

A PROPOSAL
FOR
A POLYTECHNIC ACADEMY
AT
SURAT.

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“Paraphrasing an Eastern fable, we may say that in the family of knowledge, Science is the household drudge, who, in obscurity, hides unrecognised perfections. To her has been committed all the work ; by her skill, intelligence, and devotion, have all conveniences and gratifications been obtained ; and while ceaselessly ministering to the rest, she has been kept in the back ground, that her haughty sisters might flaunt their fripperies in the eyes of the world. The parallel holds yet further. For we are fast coming to the *dénouement*, when the positions will be changed ; and while these haughty sisters sink into merited neglect, Science, proclaimed as highest alike in work and beauty, will reign supreme.”—*Spencer on Education*.

A Proposal for a Polytechnic Academy at Surat.



“SCIENCE,” says M. Dumas, “is now mixed up with all the personal acts of our existence ; she interferes in all measures of public interest ; industry owes to her its immense prosperity ; agriculture is regenerated under her fostering care ; commerce is forced to take her discoveries into account ; the art of war has been transformed by her ; politics is bound to admit her into its councils for the government of states. How could it be otherwise ? Have not Mechanics, Chemistry, the Natural Sciences, become intelligent and necessary agents for the creation of wealth by labour ? Have they not opened the way to all the institutions by which Hygiene watches over the health of workers and the salubrity of cities ? If comfort is more universal, the life of man more prolonged, wealth better distributed, houses more commodious, furniture and clothing cheaper, the soldier better armed, the finances of the state more prosperous, is it not to the Sciences that all this progress is due ? It is they that discover in the ground the first new materials that show to agriculture the most suitable productions, the most efficacious manures, and the most appropriate implements ; they, that inventing new processes for industry, put into the hands untiring machines, sometimes gigantic, rivaling in brute force the giants of fable, sometimes delicate, rivaling in nimbleness the hands of fairies. It is the Sciences, in fine, that have given to the world the rapid means of communication by land and sea, by the aid of which man takes possession of the terrestrial globe, creating new peoples and flourishing cities where our fathers knew only of barren deserts and uninhabited regions. . . . Science follows you everywhere ; breathe, there is Chemistry ; walk, there is Mechanics ; at every

moment without thinking of it, we cannot help having to do with her. Whether we wish it or not, it is necessary to accept Science as a companion, to possess her or to be possessed of her; if you are ignorant you are her slave, if you are skilled she obeys you. The future belongs to Science; unfortunate are the people who shut their eyes to this truth."

It seems to me we have shut our eyes to this important truth and the consequences have been disastrous. Our manufactures, that had once the reputation of being unrivalled in the world, have been fast decaying, and we have to depend upon foreign manufactures for the very necessaries of life. Our agricultural and industrial classes have come to a pass when their scanty earnings are hardly sufficient to enable them to keep their body and soul together. Even our educated young men, belonging to middle and higher classes, are begging from door to door for employment,—a result which, to my mind, is due to the education that they receive under the present system being quite unsuited to equip them with necessary preparation for what may be called the hard struggle for existence. It is indeed high time for us to devote our attention to this vital question of education, and to propose reforms that may be deemed essential for giving a practical tendency to the present system of education, and for adapting it to the wants and requirements of our people.

While all the European nations have recognised the most important truth contained in the passage quoted above, and every town has its own technical institutions where scientific principles, involved in agriculture and industrial arts, are taught to all the youths of the working classes, we can hardly boast of a single institution on this side of India established on the models of French Technical Lycees and German Polytechnic Schools. It is, however, a hopeful sign of the times that educationists of great eminence have perceived this want and have turned their attention to scientific and practical instruction. Active steps are being taken all over the country for the introduction of scientific instruction in the

existing system of education. His Excellency the Governor in Council has, in a resolution of October last, expressed the views and desires of the present Government on this most important question of the day. It abundantly manifests the intention of Government to make a thorough reform in the present system, with a view to introduce Science in all the grades of education. On the occasion of the last Convocation of our University, the Vice-Chancellor, a prominent member of the local government and an educationist of great eminence and experience, advocated the cause of Technical Education with marked ability and pathos. In his valuable speech he observes : “ The upholding hand of the state may properly transfer itself from that side of national education, where it planted both a demand for teaching and the knowledge how to supply it, to help in its turn another side, where at present there is little either of knowledge or demand. That side is Technical Education.”

Encouraged by such indications of the present educational policy of Government and also by their desire of establishing at least one additional Training College, as expressed in the Government Resolution of October last, I have thought it not untimely to frame a scheme for a Training College on the lines indicated in the said Government Resolution and submit it for consideration of the people and the Government. The scheme I propose will have a special reference to Surat, because I think that town affords special facilities for the development of manufacturing industries ; it will, moreover, be not only for a Training College, but so enlarged as to embrace a larger scope of instruction suited to the various requirements of the working classes.

It is a well known fact that the artizans and manufacturers of Surat show a marked degree of natural intelligence and skill in the working of indigenious arts and manufactures, and they are likely to stand competition with foreign manufacturers with tolerable success, if they only receive the necessary scientific training. Hence at Surat there will always be a good supply

of intelligent students for a Training College specially devoted to Technical Education. Surat, as the first British possession in India, has, moreover, fair claims on the attention of Government on the score of having been so long neglected in matters of education. Ahmedabad has its own Training Colleges for males and females, and Arts College and Medical School. Poona, too, boasts of her Training and Arts Colleges, Medical and Law Classes, and College of Science, where instruction in Engineering, Agriculture and Forestry is imparted. That being so, is it not rather strange that Surat must have no institution of any sort of higher education? Surat has, therefore, preferential claims on the munificence of Government in the matter of the contemplated establishment of a new Training College. It is the duty of the well-wishers of Surat to represent to Government her wants and claims for an institution for supplying an useful sort of higher education to her sons.

There exist at present in Surat the Parekh School of Art, a Drawing Class and an Agricultural Class attached to the local High School. These institutions were established with a view to give technical instruction to the working classes of Surat. We cannot shut our eyes to the fact, however painful, that they have not been able to achieve any appreciable results in developing the productive industries. I am told that only two handicrafts, viz., carpentry and fitting are practically taught at the School of Art, and even these two are not treated in any scientific manner. I have heard it said that apprentices from the workshops of native artizans turn out to be better workmen than the students of this School. The fact of the matter is that an institution established on such a limited scale as the present, and provided with insufficient scientific appliances, can be of very little use in developing the manufactures of a place. The Drawing and Agricultural Classes are attended by some few students of the High School, to which these classes are attached; and considering how only the elements of these arts are taught there, it is no matter for wonder that they are not attended in larger numbers by the students than they now are.

Now, what I beg to propose is, that instead of thus dissipating funds and energy over these petty classes and School of Art, they should be concentrated to a single central focus, where they can be utilized with the greatest advantage. The educational resources at our disposal are not ample, and great economy must needs be practised in utilizing them. An institution, organised on a systematic plan and on a suitably large scale, can be established by amalgamating the resources of these smaller institutions and adding to them necessary fresh funds. We can thus have a model institution for the whole of Gujrat, which will do real good in developing the productive arts and industries of the land. I may here offer a few suggestions for raising the necessary additional funds.

There is at present a fund at Surat which is likely to supply us with the necessary help to the proposed institution. I refer to the Surat Hindu Charity Fund, which yields an average annual income of about Rs. 8,000. A great part of it is at present spent in distributing food and raiment to the so-called poor. In the absence of any other channel, the expenditure on this head is, I am afraid, a little too lavish. In spite of such waste, I am told that a surplus does remain, which goes to swell the fund. Now, if the intelligent and public-spirited trustees of the Fund were addressed in this behalf, it is not improbable we shall be able to secure a handsome contribution to the current expenses of the projected institution. If, in like manner, some of our influential fellow-citizens of intelligence and affluence were appealed to, they will not be backward in helping liberally such an useful institution. It is not unreasonable to hope that some one will come forward to offer a donation to get up a museum, or a workshop, or a laboratory, or a library for the Academy, and another will extend his helping hand towards the construction of a building for it. The Municipality and the Local Funds, if appealed to, will not be behind-hand in endowing the institution with yearly grants. The Surat Municipality, I trust, will not be beaten in competition in this matter by

the Ahmedabad Municipality, which contributes yearly Rs. 3,000 or so to the Gujrat College, and has, I hear, taken the lead in the matter of introducing Technical Education in Gujrat by contributing an equally substantial grant. The Local Funds cannot certainly be better applied than in a useful work like this. We shall, I trust, meet with a cordial and ready support from the President and members of the Urban and Rural Boards, well known, as they are, for their intelligence, public spirit, and liberal principles. With funds from these sources easy within our reach, we can very well be in a position to address a prayer to Government, who are ere now turning the "upholding hand of state" to this side of education, to use the promise-giving and hope-inspiring expression of the Hon'ble Mr. Peile. It seems to me that if the people of Surat go before Government with their readiness to share the expenses of the proposed institution equally, then there is every reason to hope their prayer will find a response at the hands of Government.

An outline Scheme for the proposed Polytechnic Academy at Surat.

The chief objects of the Institution are :—

(1) To train the working classes by instruction in the scientific principles involved in agriculture and industrial arts and in practical work in the workshop and laboratory, so as to enable them to carry on their individual callings with profit. The aim is not merely to teach the scientific principles necessary for the improvement of the existing industries, but to enable young men to create new manufacturing industries that can be found remunerative.

(2) To train qualified scientific teachers for the local primary schools. Those, who have devoted any attention to the consideration of the present system of primary education, have perceived the great desideratum of well-trained and qualified teachers. No reform in the system of primary education is possible before efficient teachers are made available. The instruction imparted in this institution will reflect itself upon the whole system by the supply of scientific teachers. Full effect will then be given to the desire of His Excellency in Council to introduce scientific and practical instruction into primary schools.

(3) To qualify youths for various departments of public and private service by training them in various branches of knowledge requisite for their career and to impart systematically organised instruction to those destined for commercial pursuits generally.

Besides these the institution will serve many other useful objects towards the promotion of the material and moral welfare of the people, by executing plans and estimates for technical works, by performing various operations of chemical analysis, by affording advantages of an industrial museum and

laboratory, by furnishing information on all subjects coming within the sphere of industry, commerce and agriculture, and by rendering many other such services, too many to be mentioned here.

For attaining all these objects it will be necessary to establish in connection with the Academy (1) an *industrial museum* containing specimens of raw materials, manufactured articles, models of machinery and other objects necessary for instruction in agriculture, natural history and other branches of knowledge; (2) a *mechanical workshop* containing mechanical tools and machines requisite for practical work; (3) a *chemical laboratory* furnished with all the apparatus necessary for analytical and technical work; (4) a *physical cabinet* having a stock of philosophical instruments required for experimental demonstration of physical laws; and (5) a *library* containing a rich collection of books and other publications on applied science, and other subjects bearing on the objects of the institution.

The institution is intended to combine within itself the elements of both the special secondary education and technical education. Thus, according to my proposal, not merely will practical instruction in various industrial arts be imparted, but a due share will also be allotted to what are called the humanities. To adopt the modern principles of education again, it is proposed that theory and practice should go hand in hand throughout the whole course. The medium of instruction will be the vernacular of the district, viz., Gujrati, as the candidates for admission will be supplied by primary schools where they will have acquired knowledge of reading, writing and ciphering. The greatest economy of time is absolutely needed in an institution of this nature, and consequently it is not advisable to make the English language the medium of instruction. The English language, however, which may be justly called the language of the commercial world and which contains the richest treasures of science and literature, cannot altogether be omitted from the curriculum.

It is accordingly proposed to make it a necessary second language for all the scholars who will thus obtain knowledge thereof sufficient for the ordinary purposes of business.

The candidates for admission shall be at least 12 years of age and must be prepared to submit to an entrance examination to be held annually in the following subjects :—

- (1) The Gujrati language—a short theme on common topics to be written with correct orthography and grammar.
- (2) Arithmetic including decimal fractions.
- (3) History and Geography of India.

The students thus admitted are to follow the prescribed order of studies adapted to their own individual pursuits and to submit themselves to the examinations to be held at the Academy. They shall be entitled to Scholarships and Fellowships connected with the institution, and also the Diplomas of Associates which are proposed to be granted for completed studies in any section to the candidates who will satisfy the examiners at the final examination.

Besides these regular students, adults from working classes may be admitted as casual students, who will not be obliged to go through the whole prescribed order of studies, but will be at liberty to attend any lectures that they may find useful. The hours of instruction at the Academy should be so arranged as to suit the convenience of these working men.

The Programme of Studies at the Academy.

In the first place it will be necessary to institute a Preparatory Section in which the instruction received in primary schools will be recapitulated and more firmly impressed upon the mind, and several new subjects will be introduced. This preparatory course will extend over one year. The pupils, coming from various primary schools, will form this section and will during this year be fused into a homogenous whole by being educated on a uniform system.

This section may be dispensed with in future when the system of primary education will undergo a thorough reform and be adapted to the requirements of the time.

Subjects of Instruction for the Preparatory Year.

The Gujrati language.

The English language.

Geography of India with detailed study of Gujrat.

Arithmetic.

Geometry.

Natural History, including preliminary notions of
Zoology, Botany and Geology.

Drawing.

Caligraphy.

After the completion of this preparatory course, it will be necessary to divide the students into the following five sections, and to arrange the courses of study according to the wants and requirements of each section. Instruction in languages, general science, &c., will be given to the different sections in common, while lectures on special branches bearing on different pursuits will be delivered separately to each section.

FIVE SECTIONS.

SECTION I. will comprise scholars who desire to devote themselves exclusively to the study of agriculture and farming.

SECTION II. will comprise scholars who wish to select a branch of industry more especially connected with chemistry, but not requiring complicated machinery for its execution, or wish to prepare themselves merely for the chemical work of some business.

SECTION III. will comprise scholars who desire to devote themselves to some branch of industry in which complex

machinery is employed. This Section will be divided into two sub-sections. Sub-section (A) will include those who wish to devote themselves to some branch of mechanical technics specially ; Sub-section (B) will be formed by those wishing to take up some branch of chemical technics specially.

SECTION IV. will include scholars desirous of qualifying themselves as trained scientific teachers, and also those who wish to receive liberal education for its own sake.

SECTION V. will include scholars destined for public or private service, and also those who wish to follow commercial *pursuits* generally.

Subjects of Instruction for the First of the Normal Class.

During this year all the subjects will be taught to all the sections in common.

The Gujrati language.—First principles of style and composition.

The English language.

History of India, with special reference to the rise and growth of British rule.

Geography—general of the world.

Arithmetic.

Algebra.

Geometry—plane.

Natural history including :

Zoology—principal vertebrates.

Botany—plants of practical importance.

Geology and physical geography of the district.

Physics experimental, including :

General physics, heat and meteorology.

Chemistry—inorganic, metalloids.

Drawing.

Caligraphy.

Commercial accounts and book-keeping.

Subjects of Instruction for the Second Year.

During this year there will be some subjects common to all, and in addition to them subjects of special courses for each section will be introduced.

Subjects for all the Sections in common.

The Gujrati language.—Literary composition.

The English language.

History—elements of universal history.

Geography—agricultural, industrial, commercial and administrative.

Algebra.

Mechanics—principles.

Physics experimental—sound, light, electricity and magnetism.

Chemistry, inorganic—metals.

Drawing.

Special Subjects for Section I.

Algebra—higher.

Trigonometry—plane.

Practical geometry, including surveying and levelling.

Chemistry—organic, agricultural and analytical.

Vegetable anatomy and physiology.

Anatomy and physiology of domestic animals.

Mineralogy and geology in their relation to agriculture.

Special Subjects for Section II.

Chemistry—inorganic and organic, practical and analytical.

Mineralogy and geology.

Physics—chemical and technical.

Industrial botany and zoology.

Special Subjects for Section III.

Algebra—higher.

Geometry—solid, descriptive and practical.

Trigonometry—plane.

Physics—mathematical and applied.

General knowledge of machinery and mechanical designing.

Chemistry—inorganic and organic.

Chemistry—practical and analytical (for sub-section B).

Plan drawing (for A).

Commercial arithmetic and book-keeping.

Special Subjects for Section IV.

Algebra.

Geometry—practical and descriptive.

History of Gujrati literature.

Sanskrit—to be taught with a view to develop the Gujrati languages.

Caligraphy.

Commercial accounts and book-keeping.

Special Subjects for Section V.

Commercial arithmetic, accounts and book-keeping.

Knowledge of goods.

History of commerce.

Theory of commerce including the sciences of the counting house.

Subjects of Instruction for the Third Year.

During this year the courses will be arranged as they are in the last year. The Sections I, II. and V. will complete their whole special courses at the end of this year.

Subjects for all the Sections in common.

The Gujrati language—Composition applied to special subjects.

The English language.

Political economy—general notions.

Ethics—private and public morality.

Principles of general jurisprudence.

Astronomy—descriptive.

Human physiology and sanitary science.

Special Subjects for Section I.

Theory of machinery and mechanical designing with reference to agricultural machines and implements.

Meteorology in its connection with agriculture.

Theory and practice of agriculture.

Study of the rearing of animals.

Theory of farming.

Rural economy and forest economy.

Rural architecture.

Technology of branches of industry connected with agriculture.

Agricultural accounts and book-keeping.

Special Subjects for Section II.

Chemistry—continuation of the course for the last year.

Technical chemistry.

Pharmaceutical chemistry.

Knowledge of raw materials and manufactured products.

Chemical technology.

Metallurgy.

Exercises in planning chemical works.

Special Subjects for Section III.

Trigonometry—spherical (for A).
 Geometry—descriptive, practical and analytical (for A).
 Differential and integral calculus (for A).
 Mechanics—analytical and applied.
 Designing—mechanical and architectural (for A).
 Theory of machinery (for A).
 Construction of machinery (for A).
 Chemistry—practical, analytical and technical (for B).
 Mineralogy and geology (for B).
 Physics—chemical and technical.
 Industrial botany and zoology (for B).

Special subjects for Section IV.

The Gujrati language and literature—study of classical authors.

Sanskrit.

General notions of Sociology.

One of the following voluntary subjects :—

1. Mathematical sciences.
2. Physical sciences.
3. Biological sciences.
4. Mental and moral sciences.
5. Social sciences.

Special Subjects for Section V.

Theory of commerce—continuation.

Political and commercial economy.

Commercial geography and statistics.

Laws relating to commerce and bills of exchange.

Constitutional and administrative law.

Mercantile correspondence in Gujrati and English.

Subject of Instruction for the Fourth Year.

During this year there will not be any general course common to all, but Sections III. and IV. only will have their special courses.

Special Course for Section III.

- Theory and construction of machinery (for A).
 Designing—mechanical (for A).
 Engineering—general and manufacturing (for A).
 Mechanical technology (for A).
 Metallurgy.
 Chemistry—theoretical and technical (for B).
 Chemical technology (for B).
 Knowledge of raw materials and manufactured products.
 Exercises in planning mechanical works (for A).
 Exercises in planning chemical works (for B).
 Industrial economy and legislation.

Special Subjects for Section IV.

- The Gujrati language.
 The English language.
 The Sanskrit language.
 Political economy.
 Principles of logic and rhetoric.
 One of the voluntary subjects prescribed under the last year.

*Additional Subjects for those intending
to be Scientific Teachers.*

- Theory and practice of education.
 School management.
 Physiology and psychology in their relation to education.
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The above courses of study are given with a view to give an idea of the nature of instruction intended to be given in the institution. I have not attempted to define with accuracy the extent of studies under the different headings and the time to be devoted to the different branches, as it is not necessary to do so now. I shall be prepared, however, to go into details if necessary. The programme of studies may appear somewhat complicated and high to those who are unacquainted with technical institutions of France, Germany

and other European countries. Perhaps some may be inclined to say that the programme is overloaded with a multiplicity of subjects and consequently the instruction will not be substantial and sound. In reply to this objection it may be said here that it is not intended to treat all the subjects exhaustively, but the instruction to be imparted to each branch will be strictly confined within definite limits, determined on thoroughly practical considerations. It is not the object to cram the students with undigested and unorganised details in each subject, but to impart real training and culture. The practice which is generally prevalent at present to prepare students for examinations by making them learn the text books by heart, should be altogether abandoned. I have heard many complaints about the science of our Training Colleges. The unfortunate pupils understand very little from the translations of English Science Primers, and so they are obliged to cram the translations with great aversion for the study of Science, which should be the most pleasant and attractive of all. It cannot be too strongly insisted upon that real and sound knowledge should be the object of all instruction. "The attention of the scholars must be kept constantly fixed on the realities of life; they must be taught never to look without seeing; they must be made to give an account of the phenomena which take place around them; and they must learn to enjoy so thoroughly the pleasure of understanding, that this pleasure will become a necessity to them. In a word, there must be developed in the child that power of observation and judgment which will render him, when a man, at one and the same time, prudent and resolute in all his undertakings, and capable of managing his own affairs."

I am aware of the difficulty arising out of an absence of scientific books in the vernacular. The Government Resolution refers to it, and I am not prepared to say it is not worth considering. But I firmly believe that the opening of such an institution, as I propose, will be a signal to competent men to supply the want, and I am sanguine the institution will

not go down on the score of books. The law of demand and supply is universal in its operation, and will remove the difficulty which at present stares us in the face.

I shall now attempt to give a probable estimate of the cost of the building, museum, laboratory, &c., and of the annual current expenses for the salaries of Professors, and for grants for the workshop, laboratory, museum, &c.

Probable cost for the construction of a suitable building and for fitting up the laboratory, workshop, &c.

Construction of the building	Rs. 65,000
Industrial museum	,, 10,000
Workshop	,, 10,000
Laboratory	,, 5,000
Physical cabinet	,, 5,000
Library	,, 5,000
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Total.....	Rs. 1,00,000

Annual Expenses.

Principal and Professor of Chemistry ...	Rs. 4,500
Professor of Mathematics and Mechanical Engineering	,, 3,000
Professor of Biology and Agriculture and Curator of the Museum	,, 2,500
Professor of Literature and History and Librarian	,, 2,500
Assistant Professor of Mechanical Engineering and Superintendent of the Workshop	,, 1,500
Drawing Master	,, 1,000
Two other Teachers	,, 1,500
Grants for Laboratory, Workshop, Museum, Library, &c.	,, 2,500
Scholarships and Fellowships.....	,, 2,000
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Total.....	Rs. 21,000

In the beginning it will be necessary to institute several scholarships and fellowships in connection with the Academy to entice youths from the industrial classes, who are too ignorant to appreciate the advantages to be derived from such an institution. The establishment of fellowships will serve two purposes. Able and intelligent students will have opportunities of prosecuting their further study and of working in the workshop and laboratory, and they will also be very useful assistants to Professors by serving as demonstrators and instructors in various branches.

Diplomas and certificates of competency should be granted to successful candidates at the final examinations in the various sections. All the regular students, who would keep the necessary terms, complete their studies and satisfy the examiners, may be made Associates of the Academy. The granting of diplomas will be a sort of great attraction to young persons, who will be induced thereby to continue their studies to the end. Moreover, the public will very soon attach due importance to the possession of the diploma, which, in due course of time, will, I trust, be considered a better guarantee of capacity as regards public or private service than the possession of any other certificates of competency.

ASSEMBLY LANE, BOMBAY,

30th April 1886.