

# Decline in science education in India – A case study at + 2 and undergraduate level

K. C. Garg\* and B. M. Gupta

*We examine here the option exercised by students at 10 + 2 level for science subjects vis-à-vis accounts and economics for a 11-year period, from 1992 to 2002 based on the data obtained from the Central Board of Secondary Education, and Council for the Indian School Certificate Examinations. For study at the graduate level, enrolment data were obtained from some colleges of the University of Delhi and outside in B Sc (General and Honours) courses. It has been found that even at + 2 level, the priority for science is declining, while for accounts and economics it is increasing. Students opt for science with an eye on professional courses. Causes of this decline have been discussed here.*

DEVELOPMENT of science and technology is vital for the progress of any country. It is a major vehicle for enhancing the quality of human life. The developments in science and technology, particularly in information technology and computer science are occurring so fast that it is difficult to portray the world of 2020. The emergence of globalization and the intellectual property rights regime have made 'knowledge' a big resource and it is believed that in the 21st century only those countries would excel which possess a wealth of knowledge. Under such a scenario it has become all the more important that we should have a strong science base in our country, particularly in children.

A vast infrastructure for education, including science education, has been created in the country. It comprises hundred thousand schools, over 8600 colleges, more than 200 universities, several institutes of specialized learning like Indian Institutes of Technology (IITs), Indian Institute of Science (IISc), Tata Institute of Fundamental Research (TIFR), about 40 scientific laboratories of the Council of Scientific and Industrial Research with an equal number of institutes of Defence Research and Development Organization. All this had a positive impact and we could produce renowned scientists, researchers and academicians.

For the education in schools, the Government of India established the National Council of Educational Research and Training (NCERT) in the early 1960s. It has been the key player in all aspects of science education in schools, including policy formulation and implementation, curri-

culum development, textbooks production and teachers' training.

Many scholars<sup>1-5</sup> have shown concern for the decline of enrolment in science courses in higher education over the years. No attempt, however, seems to have been done to ascertain the situation of enrolment in science at school/college level. In the present preliminary study, the option exercised by children at 10 + 2 level for science subjects vis-à-vis accounts and economics has been studied for a 11-year period, from 1992 to 2002, besides studying the drift-out rate at the first degree education in different streams of science at different colleges of the University of Delhi for the sessions 1990-91 to 1997-98. These results have been compared with the corresponding data from some colleges outside the domain of the University of Delhi. The major causes of this decline have been discussed in brief.

## Data

The present study is based on the following data:

- (i) The enrolment of students at the 10 + 2 level in physics, chemistry, mathematics, biology, accounts and economics, for the years 1992-2002, obtained from the Central Board of Secondary Education (CBSE) and for the years 1996 to 2002 obtained from the Council for the Indian School Certificate Examinations (ISCE).
- (ii) The enrolment of students in University of Delhi for B Sc (General) – physical sciences stream, B Sc (General) – biological sciences stream, B Sc (General) – restructured pattern, and B Sc (Honours) courses for different science subjects for the sessions 1990-91 to 1997-98. These data were culled from the Annual Reports of the University of Delhi.
- (iii) The enrolment of students in various colleges of the University of Delhi in different streams of B Sc (General)

The authors are in the National Institute of Science, Technology and Development Studies, Pusa Gate, K.S. Krishnan Marg, New Delhi 110 012, India.

\*For correspondence. (e-mail: Kaichaga99@yahoo.com)

in the sessions 1990–91 to 1997–98. This was also culled from the Annual Reports of the University of Delhi.

(iv) The enrolment of students in B Sc in St. Xavier's College (Mumbai) and Ravenshaw College (Cuttak), the only two colleges which responded out of nearly a dozen that were approached.

## Results

### *Shift in subject priority*

The number of students who appeared at the 10 + 2 examination for the years 1992–2002 in six subjects conducted by the CBSE is depicted in Table 1 and the corresponding data for ISCE for the sessions 1996–2001 are reported in Table 2. To find the shift in priority from science subjects to other subjects, we normalized the data by the methodology suggested by Price<sup>6</sup> and calculated Priority Index (PI) for these subjects for both CBSE and ISCE. Mathematically

$$PI = \{(N_{ij}/N_{io})/(N_{oj}/N_{oo})\} \times 100,$$

where  $N_{ij}$  is the enrolment of students in the subject  $i$  for the year  $j$ ;  $N_{io}$  the enrolment of students in the subject  $i$  for all the years;  $N_{oj}$  the enrolment of students in all the subjects in the year  $j$ ;  $N_{oo}$  the total enrolment in all the

subjects in all the years. The values PI for these subjects for CBSE are given in Table 3 and for ISCE in Table 4. These results clearly indicate that the priority for science discipline as a whole (physics, chemistry and biology taken together) is on decline even at + 2 level of education.

Analysis of data for the individual subjects indicates that priority for biology has gone down considerably in comparison to that for physics and chemistry in respect of CBSE, while for the ISCE all the three disciplines, i.e. physics, chemistry and biology show a decline in values of PI. The PI for 'accounts' has gone up both for CBSE and ISCE, indicating a clear shift towards the commerce stream. Economics, in case of ISCE data also shows an increase in PI.

### *First degree education*

To find the pattern about the movement of students who had passed 10 + 2 level with science subjects and had taken admission in B Sc courses, data were obtained for students enrolment and the actual number who appeared in the final examination. The difference of the two, indicated the number of students who did not appear in the examination. Under the normal circumstances, they would be called the drop-outs; but in the present case, they are

**Table 1.** Number of students who appeared in 10 + 2 examination in CBSE from 1992 to 2002 in some subjects

Year	Economics	Mathematics	Physics	Chemistry	Biology	Accounts	Total*
1992	72,741	63,004	57,716	57,485	40,191	32,210	323,347
1993	73,962	66,114	63,845	63,860	44,478	33,253	345,512
1994	80,290	79,430	75,726	75,397	52,042	39,693	402,578
1995	85,101	80,189	79,450	79,507	53,310	42,086	419,643
1996	99,565	86,317	86,033	85,232	58,307	47,994	463,448
1997	101,375	92,972	86,511	86,055	55,660	58,436	481,009
1998	108,660	108,181	95,207	95,027	57,425	68,587	533,087
1999	125,376	113,210	101,262	101,103	59,626	78,848	579,425
2000	127,640	122,242	112,306	112,216	62,182	82,471	619,057
2001	133,772	138,891	125,183	125,797	64,497	87,085	675,225
2002	145,710	160,861	147,941	147,236	69,069	93,914	764,731
Total	1,154,192	1,111,411	1,031,180	1,028,915	616,787	664,577	5,607,062

\*Has been used to calculate PI.

**Table 2.** Number of students who appeared in 10 + 2 examination in ISCE during 1996–2001 in some subjects

Year	Accounts	Economics	Mathematics	Physics	Chemistry	Biology	Total*
1996	4413	5688	7299	8820	8792	4478	39,490
1997	5840	7167	8268	9677	9654	4716	45,322
1998	7101	8522	9395	10,652	10,597	5130	51,397
1999	8388	9717	10,356	11,471	11,442	5409	56,783
2000	9665	10,860	11,733	12,968	12,918	5896	64,040
2001	11,178	12,838	13,058	14,234	14,234	6300	71,842
Total	46,585	54,792	60,109	67,822	67,637	31,929	328,874

\*Has been used to calculate PI.

the students who moved to the professional courses. Some who are not able to make it in the first attempt, try again after a year and a good percentage shifts to medical and engineering, including IT courses. We may therefore call these students as 'drift-outs', rather than 'drop-outs', which is usually used to denote the students who leave studies.

*Drift-out rates in B Sc (General & Honours) courses:*

The data were analysed to find the drift-out rates in B Sc (General and Honours) course for the sessions 1990–91 to 1997–98 at the University of Delhi. The cumulated data, presented in Table 5, show that during these years, on an average, about 48% of the students drifted-out from different B Sc courses. The drift-out rate in B Sc (General) – biological sciences stream was higher (54%) than B Sc (General) – physical sciences (49%) and B Sc (General) – restructured course (41%). It is because the students from these courses have the aim of joining professional courses in engineering, medicine and biotechnology and go on trying for it year after year. The situation about drifting from B Sc (Honours) courses was not different from the one in B Sc (General) stream. However, the average drift-out rate from B Sc (applied sciences) was much less compared to the one from B Sc (General) or B Sc (Honours) courses. This could be due to the job-oriented nature of these courses. Raw analyses of the data indicate that the drift-out rate kept fluctuating during different years.

*Pattern of drifting from different B Sc (Honours) courses:*

The drifting from different subjects of B Sc (Honours), given in Table 6, shows that the average drift-out rate was 52%. The highest drifting (59%) was from physics (Honours) followed by electronics (Honours) (56%), zoology (Honours) (54%) and chemistry (Honours) (54%). These drifted-out students are those who got admissions in these courses after securing marks around 80–90% at the 10 + 2 level. The moment they get admissions in professional courses, they migrate to those courses, leaving B Sc (Honours) courses. The drift-out rate from statistics and geology was much less at 32% and 33% respectively. Students drifted-out from these courses are those who got admissions in these courses after securing marks around 65–75% at the 10 + 2 level. Also, the number of seats in these subjects is much less compared to traditional subjects like physics, chemistry, zoology and botany. The microbiology being a professional-oriented course, had lower (39%) drift-out rate.

*Pattern of drifting in different colleges:* The analysis of the data has revealed that the drift-out rate from science streams varied in different colleges. There was no considerable difference in drifting as far as B Sc (General) in physical sciences and restructured course was concerned in elite and other colleges. In the case of B Sc (General) – biological science stream, the drift-out rate from elite colleges was much higher than from other colleges. In the case of women colleges also, the drift-out rate

**Table 3.** Priority index values for enrolment in different subjects for CBSE during 1992–2002\*

Year	Accounts	Economics	Mathematics	Physics	Chemistry	Biology	Science** (Combined)
1992	84	109	98	97	97	113	101
1993	81	104	97	101	101	117	104
1994	83	97	100	102	102	118	106
1995	85	99	96	103	103	116	106
1996	87	104	94	101	100	114	104
1997	103	102	98	98	98	105	99
1998	109	99	102	97	97	98	97
1999	115	105	99	95	95	94	95
2000	112	100	100	99	99	91	97
2001	109	96	104	101	102	87	98
2002	104	93	106	105	105	82	100

\*Rounded off to the nearest whole number, \*\*Physics, chemistry and biology taken together.

**Table 4.** Priority index values for enrolment in different subjects for ISCE during 1996–2001\*

Year	Accounts	Economics	Mathematics	Physics	Chemistry	Biology	Science** (Combined)
1996	79	86	101	108	108	117	110
1997	91	95	100	104	104	107	104
1998	98	100	100	101	100	103	101
1999	104	103	100	98	98	98	98
2000	107	102	100	98	98	95	98
2001	110	107	99	96	96	90	95

\*Rounded off to the nearest whole number, \*\*Physics, chemistry and biology taken together.

**Table 5.** Enrolment and drift-out from various science streams of University of Delhi (sessions 1990–91 to 1997–98)

Streams	Number of students			Drift-out rate*
	Enrolled	Appeared	Drifted-out	
B Sc General (A)	10,104	5131	4973	49
B Sc General (B)	7364	3369	3995	54
B Sc (Restructured)	5348	3114	2234	42
B Sc (Honours)	31,202	16,134	15,068	48
B Sc (Applied Science)	720	525	195	27
Total	54,738	28,273	26,465	48

\*Rounded off to the nearest whole number.

**Table 6.** Cumulative enrolment and drift-out rate in different streams of B Sc (Honours) at Delhi University during 1991–92 to 1997–98

Subjects	Number of students			
	Enrolled	Appeared	Drifted-out	Drift-out rate* (%)
Mathematics	4388	2343	2045	47
Statistics	1155	785	370	32
Botany	3836	2000	1836	48
Chemistry	5936	2747	3189	54
Geology	189	127	62	33
Physics	6768	2754	4014	59
Zoology	3659	1694	1965	54
Biochemistry	792	409	383	48
Electronics	2089	909	1180	56
Microbiology	605	372	233	39
Total	29,417	14,140	15,277	52

\*Rounded off to the nearest whole number.

from biological science stream was higher than from physical science or restructured course stream. However, this rate from women colleges was much less than their average from physical science stream and restructured course.

*Drift-out rates from colleges outside the domain of the University of Delhi:* The data from St Xavier's College (Mumbai) and Ravenshaw College (Cuttack) indicated that the students from these colleges were also shifting to other courses from science stream. The drift-out rate for St. Xaviers College was about 22%, while from Ravenshaw College, it was only about 19%, during 1990–91 to 1993–94, but the average drift-out rate during 1990–91 to 2001–2002, was about 40%, which indicates that after 1993–94, the drift-out rate has increased considerably.

## Discussion

It is clear from the data of CBSE and ISCE that the priority for science is declining even at the school level. This is also reflected by the cut-off percentage for science

honours courses in the University of Delhi, which came down more sharply compared to those for the B Com or economics honours courses in the session 2002–2003. Students study science with an eye on engineering, medical or IT-related courses. The drifting of students at B Sc level, as revealed by the data of the University of Delhi, has clearly indicated their inclination towards professional courses.

The question arises as to why this is happening. One of the most important reasons for this decline is that career in science is not perceived attractive either by parents or children; many other professions appear to offer greater opportunities. For instance, even after obtaining a masters/Ph D degree in science the student do not get jobs, while an engineering graduate from a good institution get a job through the campus recruitment in good companies. Thus, an engineering graduate settles theoretically after four years from + 2 examination, while this is not so in the case of students who opt for science. Hence, more and more students are opting for engineering courses. As the number of engineering colleges has mushroomed, even students with moderate academic attainments get admission. Employment opportunities have also brightened for the commerce and economics (Honours) graduates due to the liberalization of economy. Hence more and more students opt for these courses. Another reason appears to be the change in value system. Gone are the days when a scientist was respected in the society for his deep involvement with the subject and high dedication. These days only the material achievements matter.

The Government of India is trying to encourage science education by dispensing scholarships to young science graduates through different schemes like 'Catch Them Young' mooted by CSIR as the nodal agency and 'Kishore Vaigyanik Protsahan Yojana' (KYPP) mooted by DST. However, it is doubtful that these schemes will attract meritorious students to study science at a time when economic fundamentalism is ruling the world.

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