

Access, satisfaction, and future: undergraduate education at the Indian Institutes of Technology

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Abstract The Indian Institutes of Technology (IITs) are among the most prestigious technical institutes in India (and perhaps in the world) for undergraduate engineering education. Admission to an IIT is viewed by many Indians as a passport to success, prosperity, prestige, and possibly moving to Western countries for higher studies and/or jobs. This paper examines whether (i) access to the IITs is open to students irrespective of their socioeconomic status; (ii) students' satisfaction, once they enter an IIT, is conditioned by their socioeconomic status; and (iii) students' attitudes towards their future plans are influenced by their socioeconomic status. The paper is based on a survey conducted with nearly 260 students at two out of five original IITs in 2007–2008. Findings reveal that access to the IITs, satisfaction at the IITs, and future plans after the IITs are strongly correlated to students' socioeconomic status. Even though admission to the IITs is based on an entrance examination, most of its students are from the socially and economically well-off families.

Keywords Caste politics in education · Engineering education in India · IIT · JEE · Reservation

Introduction

Since its independence in 1947, India has directed its education policies to serve the challenges of economic and technological developments. Among other initiatives of national importance, the government of India established the Indian Institutes of

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Technology (IITs) to provide advanced education in engineering and technology. To ensure that the country is self-reliant in these realms, the IITs have sought to produce world-class engineers by pursuing excellence in education. The undergraduate curriculum at the IITs is widely considered one of the most rigorous in the world. The *CBS 60 Minutes* television program in the United States gave the equation of Harvard + MIT + Princeton = IIT (Stahl 2003). It is, therefore, no surprise that the IIT graduates are sought by multinational corporations for high paying jobs and by prestigious Western educational institutions for their master's and doctorate programs. The IITs are known to have produced some of the most prominent executives, entrepreneurs, and inventors in the world. It has been suggested that more millionaires per capita have come from the IITs than any other undergraduate academic institution in the world (Murali 2003). The U.S. Congress (2005) specifically honored the IITs for their contributions to the American society.

India is a society with a sharp division along caste and class lines, among other demographic factors. Traditionally, caste is a social concept, originating in the Hindu scriptures. Although theoretically based on the concept of division of labor, the crucial distinguishing aspect of the caste system is that a person is born into their particular standing. Historically, class is viewed as a Marxist concept, based on the ownership of the means of production. Currently, it is used as an economic concept based on income, wealth, ownership of property, and so forth. Caste and class are inseparable in the Indian context (Pankaj 2007). The majority of its Hindu population (80.5%) is socially divided into the upper caste of Brahmin (priest), middle castes of Kshastriya (warrior) and Vaishya (merchant), lower or backward caste of Sudra (manual laborer/peasant), and scheduled caste of Dalits (untouchable). Each of these castes is further divided into several sub-castes. The Indian Census of 2001 has estimated that little over 16% of India's total population consists of scheduled castes. The estimates on backward castes vary from 30 to 50% (Bhattacharya 2006). The remaining 19.5% of India's population consists of Muslims (13.4%), Christians (2.3%), Sikhs (1.9%), Buddhists (0.8%), Jains (0.4%), and others (0.7%). Economically, the Indian society is divided into a very small minority of rich and a large majority of poor people. India is home to the world's largest concentration of poor, where some 350 million people still live on less than a dollar a day (Waldman 2005). According to the World Bank, India's per capita income was rupees 40,000 (~ 820 USD) in 2008 (Rediff News 2008). Incidentally, a majority of people from scheduled and backward castes also belong to the poor class. Lack of education is seen as one of the major reasons why these people remain on the lower strata of the social and economic hierarchy in India.

This paper investigates accessibility to undergraduate studies at the IITs for students from different socioeconomic status—based on family income level and social status centered on caste. We collected primary data from students enrolled at two IITs in 2007 and 2008. The study shows that even though the Joint Entrance Exam (JEE) is the sole criterion for getting admission to the IITs, and in that sense, the IITs are theoretically open to students of any caste and class, in practice, more students belonging to upper and middle castes and classes have been admitted. This is not to deny that there are some students from lower castes and classes who also get admitted to the IITs every year; in addition, there have been special provisions for admitting students from scheduled castes and scheduled tribes. The study further points out that, once admitted, students belonging to upper and middle castes and classes are likely to have a much more positive experience and higher success rate than those belonging to lower castes and classes. In this sense, education at the IITs has been for the privileged sections of Indian society.

Engineering education and IITs

Evolution

During British colonial rule, India had very little growth in engineering education. However, demand for labor to execute public work-plans such as roads and railway, and locate and assess the natural resources of the country, led to opening of a few engineering colleges in the mid-1850s (Sangwan 1990). The Thomson College of Engineering was set up in Roorkee in 1847 to train Indians for a canal project. The British also established three universities in Bombay (now Mumbai), Calcutta (now Kolkata), and Madras (now Chennai) in 1857. However, higher education in these universities mostly favored studies in languages and humanities rather than science and engineering (S&E). With the specific objective of serving the needs of the colonial government, universities and colleges neither became centers for higher learning nor led any advancement in S&E knowledge (Chitnis 2000).

The idea of central technological institutes such as the IITs took shape around India's independence. In 1946, a committee headed by Nalini Ranjan Sarkar recommended the creation of technical institutions of higher learning along the lines of the Massachusetts Institute of Technology (MIT) in the United States. Jawaharlal Nehru, India's first prime minister from 1947 to 1964, believed that excellence in S&E education was essential for India's transformation from an economically poor and technologically backward former colony into a modern advanced nation (Tharoor 2003). Nehru's government oversaw the establishment of five original IITs: IIT Kharagpur in 1951, IIT Mumbai in 1958, IIT Chennai in 1959, IIT Kanpur in 1960, and IIT Delhi in 1961. After over 30 years, two new IITs, one in Guwahati and another in Roorkee were established in 1995 and 2002, respectively. In 2008, the Indian government decided to open eight additional IITs in the states of Andhra Pradesh, Bihar, Gujarat, Himachal Pradesh, Madhya Pradesh, Orissa, Punjab, and Rajasthan, after persistent demands from the state governments which did not already have the IITs. Students were admitted to six of them through the JEE; in 2009, students were admitted to the remaining two as well.

Faculty and curriculum

Every IIT is autonomous in its hiring policies for the faculty. Besides teaching, faculty are expected to maintain a world-class research program. They must keep the standards of an internationally competitive system of higher education. The IITs faculty enjoy autonomy in deciding the curriculum and requirements for degrees.

Students are admitted into different departments based on their score/rank on the JEE and preferences. They have the option of changing their major after their first year of studies; however, switching majors is very difficult and is available to only a few of the most meritorious students as determined by their grade point average (GPA) and availability of vacant seats. Students are subjected to a challenging curriculum and heavy workloads in the English medium of instruction. In the first year, all students follow a common course structure, consisting of basic courses from the most departments. The second year onwards, students take courses from their respective departments. By the time they finish third year, students have to undertake a summer internship or project at an industry or an academic institute. A student must complete 180 credits in four or more years to receive a bachelor's of technology.

Finances

The Indian government's support for higher education stems from the understanding of the public good characteristics of higher education, the externalities associated with it, and its effect on growth, distribution, and overall development (Tilak and Varghese 1991). Both the central and state governments bear the cost of higher education in India. The central government mostly funds India's central universities and institutions of national importance while state governments fund state colleges and universities. The Indian Institute of Technology Act of 1956 declared the IITs to be "institute(s) of national importance." Currently, the central government funds over 80% of the IITs budget.

The central government's funding of central institutions and institutions of national importance is increasingly coming under criticism. It is argued that such institutions cater for <2% of the students, but get 85% of central funds for education. Nearly one-third of institutions of higher education all over India do not get central funding at all, and of the remaining, only about half of them get some central funding (Agarwal 2007). Other engineering institutions depend on state governments for funding, the lack of which has created a sharp increase in tuition fees. Better funding and fewer students at the IITs translate into superior education, improved facilities, and a high faculty to student ratio compared with other engineering institutions.

Since the IITs get the most support from the central government, it keeps the cost of education to students low compared with the cost to engineering students elsewhere. The tuition, room, and board for a four-year bachelor's of technology program at the IITs are estimated to cost a student approximately rupees 100,000 per year (~2,000 USD). In addition, there are some scholarships available to students. For instance, the Institute Merit-cum-Means scholarship in the amount of rupees 1,000 per month (~20 USD) plus some tuition waiver is available to 25% of students whose parent's annual income does not exceed rupees 200,000 (~4,000 USD). Renewal of scholarship is every semester and is subject to a minimum cumulative GPA of 5.0. Students belonging to scheduled castes and scheduled tribes are exempt from the payment of all tuition fees. If these students maintain a cumulative GPA of 5.0 every semester and their parent's annual income does not exceed rupees 200,000 (~4,000 USD), they are also given pocket allowance of rupees 250 per month (~5 USD), free food in mess, and exemption of hostel rent.

Admission and JEE coaching

For admission to an undergraduate program at the IITs, students must have senior/higher secondary school certificates with a minimum total score of 60%, they should be below age 25, and they have to take the JEE. There have been several changes to the JEE—in the format as well as in the content, over the past several years. Currently, the JEE, which is common to all 15 IITs, tests students in three subjects—chemistry, mathematics, and physics. The rationale for the JEE is that varied marks of different school boards cannot be used to create a common merit list. The JEE is extremely competitive, and students are allowed a maximum of two attempts at it. Prior to 2008, 200,000–350,000 students from all over India appeared in the JEE for nearly 4,200 seats in seven IITs. The number of seats first increased to nearly 5,000 with the opening of six new IITs in 2008, and then to nearly 6,000 in 2009 with the opening of two new IITs.

The need to "crack" (pass) the fabled JEE has spawned a massive private coaching industry. According to one estimate, the annual cumulative turnover of the coaching industry is a staggering rupees 1,000 crores (~200 million USD), spent by parents, which

is more than the annual expenditure of rupees 100 crores (~20 million USD) of an IIT (Murthy 2005). Often, the preparation for the JEE begins as early as primary school. It culminates in the final year of secondary school that includes up to six hours of training and homework at the JEE coaching schools, in addition to regular school classes. The nature of teaching in the coaching centers is intensive and demands that students distance themselves from a normal adolescent life. Furthermore, coaching schools with better facilities tend to be expensive and located in metropolitan cities; thus, they are outside the reach of students from the lower and lower middle classes and from rural areas. An exception is the Super 30 (<http://www.super30.org/>), an educational program in the state of Bihar, which opened in 2003 to select a group of 30 IIT aspirants from extremely poor families and provide them with free coaching, food, and accommodation. During the first year of coaching, 18 students made it to the IITs. The number rose to 22 in 2004, 26 in 2005, and 28 each in 2006 and 2007. It finally culminated to 30 each in 2008 and 2009, a 100% success rate.

Reservation policies

Earlier, children belonging to scheduled and backward castes had been excluded from formal education. The Indian Constitution acknowledges that the scheduled castes (they are considered to be lowest in the caste hierarchy) and the scheduled tribes (they have functioned outside the mainstream of urban and rural life) have historically been neglected and discriminated against, and categorically accepts the obligation to provide them with “special protection” and “special provisions” for advancement (Rao 2002). Towards this end the scheduled castes and scheduled tribes are provided with a quota of “reserved” admission seats to institutions of higher education as well as “reserved” positions in government and public sector employment. The national reservation policy makes it mandatory for government funded colleges and universities to accept students from the scheduled castes and scheduled tribes, even if the level of their performance is below that of those who are admitted on the basis of open competition.

Before 1973, students were admitted to the IITs solely based on their performance/rank in the JEE. Since 1973, a total of 22.5–15% of seats for the scheduled castes and 7.5% seats for the scheduled tribes—have been reserved in each IIT. Typically, reservation seats are offered to those who get at least two-thirds of the marks obtained by the student with the lowest score in the JEE who is admitted in the open category. Students who do not meet the two-thirds criterion are offered free “preparatory courses” in Chemistry, English, Mathematics, and Physics for a year at the IITs they are admitted. If these students are able to secure a passing grade during the end-of-semester exams, they are admitted into the first year undergraduate program. Otherwise, they have to leave the IIT, a policy that has been criticized since those forced to leave waste their year as well as develop a sense of failure (Kirpal and Gupta 1999).

India’s reservation policy has generated lots of controversies. The main argument against the reservation policy is that it does not promote merit. Critics have been arguing that the reservation at the IITs is going to kill meritocracy which is needed to make India a “soft power” in the global economy. They contend that the reservation divides the society into caste lines, which should be eliminated in an independent India. They further claim that the reservation is against the fundamental right of equality for everyone. Most importantly, critics view a support for reservation as a populist measure used by political parties and politicians for electoral gains (Gulhati 2006). They suggest that the Indian society would be better off not dragging the IITs into caste politics.

In 2006, the central government announced that it would implement the 1980 recommendations of the Mandal Commission to reserve 27% of seats for “other backward castes” (they are specified by the central government on the basis of 11 social, economical and educational factors), in addition to already 22.5% seats reserved for the scheduled castes and scheduled tribes, at the central higher educational institutions including the IITs. This proposal resulted in widespread protests, including demonstrations, hunger strikes, and threats of self-immolation. A challenge to the government’s proposal was filed which reached all the way to the Supreme Court (Menon 2006). Before the Supreme Court ruling, there were petition drives initiated by the alumni, faculty and students at most of the IITs. In 2008, the Supreme Court upheld the government’s proposed reservation policy at the IITs.

Following the Supreme Court ruling, the IITs directors agreed to implement the 27% quota for the other backward castes over a three year period in phases, starting with July 2008 (Chhopia 2008). In 2008, 1,134 out of 72,116 other backward castes, 690 out of 28,393 scheduled castes, and 159 out of 8,514 scheduled tribes candidates cleared the JEE (Staff Reporter 2008). In 2009, with 10% relaxation in the cut-off for the other backward castes category vis-à-vis the open category and 50% relaxation for the scheduled castes and scheduled tribes, 1,930 out of 1,04,045 other backward castes, 967 out of 36,117 scheduled castes, and 208 out of 12,484 scheduled tribes candidates have emerged successful in the JEE. In addition, 473 scheduled castes and 641 scheduled tribe’s candidates have qualified for the preparatory courses (IIT Bombay Heritage Fund 2009). Despite relaxation, the number of scheduled castes students who qualified was still 75% of the seats reserved for them; in the case of the scheduled tribes category, the percentage of those who qualified was 33% of the available seats in 2009.

After graduation

The degrees awarded by the IITs are well recognized inside and outside India. After finishing their undergraduate studies at the IITs, many students are known to leave India to pursue a graduate degree in S&E in the Western countries. After obtaining their graduate degrees, they tend to settle abroad, as they are offered lucrative jobs by the multinationals or academic jobs by institutions of higher education (Varma 2006). One estimate suggests that close to half of all the IIT graduates are working or studying outside India (Leslie and Kargon 2006). The departure of the IIT graduates has been seen as a brain-drain—a one-way movement, or an exodus, that involves the movement of highly skilled personnel from the South to the North, or from the developing to the developed countries, which only benefits the developed (host) countries (Gaillard 1991). The 2001 Human Development Report of the United Nations Development Programme estimated that India’s loss from the migration of software professionals, many of whom are IIT graduates, is as much as 2 billion USD a year (Murali 2003).

With the economic liberalization policies introduced by the Indian government in 1991, many big multinationals have established their research and development (R&D) centers in India. They are increasingly recruiting students graduating with a bachelor’s degree for jobs in India at their subsidiaries as well as in their parent companies outside India. Indian companies are not behind the multinationals either. In fact, Indian companies and foreign multinationals visit the IITs frequently for recruiting purposes. The jobs packages are extremely lucrative. This seems to have resulted in fewer and fewer IIT graduates going for higher studies within India and/or abroad. For instance, only 1% of students graduating

from the IITs and Indian Institutes of Science opted for a master's of technology degree in 2006 (Banerjee and Muley 2007).

The study

The present paper is based on a survey conducted by Varma of undergraduate students at two of five original IITs (established by the early 1960s) in 2007 and 2008; the two IITs which were established in the 1990s are comparatively small in size and the remaining eight IITs came into existence in 2008, after the data were collected. Further, new IITs are yet to be fully established; they offer limited degrees and currently lack faculty and resources (Chaudhary 2008). Based on the ranking received in the JEE, students get to choose the location for their studies and there is a high demand for admission to the five original IITs. The Institutional Review Board (IRB) at the University of New Mexico, which granted the permission to collect primary data, requires that names of IITs and subjects cannot be disclosed. The technique of survey was considered useful primarily because the purpose of the study was to acquire information on the attitudes of students, and it allowed the collection of data from a large number of students in relatively short periods at low costs. Three classes at each IIT were randomly selected and surveys were administered to all students before the classes began. A total of 259 surveys were completed. The participation was voluntary. None of students declined to fill out the survey once given, though not all students answered every question.

The survey was organized into different categories: (i) socioeconomic information about students and their families (ii) schooling and coaching (iii) infrastructural support and other support mechanisms at the IITs (iv) satisfaction at the IITs (v) future plans vis-à-vis job in India/abroad or going for higher studies in India/abroad, and (vi) how well IITs have served people in India. Responses to these questions were used to test the following hypotheses:

- H₁: Students' family income level will vary significantly with their rank in the caste hierarchy.
- H₂: Students' intermediate college types will vary significantly with their family's income level.
- H₃: Students' attending the coaching school will vary significantly with their rank in the caste hierarchy.
- H₄: The amount of money spent in the coaching school will vary significantly with students' family income level.
- H₅: Students' satisfaction at the IITs will vary significantly with their family's income level.
- H₆: Students' satisfaction at the IITs will vary significantly with their rank in the caste hierarchy.
- H₇: Knowledge added at the IITs will significantly vary with respect to students' future plans.
- H₈: Students' from different castes will vary on their view on increasing the number of undergraduate students admitted to the IITs.

Two independent coders coded the data to ensure consistency. The cross tabulation function of SPSS version 14.0 was used for testing the significance of the differences in the perceptions of students (H₁–H₈). Statistical testing was based on the Pearson Chi-square test.

Findings

Caste and class status

The first hypothesis tested whether students' family income will vary significantly with their caste (upper, middle, and lower). Since the status of caste has been socially constructed over a long period of time based on a number of factors such as the birth, customs, economic well-being, occupation, and rural areas, students were asked to identify the rank of their caste, than the actual caste. The category not applicable included students who did not believe in the caste system, did not know their caste, or were from religions other than Hinduism. A large majority of students identified themselves as Hindus (88%), followed by Jains (3.6%), Sikhs (3%), Christians (1.6%), Muslims (1.2%), Buddhists (0.8%), and others. Table 1 presents very big χ^2 (33.556) and very small p value (0.0001). It proves that as the income level increases, the proportion of students in higher caste increases and the proportion of students in lower caste decreases. Hypothesis One was supported.

Pre-IIT schooling and coaching

The second hypothesis tested whether the types (private, central government, and state government) of intermediate college (11 and 12th grades) attended by students will vary significantly with their family's income level. Table 2 shows big χ^2 (18.449) and very small p value (0.0052). It indicates a positive relationship between intermediate college types and family's income level. Hypothesis Two was supported. The proportion of students in private college increases if family income level increases. For the monthly income level rupees 25 K–50 K and rupees 50 K–100 K, attendance in private college is much higher than in central or state government colleges.

Table 1 Family income level and caste rank

Caste	<25 K rupees per month	25–49 K rupees per month	50–100 K rupees per month	>100 K rupees per month	Total	Percentage
Upper caste	15	21	28	34	98	43.2
Middle caste	13	7	10	19	49	21.6
Lower caste	12	8	1	0	21	9.3
Not applicable	19	14	6	20	59	26
Total	59	50	45	73	227	100

$$\chi^2 = 33.556, df = 9, p \text{ value} = 0.0001$$

Table 2 Intermediate college and the family income level

College types	<25 K rupees per month	25–49 K rupees per month	50 K–100 K rupees per month	>100 K rupees per month	Total	Percentage
Private	36	41	38	55	170	71.1
Central government	4	7	2	2	15	6.3
State government	23	9	4	18	54	22.6
Total	63	57	44	75	239	100

$$\chi^2 = 18.449, df = 6, p \text{ value} = 0.0052$$

Table 3 Caste and the coaching school

Coaching	Upper caste	Middle caste	Lower caste	Not applicable	Total	Percentage
Yes	90	49	19	55	213	90.3
No	7	8	6	2	23	9.7
Total	97	57	25	57	236	100

$$\chi^2 = 10.193, df = 3, p \text{ value} = 0.017$$

Table 4 Money spent on the coaching school and the family income level

Coaching cost (in rupees)	<50 K rupees per month	>50 K rupees per month	Total	Percentage
<25 K	16	4	20	9.5
25–49 K	37	36	73	35.5
50–74 K	27	42	69	33.5
75–100 K	8	13	21	10.2
>100 K	5	18	23	11.2
Total	93	113	206	100

$$\chi^2 = 17.234, df = 4, p \text{ value} = 0.002$$

The third hypothesis tested whether the likelihood of students attending the coaching school will vary significantly with their caste. Table 3 displays big χ^2 (10.193) and small p value (0.017). It shows the higher the caste, the more likely it is that the student will attend the coaching school. Hypothesis Three was supported.

The fourth hypothesis tested whether the amount of money spent for students' preparation of JEE in the coaching school will vary significantly by their family's income level. Table 4 illustrates big χ^2 (17.234) and very small p value (0.002) when monthly income is coded less and more than rupees 50,000. It shows the higher family income, the more money family invests in the coaching school for the JEE. Hypothesis Four was supported.

Satisfaction at the IITs

The fifth hypothesis tested whether students' satisfaction at the IITs will vary significantly with their family income level. Table 5 combines bad and not good into one category, and excellent and good into the other category. It shows big χ^2 (11.058) and small p -value

Table 5 Satisfaction at the IITs and the family income level

Satisfaction	<25 K rupees per month	25–49 K rupees per month	50–100 K rupees per month	>100 K rupees per month	Total	Percentage
Bad and not good	33	12	6	17	68	30.4
Excellent and good	42	46	25	43	156	69.6
Total	75	58	31	60	224	100

$$\chi^2 = 11.058, df = 3, p \text{ value} = 0.011$$

(0.011). Hypothesis Five was supported. Generally, the lower the income level, more students have bad and not so good satisfaction; conversely, the higher the income level, more students have excellent and good satisfaction.

Two sub-hypotheses were also examined: responses with respect to (i) how the IIT education added to the students' knowledge base, and (ii) infra-structural support available to students at the IITs differed based on the income level of their families. A positive relationship was found for both sub-hypotheses. Therefore, Hypothesis Five was confirmed under any condition.

The sixth hypothesis tested whether students' overall experience at the IITs will vary significantly with students' caste. Table 6 presents small χ^2 (1.872) and big p value (0.599), which indicates that Hypothesis Six was not supported. Students overall experience at the IITs appears to be independent of their castes and more linked to economic background as measured through the family income level.

Post graduation plans

The seventh hypothesis tested whether knowledge added at the IITs will vary significantly with respect to students' future plans. Table 7 combines little and average knowledge added by the IITs into one category, and significant and very significant into the other category. Future career plans were classified in terms of higher studies and job, both in India and abroad. Table 7 shows big χ^2 (9.052) and small p value (0.029). It indicates that knowledge acquired at the IITs indeed differed with respect to students' future plan about studying abroad, working abroad, studying in India, and working in India. Hypothesis Seven was supported. There are more students selecting to study abroad within little and average category than going abroad to work, study in India, and work in India. There are more students desiring to work in India within significant and very significant category than studying abroad, studying in India, and work abroad.

Two sub-hypotheses were also examined: responses to knowledge acquired at the IITs differed significantly with respect to students' future plans about (i) study or job; and (ii) going abroad or staying in India. A positive relationship was found for both sub-hypotheses. Therefore, Hypothesis Seven was confirmed under any condition.

Table 6 Satisfaction at the IITs and caste

Satisfaction	Upper caste	Middle caste	Lower caste	Not applicable	Total	Percentage
Bad and not good	27	14	6	21	68	31.3
Excellent and good	68	30	17	34	149	68.7
Total	95	44	23	55	217	100

$$\chi^2 = 1.872, df = 3, p \text{ value} = 0.599$$

Table 7 Knowledge acquired at the IITs and future plans

Knowledge added by the IITs	Study abroad	Job abroad	Study in India	Job in India	Total	Percentage
Little and average	28	20	23	20	91	39.7
Significant and very significant	40	19	24	55	138	60.3
Total	68	39	47	75	229	100

$$\chi^2 = 9.2409, df = 3, p \text{ value} = 0.026$$

Table 8 Caste and increasing the student population

Increasing admission	Upper caste	Middle caste	Lower caste	Not applicable	Total	Percentage
Yes	15	13	10	14	52	25.6
No	76	33	10	32	151	74.4
Total	91	46	20	46	203	100

$$\chi^2 = 10.954, df = 3, p \text{ value} = 0.012$$

Opening up the IITs

The eighth hypothesis tested whether students from different castes will vary significantly on their attitude towards increasing the number of undergraduate students admitted to the IITs. Table 8 displays big χ^2 (10.954) and small p value (0.015). Hypothesis Eight was supported. The higher the caste the students are from, the more likely they are to say “no” to the increase in the number of seats.

Discussion

Access

Theoretically everyone desiring to study at the IITs has an equal chance at getting into them since the IITs do not bar any student based on caste, class, gender, region, or religion, and the admission to the IITs is by enlarge strictly based on the performance in the JEE. The socioeconomic status (as measured by caste and class representation) of the Indian society, however, is not reflected at the IITs. The study shows that students from upper and middle castes and classes are likely to have a better chance of getting admitted into the IITs. Socially, almost 65% of the students came from upper and middle castes, with 43% belonging to upper castes; only a little over 9% of students were from lower castes. Economically, over 50% of students came from families whose annual income exceeded rupees 600,000 (~12,275 USD), with 32% being in the over 1,200,000 (~24,550 USD) per year income brackets; 26% of students' families earned less than rupees 300,000 (~6,140 USD) per year. These students had better access to a good high school (9 and 10th grades) and intermediate college (11 and 12th grades) with English medium of instruction. Most importantly, their families had financial resources for using a reputable coaching school for the JEE.

The survey reported near unanimity among all students that coaching outside regular schooling is essential for succeeding in the JEE. In fact, over 90% of the students went for coaching for the JEE. Coaching was considered necessary even when students had gone to prestigious high schools and intermediate colleges. There appears to be little relationship between what students are expected to master to perform well at the board examinations and the syllabus for the JEE (Murali 2007). Furthermore, the JEE is extremely competitive (about 2% success rate), and a single mark in the JEE score (which is a miniscule percentage of total number of marks) can decide whether one gets into an IIT or not.

The coaching industry for the JEE has grown tremendously and has become professionalized and corporatized (Murthy 2005). Most renowned coaching schools are in metropolitan cities, and students are taught by reputable teachers including retired IIT professors and/or IIT graduates. Some of famous coaching centers have their own entrance

tests to select students for admission. Generally, the reputation of the coaching centers attracts students from all over the nation. Most coaching centers differ in their fee structure, but the survey shows that a family may have to spend anywhere from rupees 50,000 to 100,000 (~ 1,000 to 2,000 USD) which can be a substantial percentage of the savings of a low income family. This cost does not even include living costs for students who must move away from home city/town to attend the coaching centers. These factors put students from low income families and rural/small towns to further disadvantage.

Satisfaction

Living experience and academic satisfaction of students after admission to the IITs are also conditioned by their socioeconomic status. The study shows that students from the low income families seem to have more difficulty adjusting to the IIT life style than those from high and middle income families. Whereas most students from varied backgrounds reported overall satisfaction at the IITs, among those who reported bad or not good satisfaction, most were from low income families. This is mostly because the living environment at the IITs is rather urban and westernized, which can be intimidating at the beginning for those students who have not been raised in such a setting.

Considering the caste division is very much alive even after 60 years of India's independence and most IIT students are from upper and middle castes, it is likely that students belonging to lower castes will face a difficulty in integrating into the IITs mainstream culture. For instance, students tend to graduate from the IITs in four years. The drop-out rate is from 5 to 10%; however, the drop-out rate among students from scheduled castes and scheduled tribes is much higher, ranging from 15 to 25% (Kirpal and Gupta 1999). A report prepared by two former directors of IITs noted that 25% of those admitted through seats reserved for scheduled castes and scheduled tribes, were forced to quit, as they could not complete a four-year course even in six years (Gill 2006). In 2009, 12 students belonging to scheduled castes and scheduled tribes from the IIT Delhi were asked to leave due to their poor performance (Dhoundial 2008). The present study, however, did not find any support between students' caste and their satisfaction at the IITs. Perhaps, it is because the percentage of students belonging to lower castes is quite small, at slightly more than 9%.

Future

Regarding future plans, the study shows that IIT students are more inclined to go for jobs than for higher studies. As they learn about opportunities for their career, opting for graduate studies became less attractive, especially when the multinational corporations have eagerly recruited IIT graduates not only for their subsidiaries in India but also for their companies abroad. The job packages include high salaries and generous benefits. Consequently, going for higher education is no longer the main passport for going to the United States or European countries. This shows that the phenomenon of brain drain for the IIT graduates might be changing. Nonetheless, future prospects are also conditioned by students' socioeconomic status. Though the study did not survey students after they graduate from the IITs, it has been found that graduates belonging to the lower strata from the IITs face considerable hurdles in the job market (Gill 2006).

On the question of opening the IITs to the broader section of the Indian society, there seems to be a general consensus among those who are already at the IITs that the quality and the brand name will suffer if this is done at the expense of JEE-based admission. This

study did not separately survey those who belong to scheduled castes and scheduled tribes; they are likely to feel that broadened reservation at the IITs will increase the chances of those belonging to lower castes for studying in IITs. When asked about whether the number of students admitted to the IITs should be increased, nearly 25% of students responded favorably. Among the lower castes, the percentage of students jumped to 50%.

Conclusions

Given that the population of India is demographically diverse, it is critical that the IITs (and other institutions of higher education) need to aspire to reflect such reality. The IITs with diverse student bodies and policies can foster open interaction and learning across caste, class, gender, and religion, as well as can provide a strong foundation for the IITs' efforts to achieve a fair and inclusive environment. The IITs themselves need to identify under-representation of students along caste, class, gender, and religion, and establish goals to improve the situation. They need to undertake actions to reverse historic patterns of discrimination against low castes, low income families, religious minorities, and women. But, it seems the IITs have been catering to predominantly Hindu students from upper and middle castes and classes. Both administration and the faculty have failed to address lack of diversity among the IITs student population.

Now the central government has intervened. By implementing the recommendations of the Mandal Commission in education in 2008 (and in government in 1990), the government has selected caste as a sole instrument of social change. However, not all students from scheduled castes, scheduled tribes, and other backward castes are poor; similarly, not all students from upper and middle castes are rich. In the study, 15% of the upper caste students identified themselves belonging to families with the lowest income level (less than 25 K rupees per month). Also 26% of students stated that the caste was not applicable to them. Some of these students are perhaps non-Hindus, but also some students did not want to identify themselves with any caste either because they did not "believe in the caste system" or found "caste to be immoral". Further, it is not clear whether the benefits of reservation are going to the poor segments of scheduled castes, scheduled tribes and other backward castes; it is very likely existing reservation benefits are taken by the higher class of lower castes than the needy ones. In other words, caste does not seem to be a useful construct. This suggests that class needs to be combined with caste in the central government's reservation policy.

In the midst of mediocre higher education institutions in India, the IITs remain a small number of centers of academic excellence. The government's fixed quotas to make the IITs accessible to students belonging to lower castes by relaxing admission criteria cannot be considered a panacea to equity and social justice in the caste-ridden Indian society. There is a need to find a balance between equity and quality at the IITs. Many different complimentary mechanisms need to be developed. The central government could provide free coaching facilities to students who can qualify to write the JEE and are from poor households, scheduled castes, scheduled tribes, and other backward castes so these students are prepared to handle the IITs rigorous curriculum. The success of Super 30 (<http://www.super30.org>) group has demonstrated that when provided proper opportunities and coaching, students from lower castes and classes can succeed in the JEE as well. One possible alternative is for the central government and state governments to provide funding to organizations such as Super 30 to run coaching institutions for students belonging to lower castes and classes.

With regards to helping students from lower castes and classes, after their admission to the IITs, in adjusting to the new living and academic environment, support groups, both informal and formal, and living communities should be developed. When these students face problems, they should be able to go freely to such organizations and get help—academic, social, and psychological. All the IITs do have counseling services for students; however, it is unclear how well they have functioned for students belonging to lower castes and classes.

In addition, there is a need to expand similar studies by focusing on students belonging to different religions as well as women on the IIT campuses. The Indian government has commanded attention to the lower segments of the Hindu population, and not given consideration to the backward sections among religious minorities especially Muslims who are over 13% India's population but a tiny minority (about 1%) at the IITs. Similarly, women make a very small portion of IITs students (about 10%) and little consideration is given to them in increasing the diversity at the IITs.

The diversity of the student body at the IITs is in sharp contrast to the admission mechanisms used by the top U.S. universities, including the MIT, on which the IITs have been modeled and are compared with. The admissions criteria at the MIT takes into consideration many factors, besides merit, which have led to increased enrollments of women and minorities. Women make up nearly half of MIT's undergraduate student body while minorities including Asians make up over 40% of its undergraduate students. With the vision that science, technology, engineering and math (STEM) are not “just for boys” or “just for whites,” MIT has attracted a diverse student body in order to have a “collaborative culture.” In fact, MIT is one of the most diverse universities in the world; there is no majority gender or race/ethnicity. This has been achieved through a wide variety of programs without sacrificing merit and higher standards in any way. To make sure they do well in their studies, the MIT provides a number of resources specifically intended for women and minorities such as advisors, support groups, enrichment programs, career advisement, and hiring of women and minorities as a faculty (Leslie and Kargon 2006). While there is still a lot to be achieved in improving diversity of student populations at the MIT and other top U.S. institutions of higher learning along gender, ethnic/race, and class lines, there is a general consensus that diversity does not have to sacrifice higher standards and merits. The general view of the faculty and administration at the IITs seems to be that enhancing diversity of the student body based on caste, class, and minority representation will lower the quality of the student body and the IIT education, thus damaging IITs' image and standing in the world.

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