Technology, Education and Colonialism in British India 1830's-80's: Convergence or Incongruence?

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> Education may be generally defined to be the cultivation of the mind in relation to the laws of external nature and of our own consciousness. The drawing out and disciplining of the faculties of the mind for the methodical pursuit of knowledge may be said to constitute the great aim of education.
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> S. C. Chuckerbutty
> *Popular Lectures on the Subject of Indian Interest*
> (Calcutta 1870) 74.

> For the development of her natural resources, India's most crying need is not higher technical education, but private enterprise and private capital.
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> *Calcutta Review* 104 (1897) 238.

The first statement shows how some of the colonized felt about education *per se* while the second sums up succinctly the colonizers' point of view. Some interesting work has been done on the place and role of technology in the process of colonization[1] and a lot more on 'colonial education'.[2] Colonization being a complex process, means that it is not only technology as a tool that is important. Technology as a form of knowledge (referred to somewhat loosely as technical education in the colonial records) is much more important. How was this

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1 D. R. Headrick *Tools of Empire* (New York 1981); *The Tentacles of Progress: Technology Transfer in the Age of Imperialism, 1850-1940* (New York 1988); Michael Adas *Machines as the Measure of Men* (Ithaca 1989).

2 A recent work that deserves special notice: Krishna Kumar *Political Agenda of Education: A Study of Colonialist and Nationalist Ideas* (New Delhi 1991).

knowledge to be generated, used or transferred, and to whom? Did these interests converge or did they remain largely incongruent? My argument is that though theoretically they seem to converge (with the colonizer using both education and technology to strengthen his position), in practice they appear ad-hoc, half-hearted and incongruent colonial imperatives, distorting and subverting the nature and purpose of scientific and technical education (or education itself) meaning that what a colony received was some sort of a low form of technical education administered under 'controlled' conditions.

Here it is important to note that under the East India Company, perhaps for the first time in Indian history, the state had emerged as the producer of knowledge and the sole arbiter of what was to be delivered and to whom. The recipients had limited options and a limited access. Moreover, they had their own prejudices and requirements which were not always congruent with those of the rulers. Rather they differed greatly. It is in the realm of education that cultural encounters take place and unfold the complications of civilizational interactions. From this point of view the period 1830 to 1880 is perhaps more significant and eventful than any other period. It begins with the so-called Anglicist-Orientalist controversy[3] in which the participants were the British themselves. Behind the facade of divergence there existed a remarkable unity—unity in views about the 'nature of the natives' and the purpose of British rule. An emerging Indian middle class was quick to perceive the benefits of Western knowledge and techniques. Ram Mohun Roy was one of the earliest to realize the importance of Western rationality as handed down by Bacon and Descartes. He did not refer explicitly to technology. His reference to Western science and knowledge perhaps included that. But for the colonial administrators technical assistance (not expertise) from the Indians was more important. Proper science education did not fit into the exigencies of the Company Raj.[4] But the Company required a number of subordinates, assistant surgeons, overseers, etc., to help the British army and public works establishments. Importing them from Europe would have been uneconomical. So some sort of technical education for the Indians soon came on the agenda. Local support for the imperial edifice was vital in more than one sense. Medical and engineering education were thus important projects which deserve notice in some detail.

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3 For details see H. M. Griffin "T. B. Macaulay and the Anglicist Orientalist Controversy in Indian Education" (Dissertation, Pennsylvania University 1972).

4 Deepak Kumar 'Science in Higher Education: A Study in Victorian Era', *Indian Journal of History of Science* 19.3 (1984) 253.

1. Medical Education

As the demands of subordinate health workers grew, a medical school was proposed in 1822 with the twin purposes of teaching both the Western and Indian systems of medicine. Medical classes were also started at the Calcutta Sanskrit College and the Calcutta Madarsa. Similar experiments were made in Bombay and Madras as well. In early 1826 a medical school was founded in Bombay by Elphinstone, the governor, with a loftier objective of general diffusion of medical science among the natives by educating native youths to a knowledge of the European system and then sending them into the districts to practice.[5] But since the government's needs were primarily of a military character, this utilitarian object sank into one of secondary and subordinate concern, and the education of hospital assistants, an object not mooted in the first instance, was taken up. But even this could not progress well due to the government's lack of interest and paucity of funds. After a brief and sick existence of six years, this school was abolished.

The progress of medical education through the only surviving Calcutta school, the experiments in Bombay and Madras having failed, took a curious turn in the year 1833, when the 'language controversy' arose. In this controversy, Dr. John Tytler, principal of the school, sided with the orientalists. He admitted that the indigenous systems were medieval, but he knew that they contained grains of truth. For him, the only solution was to allow the students to draw comparisons, sort out errors, and then work towards the improvement of their own system.[6] The Anglicists, as expected, found no merit in Tytler's views. Tytler found himself in the soup when he started preparing Arabic translations of a few European textbooks. The problem of vocabulary was most serious, for in order to translate one word of English, he spent hours in searching through Arabic lexicons, only to find that its counterpart did not exist. He concluded that translations were unprofitable, and that many years would elapse before the Indians rejected the 'crude fallacies' which their medical system upheld. He thus provided the Anglicists a stick to beat around.[7] The result was, in early 1835 the medical classes at Sanskrit College and Madarsa were abolished along with the Native Medical Institution itself, and a new college was founded wherein all pupils were required 'to learn the principles and practice of medical science in strict accordance with

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5 *Home Public* 18 (KW July 18, 1838).

6 *Centenary Volume of Calcutta Medical College* (Calcutta 1935) 7-9.

7 Griffin, H. M. *Op. cit.*, 135.

the mode adopted in Europe'.[8] This was an important event, for henceforth, through syllabi and language, was to be fostered a 'dependent science', and Indians were made to look for Western models in every field of medical science.

It was easier to dangle Western models and flaunt the superiority of Western systems, but when some financial investment was required in realization of its proclaimed objectives, the government would develop cold feet. To quote a despatch from the Court, "the plan of establishing a laboratory at the Presidency [College, Bengal] similar to that at Apothecaries Hall in this country [England], with an establishment of chemists, aided by a steam engine, and other expensive apparatus, will, we apprehend, be found an inexpedient and unnecessary measure and we desire accordingly that it be not carried into effect."[9] This veto was given in the very year in which Madhusudan Gupta had become the first Indian to dissect a human corpse—an event thought worthy of commemoration and for which Fort William even boomed a 51 gun salute.

Pumping resources was thus no easy matter. The local rich came forward. The next year a magnificent galvanic battery was presented to the College by public subscription. D. N. Tagore offered annual prizes to the tune of Rs. 1000, and Mutty Lal Seal later gave a large piece of land. In 1845 four Indian medicos were sent to England for higher studies; two were sponsored by D. N. Tagore and one each by Dr. Goodeve and the Nawab of Murshidabad.

The progress was certainly steady and well-geared to meet the immediate requirements of the government. By 1838 the demand for 'Native Doctors' in the army became so pressing that a Hindustani class had to be opened in which anatomy, medicine and surgery were taught in Urdu, the original scientific nomenclatures, however, being retained. Later, in 1851, a Bengali class was also opened. Despite the Macaulayan verdict, subdued voices were still heard in favour of the vernacular. The Hindustani and Bengali classes were extremely popular, and many thought that only through them European science could be popularized. Academically, the students of Hindustani (Military) classes were often found better. In 1848 a teacher noted, 'the dissections of the English class were for the most part decidedly inferior to those of the Military class. Whereas the dissecting rooms of the Military class were found generally full of diligent dissectors, and the subjects were never thrown away only partly dissected; the reverse was the case with the English class.'[10]

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8 *Home Public* 20 (March 7, 1835).

9 Court to Gov. General, September 26, 1836, IOR, E/4/752, *Bengal Despatches* XIII (1837).

10 *The Indian Register of Medical Science* I (Calcutta 1848) 329-332.

The Medical colleges were fairly stabilized by the time the new universities assumed control over them. In 1858 the Calcutta Medical College had ten chairs in anatomy, physiology, zoology, chemistry, botany, materia-medica, medical jurisprudence, midwifery, surgery, medicine and opthalmic surgery. Around 900 bodies were being annually utilized for study purposes.[11] In 1860 the students were divided into four classes: the Primary class, the Apprentice class, the Hindustani class, and the Bengali class. Primary class students had the full course of five years in English and were eligible to sit for the Licence in Medicine and Surgery (LMS), the Bachelor of Medicine (MB), and the Doctorate of Medicine (MD) examinations of Calcutta University. Apprentice class was for the Eurasians and was like the other two classes of three years duration. In 1864 the Bengali class was subdivided into two: the Native Apothecary class which trained students for hospital assistantship and the Vernacular Licentiate class which gave more extended clinical training in order to fit the students for independent practice amongst the poor people.[12] This sort of divided system of education effectively met the most pressing local needs, particularly that of the army.

The medical colleges at Bombay and Madras were also doing well. In 1856 the course of instruction given at Madras was recognized by the Royal College of Surgeons, London, and within a decade it had eight professors and five assistant professors.[13] But Madras had no provincial school to impart medical education in the vernacular while Bombay had them in Poona, Ahmedabad, Hyderabad (Sind) and NWP at Agra and Lahore. A medical school was opened at Agra in 1855. This was meant to relieve pressure on the Hindustani class at Calcutta Medical College. But the very next year the proposal to establish a similar school at Beneras was turned down by the Court.[14] Its chairman, Charles Wood, rather preferred elevation of the Agra school to the college level. The Lt. Governor of NWP jumped at the idea and formally asked for it in early 1862. The original function of these medical schools was to educate the natives as native doctors only, and with this in mind, the IG of the Medical Department refused any upgrading. Only the number of students, their scholarships and the salary of the professors were increased.[15] Consolidation of British rule over Punjab and the army needs there, called for the establishment of a medical school at Lahore also. This was done in 1858. The pattern was the same, one English class in which

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11 *Centenary Volume of the Calcutta Medical College* (Calcutta 1935) 39.

12 *DPI Report* (Bengal 1864-65) 19.

13 Crawford, D. G. *A History of the IMS* II (London 1914) 448.

14 Court to Gov. General, July 2, 1856, IOR, E/4/847, *Bengal Despatches* XCVIII (1856) 37-38.

15 IOR, V/6/291, Despatches to India, 1863, *Home Education* 21 (February 28, 1863) 227-232 (emphasis as in original).

Europeans, Eurasians and natives were trained as sub-assistant surgeons in five years, or as apothecaries in three years; and another, a Hindustani class which produced native doctors in three years.[16]

In the mid-1870's medical schools were established at Dacca, Patna, and Cuttack to cater to local needs in the vernacular. Some officials were quite skeptical about these schools. Dr. Wise (Superintendant Mitford Hospital, Dacca), for example, regarded the whole scheme of establishing vernacular medical schools as:

> a most ill-judged and retrograde one... In a small provincial city, where everything that occurs is talked of and often misrepresented, the introduction of a study which is repugnant to the feeling of all classes of natives must afford for many years to come a fruitful subject for exaggeration.[17]

But there was certainly no dearth of students. At Patna, for example, about 80 boys applied for admission out of which 31 were taken. The real problem was that of finance and of incentives. Many were too poor to pay fees and many would leave before the completion of their studies. The principal of Patna Medical School asked the Bengal Government to double the stipendiary grants, and was supported by the deputy surgeon-general of Danapur circle. But the surgeon-general was not in favour of such incentives and the plea fell through. As a result, the number of students gradually declined; in 1885 it fell from 151 to 92.[18]

The products of these schools did labour under certain disadvantages. They were almost entirely debarred from improving their professional knowledge, being unable to consult English works, while those in the vernacular were few and elementary. They had to spend one year at a military hospital or a civil dispensary before going on to the professional LMS course. And there was no uniformity in the curriculum. At Sealdah, Patna and Cuttack medical jurisprudence was taught both in the second and third year while it found no place at the Agra school which rather preferred arithmetic for the first year students. The Agra syllabus was more practical oriented. Every session of the three years' course had lectures on what was then called practical anatomy, practical pharmacy, and practice of medicine. For final year students it prescribed even clinical surgery and clinical medicine. This was not done at the schools in Bengal. The Sealdah and Cuttack schools introduced separate courses on anatomy and physiology, but at Patna they were combined. Again, midwifery was made optional at Patna and was not taught at Agra at all, while at Sealdah, Dacca and

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16 *Home Education* 9-13 (April 7 1863).

17 WBSA *General Education* 113-115 (June 1874).

18 *Bengal Administration Report* (1885-88) 317.

Cuttack it formed part of the second and third year curriculum. Barring these differences, their common subjects were anatomy, chemistry, materia medica, medicine, and surgery.[19]

Botany and other natural sciences were not taught in these schools, but the medical colleges did pay some attention to them. Before 1880 the difference between MB and LMS examinations in Calcutta consisted only in the absence of zoology in the course for the latter. This was often resented. Some thought that the medical colleges were wasting time on natural sciences while they should have concentrated only on 'professional skill, tact and practical knowledge' of the art that medicine was. The Sanitary Commissioner for Madras, Major Cornish, was opposed to what he called a meagre smattering of a few scientific subjects.[20]

2. Engineering Education

The 1830's were important not only for medical and general education purposes. Talks about steamers, the telegraph, drains and railways and the expansion of survey and revenue operations had brought to the fore the necessity of raising a subordinate class of surveyors, mechanics, and overseers. During the last Anglo-Maratha war, Maitland had noticed how difficult it was to secure the services of local artificers, and later recalled "there was a terrible dearth of practical men for the public service, and [that] may account for the very great expenditure of artillery carriages, carts and machines in the ordinance departments".[21] So in 1840, he on his own, without government assistance, set up in Madras a school for ordinance artificers. But in Bengal, the government took the initiative and an engineering class was instituted at the Hindu College in 1843. Two years later, Baird Smith started private engineering classes at Saharanpur.

The stage was thus set for a bigger experiment. The need for a vigorous prosecution of the building of the Ganges canal provided the pretext and in October 1847 a full-fledged engineering college at Roorkee was started. Three courses were offered. The first was an advanced one, the second was exclusively for European soldiers, while the third course was in Urdu for local youths. Unlike the medical ones, these classes were an instant success, and within five years the college got a workshop for scientific instruments, an observatory and a geological museum.[22]

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19 These comparisons have been deduced from: *Home Medical* 23-53 (July 1880).

20 *Home Medical* 42 (August 1877) 101.

21 *Home Public* 3-4 (April 19 1850).

22 Thomason's Despatches *Selections from the Records of the Government of NWP* II (Calcutta 1858) 318.

The success at Roorkee inspired the Court to initiate a degree course in civil engineering in the proposed university curricula. It had been found that the Roorkee teaching was 'far more useful than other lectures'.[23] In 1855 a separate engineering college at Calcutta was enthusiastically sanctioned.[24] Bombay and Madras did not lag behind and here also the Roorkee model was followed. Maitland's Artificers' school was left untouched and a separate engineering college was established.[25] Preparations were thus in full swing for the expansion of what was then termed 'public works'.

The college at Roorkee was an instant success. However, the official view concerning Calcutta was that it could not stabilize. It had a staff of only three persons, and its students were found good only in the book work of Euclid and not in geometry, etc. Thus, Roorkee was favoured and considered superior. Calcutta University had set a very high standard in examinations, in its Master of Civil Engineering (MCE), and its Licentiate in Civil Engineering (LCE). In 1862 it made FA the minimum qualification for appearing at an LCE examination. The result was that no candidate could be found eligible for the LCE.[26] So in November 1864, this college was abolished and its classes were transferred to the Presidency College. This was a mistake. In a petition to the government, one of its ex-students B. N. Das refuted the official charge of local apathy. He rather argued that the system of guaranteed appointments had such a salutary effect that 'many students had their scholarships transferred from the colleges of general education, and the very best students of the Presidency College did not hesitate to throw away his metaphysics and law for the exact sciences'. This was not liked by the heads of the general colleges, hence the amalgamation of the Engineering College with the Presidency College, or rather its reduction from a position of rivalry to one of subordination.[27] The guaranteed employments were subsequently withdrawn and engineering education in Bengal began to show signs of decline.

In England, three years were found sufficient to train an engineer, at Roorkee even two years sufficed whereas in Calcutta the students were asked to undergo two years practical training after completing the three years' theoretical course. This had a detrimental effect. As Das wondered, "it can not be that the Bengalis are so slow in acquiring a scientific education that they would take five

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23 IOR, E/4/826 *Bengal Despatches* LXXXVII (July 19 1854).

24 IOR, E/4/830 *Ibid.*, XCI (May 2 1855).

25 IOR, E/4/987 *Madras Despatches* 127 (February 11 1857).

26 *DPI Report Bengal* (1862-63) 10.

27 Memorandum by Bholanath Das on the causes of the decline of the Calcutta Engineering College, 1 February 1876, in Spring, F. J. E. *Technical Education in Bengal* (Calcutta 1886) 27-29.

years while the alumni of the sister college in NWP would take only two".[28] In early 1878 a committee was appointed by the Government of Bengal to look into the shortcomings in engineering education. This committee recommended the removal of engineering classes from the Presidency College and a separate engineering college was revived again, this time with a workshop and more facilities. Its educational aspects were to be looked after by the Educational Department while practical training was placed under the PWD. Four classes were opened, for civil engineers, mechanical engineers, civil overseers and mechanical overseers. The courses were revamped in 1882. Entrance was made the minimum qualification for entry. After a two and a half year course the students appeared at what was called the first Examination in Engineering. The papers were on mathematics, natural science, engineering construction, geodesy and drawing. One more academic year after this examination made them eligible for the LCE examination. An FA after passing the first engineering examination could sit for BCE. The syllabus for both LCE and BCE examinations were the same and an LCE, once he passed the FA examination also, could be admitted to the degree of BCE without further examination. The civil engineering branch had papers on mathematics, natural science, engineering construction and drawing. Mathematics had differential calculus, integral calculus and hydrostatics, while the paper on natural science concentrated only upon geology, mineralogy and metallurgy. Engineering construction called for a knowledge of the construction of buildings, bridges, roads, canals, and machines like turbines, steam engines, etc. The mechanical branch had a paper on machinery in place of the natural sciences and it dealt with different types of machines and workshop appliances.[29] The whole course consumed four years and this was followed by one year of practical training. An apprentice department was also opened to train the foremen and overseers, etc.

In its enthusiasm for the revenue and cadastral operations, the Bengal Government wanted its executive wing to learn at least the rudiments of surveying and engineering. The mofussil colleges at Hughli, Berhampur, Patna and Dacca were asked to arrange for such a course. The principals of these colleges expressed their inability and the DPI himself pointed out that their object was to provide for a liberal general education, and not for the requirements of any special occupation or profession.[30] So three survey schools were opened at Dacca, Patna and Cuttack. Simultaneously several industrial schools had also sprung up

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28 *Ibid.*, 28.

29 *Home Education* 3-5 (June 1882).

30 WBSA *General Education* 53 (June 1872).

all over the province. The Principal of Shibpur College was authorized to visit and supervise these schools. His college now functioned as a central technical institution to which these moffusil schools sent their best boys for final training and from which they received their supply of teachers.

In Bombay, the most important school was the Poona College of Science which had arisen out of a school established in 1854 for the purpose of educating subordinates for the PWD. This college was not an exclusive engineering institution, it held classes on agriculture and forestry also. The result was a hotch-potch of various types of instruction, and that too, without adequate staff. In a memorandum to the Governor of Bombay, a teacher of the college complained that:

> most of the professors sent out from England when here have no other object in view than of teaching what they have learnt in their days but never or rarely of indulging in the luxury of keeping pace with the advancing science or engaging themselves in scientific research, with the result that their teaching becomes deplorably old.[31]

Only the inferior class of matriculates joined the engineering or agricultural classes, looking for guaranteed appointment in the government departments, while the arts colleges attracted more and better students. The workshop of the college did not get any financial aid; rather, it earned money for the government by executing different types of works assigned by the PWD and private firms. So its original function of instructing the students was lost.

The curriculum, the instruments, and the very organization of these colleges were geared to meet the requirements of only subordinate grades. Seldom did private firms of repute touch them. And for the supply of superior grades in government departments, there was an apex college at Cooper's Hill in England. This college was established by the secretary of State without consulting the Government of India, rather contrary to its wishes, in 1869-70. But the whole expense had to be borne by India without any Indian taking advantage of this education. Many officials did not like this superimposition of a 'super' class of engineers. The Lt. Governor of NWP viewed Cooper's Hill as detrimental to the healthy growth of the Roorkee college. He wanted its abolition and in its place he preferred only a limited import of European engineers, as and when the situation demanded.[32] The practical portion of training at Cooper's Hill was found ineffectual in Indian conditions and its syllabi too non-professional and too academic. This college turned out foresters also and the IG of Forests, who

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31 N. A. F. Moos to Lord Reay, August 28, 1886, Reay Papers, *Op.cit.* , n 129.

32 *Home Education* 12-15 (December 1877).

absorbed them, held the training there 'inferior to the best continental education'.[33] But the Home Government would not budge and the Government of India had merely to acquiesce. This college was finally abolished in 1903 only after much hue and cry.[34] Its more than 30 years of existence nevertheless symbolized the supremacy of metropolitan institutions over the colonial ones like those at Roorkee and Dehra.

The logic of the metropolis-colony relationship was not in favour of the latter getting anything like a higher form of scientific or technical education. What it got was some sort of a hybrid emerging out of a careless fusion between industrial and technical education. It meant different things to different people. Even in official hierarchy its connotations differed. E. Buck (Secretary, Revenue and Agriculture), for example, treated it as the equivalent of practical training.[35] G. Watt (Reporter on Economic Products) discussed it as if it meant the general development of economic products, combined with research and practical training in particular industries.[36] While Chatterton (Principal, Madras Art College) regarded it as a machinery consisting chiefly of workshops and a system of sales for developing manual industries.[37] The term generated lots of confusion. To Cambell, for example, the teaching of drawing and surveying appeared most important. The first of the technical sciences to be taught in schools, he urged, "should be a good handwriting. In former days Bengalis were celebrated for their English handwriting." [38]

3. Conclusion

The British educational experiments in India have been severely criticized in earlier as well as in subsequent years. Education was no doubt an important segment of the whole colonial enterprise and was definitely meant to strengthen it. Viswanathan calls it a "mask of conquest"[39] and Goonatilake considers it a tool for "cultural blanketing".[40] Are these sweeping judgements? S. Ambirajan raises an important question that asks whether the system was planned and erected for

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33 *Finance and Commerce, Salaries and Establishment* (April 1890) 149-155.

34 *Royal Indian Engineering College Committee Report* (Simla 1903) 13.

35 Buck, E. C. *Report on Practical and Technical Education* (Calcutta 1901) 28. Curzon tended to agree with Buck.

36 Watt, G. A 'Note on Technical Education in India', *Home Education* 47-61 (November 1901).

37 *Ibid.*

38 WBSA *General Education* 6 (July 1872).

39 Gauri Viswanathan *Op.cit.*

40 Susanta Goonatilake *Crippled Minds: An Exploration into Colonial Culture* (New Delhi 1982).

just this aim or whether there were other forces that brought about the same results. He believes that chance more than foresight determined how the future was to be. "There is a bureaucratic momentum", he argues, "which propels institutions along a path, though not necessarily the one charted by the initiators".[41] 'Chance' and 'bureaucratic momentum' are valid arguments so far as we do not lose sight of the fact that it was a colonial bureaucracy. This bureaucracy ensured the primacy of colonial requirements. Engineering colleges existed for the Public Works Department and were called 'civil' engineering colleges.[42] The nature and pattern of engineering education in India differed from that of Britain. Whereas in England it evolved from below and gradually became a part of the university curriculum, in India it was organized from above. Though it was organized from above in France also, the motive and situation differed greatly. In Europe engineering education was developed in order to facilitate the process of industrialization. In India there was no such imperative.[43] In 1863 a despatch from London cited the French example:

> Besides furnishing engineers, the Civil Engineering College in Paris has sent forth an army of devotees, to economic science, who have directed their energies with all the ardor of missionaries to the destruction of bourgeois and bureaucratic prejudices, in matters connected with commerce, consequently to the opening of trade, and therefore to the removal of the fetters on French industry and enterprise. Thus the newborn class of civil engineers in France, by the nature of their duties and avocations, was brought into immediate communication with all the smaller capitalists in the bourgeois class... We may then fairly hope that as in France, the large moral and intellectual result (in India),will follow...[44]

The last sentence is interesting. The hopes were pinned not on 'material' but on 'moral' upliftment. In fact, the whole aim of colonial education was 'moral development' and 'character formation'. The 'native' character was considered defective, immoral and superstitious. The 'new' education armed with Western rationality was supposed to correct it. But the PWD oriented education could not have done this (even now the PWD engineers are considered to be more corrupt than any other professionals!) Examining the relevance of professional education in British India, Ambirajan poses certain pertinent questions:[45]

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41 S. Ambirajan 'The Content of Science and Technology Education in South India', in R. MacLeod, D. Kumar, eds. *Technology and the Raj* (forthcoming).

42 For details see Arun Kumar "Engineering Education and Public Works Department" (Dissertation, University of Delhi 1989) 1-75.

43 *Ibid.*, 591.

44 IOR V/6/291 *Despatches to India* (1863) 245-46.

45 S. Ambirajan *Op.cit.*

1. Did the institutions built and the knowledge transferred to India through its medium, become the basis for self-generating additional knowledge?
2. Did the knowledge in anyway enrich the country and generate development?
3. If India had to be properly exploited, did the organs of colonial rule have a clear notion of how to go about it?

Clear-cut answers are difficult to attempt, for colonialism was no monolith and it left several facts and questions open which can be interpreted either way. The organs of colonialism did differ in their views and implementation programmes. But these differences were not of a very basic nature. They differed in matters of detail and execution. That is why the implementation part appears ad-hoc and half-hearted. But when one looks at the policy pronouncements, particularly at the higher levels, one is struck by its generosity and utilitarianism. Full trust or emphasis on them, however, could be misleading, for they tend to hide the 'real' requirements and intentions of a colonial power.

The later half of the nineteenth century is a period of consolidation and institution-building. These institutions not only 'imported' knowledge, they imparted and, to some extent, generated knowledge. But did they diffuse new knowledge and to what extent? Telegraph and railways were the high-technology areas of those days. Telegraph remained a purely governmental exercise while the railways, raised on guaranteed profits, depended on wholesale import from Britain. Even its great repair-cum-manufacturing establishments like the Jamalpur workshop proved to be enclavists. No technological spin-off could emerge, much less galvanize, the neighborhood of a railway colony. Mechanical engineering came late and remained a poor-distant cousin of the public-works engineering. Irrigation and later hydraulic engineering definitely benefitted, thanks to the large irrigation works. The Roorkee Engineering College was closely linked to Cautley's Ganges canal. Whether the generation or refinement of irrigation technology at Roorkee or Guindy reduced or increased the economic dependency of India is rather arguable and a matter of several statistical debates. These enterprises were basically technology projects with specific aims, and not technology systems with a wider canvas and greater results. A geographical relocation of technology (as in the case of railways) was possible and was achieved but a cultural diffusion of technology is so different and much more complex. Moreover, the professional colleges were so controlled that they could not induce changes at a perceptible or faster pace. The medium of instruction was also a factor. The Japanese had insisted on their own language. The result was modern knowledge and scientific

spirit that could percolate down to the lower level of the masses. In India, colonial education widened the gulf and accentuated the age-old divide. Even in government institutions, growth was kept under a self-regulatory check. The Tokyo Engineering College was established in 1873, much later than Roorkee, and by 1903 it had a staff of 24 professors, 24 assistant professors and 22 lecturers. The Massachusetts Institute of Technology was established in 1865 and by 1906 it had 306 teachers.[46] And Roorkee, even after 100 years (i.e. in 1947), had only 3 professors, 6 assistant professors and 12 lecturers.[47] The inference is simple. As Headrick points out, colonial rulers educated their subjects only up to a point. Beyond that point, they withheld the culture of technology.[48]

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46 D. E. Alexander "The Development of Engineering Education in the United States" (Dissertation, Washington State University 1977) 96.

47 Arun Kumar *Op.cit.*, 666.

48 D. R. Headrick 'The Tentacles of Progress', *Op. cit.*, 345.