 school science centres across several states.

Children's Science Congress: is an annual event organised by the NCSTC. Children in the age group of 10-17 years work on scientific projects related to local issues, under the supervision of the teachers/science activists and report their findings at school/block or district level Congresses (Rajput and Srivastava, 2005).

National Science Day: is another initiative of the NCSTC, observed every year on February 28 to celebrate the discovery of Raman Effect by the Indian Physicist Sir C. V. Raman on 28th February, 1928. Various programmes ranging from a day to a full month either begin or culminate on February 28. The activities, centred around a theme selected for the year, include debates, quiz competitions, exhibitions, lectures and involve college and school students and teachers.

Exploratory: is a science centre developed at Pune where school and college children can explore and experiment, invent and innovate, and design and fabricate. Its vision is that very young children aspire to become scientists. There are no teachers in the Exploratory but highly experienced guides who explore along with the students the basic concepts in science through carefully designed activities. The purpose is to enable children to learn science by participating in the process of science. The exploratory promotes keen and careful observation, excites curiosity, encourages children to ask questions, question the answers and enables them to generalize and discover. The formal system of science education has not yet adopted the exploratory way of learning science (INSA, 2001).

Section 2

STATE OF THE ART - SCIENCE EDUCATION AND DIVERSITY WITHIN INTERNATIONAL ACADEMIC LITERATURE

The chapter on Science Education in the Sixth Survey of Educational Research (1993-2000) reveals the paucity of research in the field of science education, particularly school science education. As few as 120 studies featured across five science education journals during this period. The focus of about a quarter of the studies was on cognitive aspects of science (understanding of science, misconceptions of science, cognition), and a third of the studies were on science teaching (science content, contexts of teaching, ethics in science, assessment, gender issues) and teaching materials (curricula, science kits, software development). The other areas studied were students' attitudes towards science, achievement in science subjects, creativity, and environmental factors that influence the science learning (Chunawala, 2000).

In the Indian context, the issue of gender has received significantly greater attention in research related to science education/careers in science as evidenced by the studies/projects undertaken. A project undertaken by the Centre for Science Education and Communication (New Delhi) jointly with UNICEF India and UNESCO New Delhi on gender issues in school science was reported in 'How to make Science more Friendly, particularly to Girls, within the framework of STL' (Mukherjee and Varma, 2001). The primary activity of the project was to develop supplementary teaching materials by teachers at workshops organised for this purpose, and to modify them after field trials in their own schools. The participation of women teachers from government institutions and NGOs was sought; they were encouraged to reflect on what makes science unfriendly to girls and design materials to rectify this.

Subrahmanyan (1995) explored two factors that contributed to the choice of science as a specialisation by a group of academic women scientists at the University of Madras in South India: the encouragement they received to pursue education to the highest level, and the circumstances that led to their pursuit of science as a specialisation. In spite of patrifocality, the reasons for the participants' choice of science have been personal or school-related. An interesting challenge to patrifocality is in the form of mentors and role models in schools and in work-places who are able to

help women focus their interest in science, and in some cases, even influence family decisions in favour of girls and women.

Mukhopadhyay (2001) studied the cultural context of gendered science in India and found that "patrifocality is only one major factor in student science-related academic decisions." Patrifocality intersects with socioeconomic factors and academic prerequisites in affecting decisions to continue schooling as well as science-related choices.

A study in 2004 to investigate factors which influence science career as a choice for women scientists and post-graduate students (sample size 149 and 147 respectively) revealed that the preferred choices tended to be biotechnology, microbiology and the life sciences. As many as 90 percent of the scientists and students said the choice of science as a career was an individual choice driven by personal motivation, and most of them were encouraged by their teachers and parents. However, the motivation for girls and women in colleges in north India to pursue science at the higher secondary level and subsequently at the graduate level was because it enhanced their value in the marriage market! Girls were encouraged to take up science as it added value, and was useful for them to teach children at home. Majority of the respondents were educated in cities or towns suggesting that selective, privileged individuals opt for science (INSA, 2004).

Kurup, Maithreyi, Kantharaju, and Godbole (2010) conducted a survey to understand the reasons for the loss of trained women scientists and to identify strategies and provisions to retain them in Science. The survey was conducted across India with 568 women scientists and 226 men scientists who had a PhD in Science, Engineering or Medicine: either currently engaged in scientific research and teaching (55 percent women, 71 percent men); or engaged in jobs other than scientific research and teaching (32 percent women, 28 percent men); and even those who were currently not working (13 percent women and 0.44 percent men).[21]

[21] Data was reported with respect to four groups: Women in Research (WIR), Women Not in Research (WNR), Women Not Working (WNW), Men in Research (MIR).

The three groups among the women scientists – WIR, WNR, and WNW – differ in their degree of perceptions of why women drop out of Science (see figure 6). Yet, the majority in all three groups considers family commitment as the reason for women to drop out of science.

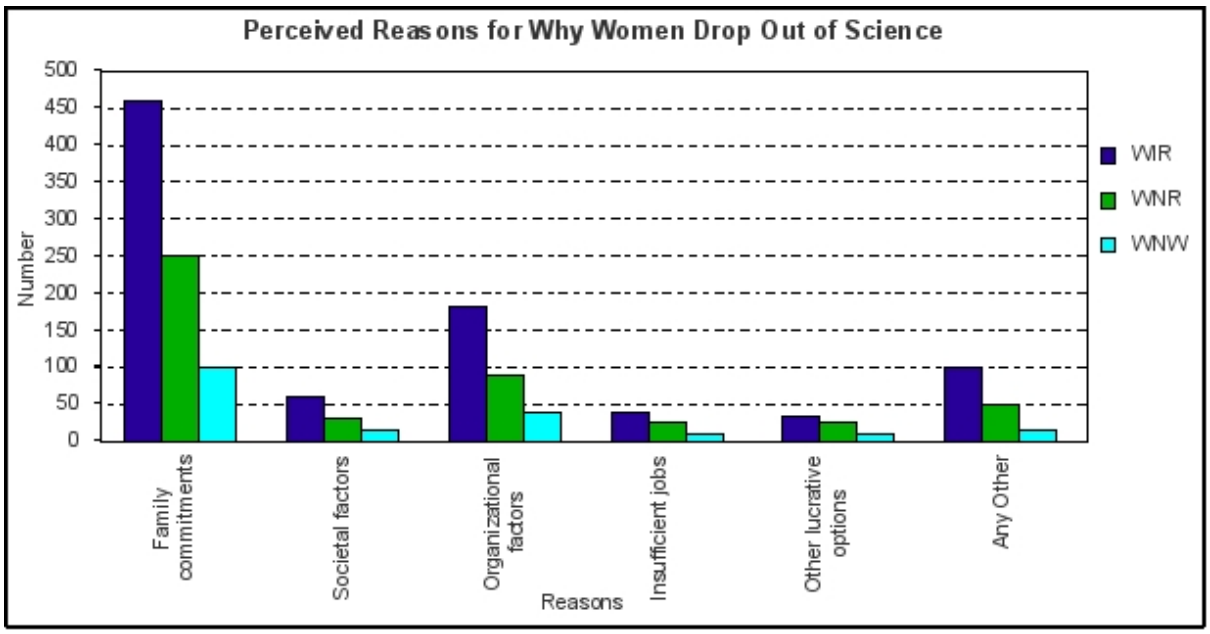

Fig. 6. Women scientists' reasons for why women drop out of science
Source: Kurup, Maithreyi, Kantharaju, and Godbole, 2010.

The majority of the MIR group also considers family commitment as the reason for women dropping out of science. In contrast, the majority of WIR as well as MIR consider the search for lucrative careers the reason for men to drop out of science.

The three groups of women scientists differ with respect to the provisions considered important by them to retain women in science careers. All three groups are in agreement about flexibility of timings being the most important provision. In addition, provisions for transport and accommodation are important for the WIR group; better HR policies for the WNR group; and child care facilities at the workplace for the WNW group.

Section 3

Under review and dialogue between partner countries

Section 4

Barriers impeding and Factors facilitating Reform for Supporting Diversity

The heterogeneity of the country poses a formidable challenge to support diversity--with a view to the larger goal of achieving equity. The NFG on the Teaching of Science addressed this issue in their position paper. Quality science education “for all” remains
an issue to be grappled with; many groups of students are in a disadvantageous position vis-a-vis the learning of science and exit the school system as 'scientific illiterates.' The disadvantaged groups are girls, children from rural and tribal areas, other socio-economically underprivileged students in rural and urban areas, those with learning disabilities, and physically challenged children. In addition, the quality of science education for Muslim students studying in madrassas is also unsatisfactory.

The main barriers to support diversity are lack of minimum infrastructure, inadequate support systems, and lack of access to resources for quality science education for the disadvantaged students. A consequence of this is that curriculum designers and textbook writers create material that is aligned with the poor facilities—supporting the belief that space and practical work are not essential to science teaching. Another consequence of poorly equipped or non-existent laboratories is teachers neglecting the possibilities afforded by low-cost activities and experiments using locally and easily available material. Science curricula and textbooks do not adequately reflect the diversity of the students across the country in terms of content or pedagogy. The wide potential of the use of ICT to bridge the social divide remains untapped; appropriate multimedia software in different Indian languages is still uncommon

The rural-urban divide in science education is apparent in science curricula and programmes in which rural issues, lifestyles, trades and occupations are in low proportion, if at all. Educational and career information in science, and assistance for competitive examinations in science are not easily available to rural students. Curricular

and classroom practices are known to smack of gender bias. There is little or no gender sensitisation of teachers at the pre-service or in-services stages of teacher education (NCF, 2005).

The Centre for the Promotion of Science established by the Aligarh Muslim University[22] focuses attention on modernising education, especially the sciences, in madrassas. The main objectives of the Centre are i) to create awareness amongst Indian Muslims of the importance of acquiring and creating scientific knowledge and to provide possible help to minimize their backwardness in sciences, and ii) to help in the introduction of regular science teaching in madrassas and in the improvement of the quality of science education in Muslim schools.

Section 5
Identifying approaches to Teacher Training related to Diversity and Evidence of Success or Otherwise

The position paper by the NFG on the teaching of science addresses the need to sensitise teachers to gender issues and the needs of disadvantaged groups. "Teachers should be sensitized to promote equitable classroom practices to ensure 'science experiences' of comparable quality to girls." Teachers should be exposed to insights from studies which explore how gender bias operates in schools within and outside the classrooms. Techniques of teaching which are appropriate to the "science needs" of disadvantaged students need to evolve in consultation with experts. However, there are is no evidence of specific approaches that have been conceptualized for teacher training and/or implemented in science classrooms which speak to issues of diversity in a deliberate way.

[22] Founded in 1875 as a college, it acquired the status of a central university in 1920 and came to be known such.

REFERENCES

Agarwal, P. 2006. *Higher education in India: The need for chang*e. Working Paper No. 180. New Delhi: Indian Council for Research on International Economic Relations.

Chunawala, S. 2006. Science Education. In *Sixth Survey of Educational Research 1993-2000, Volume 1,* p 77-92. New Delhi: National Council of Educational Research and Training.

Heitzman, J. & Worden, R.L. 1995*. India: A country study*. Washington D.C: Library of Congress.

Indian National Science Academy. 2001. *Pursuit and promotion of science: The Indian experience.* New Delhi.

Indian National Science Academy. 2004. *Science career for Indian women: An examination of Indian women's access to and retention in scientific careers*. New Delhi.

Khubchandani, L. 2008. Languages of instruction in plurilingual India. *International Review of Education, 24* (3), 375-380.

Kurup, A., Maithreyi, R., Kantharaju, B., & Godbole, R. (2010). *Trained scientific women power: How much are we losing?* Bangalore: Indian Academy of Sciences and National Institute of Advanced Studies.

Ministry of Human Resource Development. 2000*. Education for All: The Year 2000 Assessment Report*. New Delhi: Government of India.

Ministry of Human Resource Development. 2010. *Report to the people on education 2009-10*. New Delhi: Government of India.

Ministry of Science and Technology. 2009. *Research and development statistics 2007-08*. New Delhi: Government of India.

Mitra, A. 2007. Country Profile commissioned for the EFA Global Monitoring Report 2008, *Education for All by 2015: Will we make it?*

Mukherjee, A. and Varma, V.S. (2001). *How to make science more friendly, particularly to girls, within the framework of STL*. New Delhi: Centre for Science Education and Communication.

Mukhopadhyay, C. 1996. The Cultural Context of Gendered Science: An Indian Case Study. Proceedings. *8th International Conference on Gender, Science,Technology [GASAT]. Towards Sustainable Development: Achieving the 4E's: Education, Employment, Equality, Empowerment*. Vol.I: pp. 286-304. SATWAC: Ahmedabad,India.

Nair, P. 2009. *The State and madrasas in India*. Birmingham: Religions and Research Development Programme.

National Council of Educational Research and Training. 1975. *Curriculum for the Ten Year School: A Framework.*

National Council of Educational Research and Training. 1988, 2000, 2005. *National Curriculum Framework*.

National Council of Educational Research and Training. 2009. *Comprehensive evaluation of Centrally Sponsored Scheme on Restructuring and Reorganization of Teacher Education*: *A Report.*

National Institute of Educational Planning and Administration. 1988. *Development of Education: 1986-1988. National Report of India*. New Delhi: NIEPA.

National University of Educational Planning and Administration. 2010. *Elementary Education in India: Progress towards UEE, DISE Flash Statistics: 2008-09.* New Delhi: NUEPA.

Rajput, J. S. & Srivastava, V.P. 2005. India. In *Science education for the contemporary society*, ed. D.B.Rao, 37-51. New Delhi: Discovery Publishing House.

Ramachandran, V. 2009. *Education for all—Mid decade assessment: Towards gender equality in education*. New Delhi: NUEPA.

Shrinivasan, R. *55% percent of India's population poor: A report*. Times of India, July 15, 2010.

Shukla, R. 2005. *India Science Report: Science Education, Human Resources and Public Attitude towards Science and Technology*. New Delhi: National Council of Applied Economic Research.

Subrahmanyan, L. 1995. Patrifocality and the entry of women into science. *Higher Education 30*, 1-15.

The World Bank. 2006. *Skill development in India: The Vocational education and training system* (draft paper).

The World Bank. 2009. *Secondary education in India; Universalizing opportunity*, vol.2.

Position Paper National Focus Group on Educational Technology. 2005. New Delhi: NCERT.

Restructuring Post-School Science Teaching Programmes: A Position Paper. 2008. Indian Academy of Sciences (Bangalore), Indian National Science Academy (New Delhi), The National Academy of Sciences, India (Allahabad).

http://ncst.nic.in/	National Commission for Scheduled Tribes
http://censusindia.gov.in/	Census of India
http://www.ideadutch.com/	Indian Dutch Education Society I.D.E.A.
http://www.ncte-india.org/noti/determ.htm	National Council For Teacher Education
http://www.education.nic.in/policy/npe-1968.pdf	National Policy on Education 1968
http://education.nic.in/cd50years/g/T/49/toc.htm	National Policy on Education 1986
http://education.nic.in/policy/npe86-mod92.pdf	National Policy on Education 1986 (as modified in 1992)
http://www.navodaya.nic.in/	Navodaya Vidyalaya Samiti, MHRD.