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R E P O R T

FROM THE

SELECT COMMITTEE

ON

SCIENTIFIC INSTRUCTION;

TOGETHER WITH THE

PROCEEDINGS OF THE COMMITTEE,

MINUTES OF EVIDENCE,

AND APPENDIX.

Ordered, by The House of Commons, to be Printed,
15 July 1868.

Tuesday, 24th March 1868

Ordered, THAT a Select Committee be appointed to inquire into the provisions for giving instruction in theoretical and applied Science to the Industrial Classes.

Friday, 27th March 1868.

Ordered, THAT the Select Committee on Scientific Instruction do consist of Eighteen Members.

Committee nominated.—

Mr Acland.	Mr. Gregory.
Mr Akroyd.	Mr. Thomas Hughes.
Mr, Bagnall	Sr Charles Lanyon,
Mr Bazley.	Mr. M'Lagan.
Mr Beecroft	Lord Robert Montagu.
Mr Henry Anstin Bruca.	Mr. Edmund Potter.
Lord Frederic Cavendish.	Mr. Powell.
Mr Dixon.	Mr Read.
Mr. Graves	Mr. Samuelson.

Ordered, THAT the Committee have power to send for Persons, Papers, and Records.

Ordered, THAT Five be the Quorum of the Committee.

Monday, 30th March 1868.

Ordered, THAT the Committee do consist of Nineteen Members.

Ordered, THAT Mr. William Lowther be added to the Committee.

Wednesday, 16th July 1868.

Ordered, THAT the Committee have power to report their Observations, together with the Minutes of Evidence taken before them, to the House.

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R E P O R T.

THE SELECT COMMITTEE appointed to inquire into the Provisions for giving INSTRUCTION in Theoretical and Applied SCIENCE to the INDUSTRIAL CLASSES ;— HAVE considered the matters to them referred, and have agreed to the following REPORT .—

In order to ascertain the state of scientific instruction amongst the industrial classes, your Committee has called before it witnesses representing the following bodies .—

1st. The Department of Science and Art of South Kensington, the Committee of Council for Education, and the Government Colleges of Science and Naval Architecture.

2nd The Universities of Oxford, Cambridge, London, and Edinburgh ; The Royal College of Science, Dublin , Queen's College, Belfast , King's College and University College, London ; and Owens' College, Manchester.

3rd. The few secondary schools in which science has been for some time systematically taught

4th. The managers and teachers of science classes and mechanics' institutes receiving aid from the State, or supported exclusively by voluntary efforts.

5th. The population engaged in the great staple industries carried on in the principal manufacturing towns and districts

Their evidence may be included under two heads .—

1st The state of scientific instruction of,

(1.) The foremen and workmen engaged in manufactures.

(2) The smaller manufacturers and managers.

(3) The proprietors and managers-in-chief of large industrial undertakings, and—

2nd. The relation of industrial education to industrial progress.

I.—THE STATE OF SCIENTIFIC INSTRUCTION OF FOREMEN and WORKMEN.

It is stated that the foremen are almost, without exception, persons who have been selected from the class of workmen by reason of their superior natural aptitude, steadiness, and industry. Their education, and that of the workmen, during the school age, has been received in elementary schools ; and owing both to the defective character of the instruction in some of those schools, and to the early age at which the children go to work, it is rarely sufficient to enable them to take advantage of scientific instruction at a later period.

In this statement the children educated as half-timers under the Factory Acts must as a rule be included. The evidence of Mr. Mundella and other witnesses tends to show that the primary education received in the factory schools

is insufficient, except where the employment and education are both uninterrupted between the ages of 8 and 13, and where the instruction is given in good schools established or supported by manufacturers who take an active and intelligent interest in the welfare of the children whom they employ.

The little rudimentary knowledge acquired at school is rarely retained after the young people have been at work two or three years, and elementary scientific instruction is thus entirely beyond the reach of a large portion of our industrial population. The series of schools at Halifax, at Oldham, &c. are exceptional instances of fair elementary education to children, followed by elementary instruction in theoretical and applied science to young persons and adults.

It is stated by many witnesses (and on this subject your Committee would direct particular attention to the evidence of the Rev. Thos. Cromwell, Principal of the Training School at Chelsea) that the tendency of the Revised Code has been to diminish the efficiency of elementary education. It is hoped that the recent introduction of a seventh standard of examination may have a contrary and beneficial effect, and it is contended that drawing and elementary knowledge of physical geography, of the properties of matter, and of the laws of health, may be taught to young children in every elementary school.

The existing elementary classes in experimental science are generally held in connection with mechanics' or literary institutions; although their number has increased of late, they are confined chiefly to the Metropolis and its neighbourhood, and to Lancashire, the West Riding of Yorkshire and Cornwall, and to Edinburgh and Glasgow, and Birmingham.

The pupils may present themselves for the examinations of the Society of Arts, and of the Department of Science and Art at South Kensington. When such pupils are of the artisan class, and are successful, payment according to results is made to the teachers by the Department, and Queen's prizes or medals are given to the pupils themselves.

Besides artisans, draughtsmen, clerks, teachers, and other persons of various grades, attend these classes, and the evidence of Professor Tyndall, Professor Huxley, and the other examiners, as well as of many other competent witnesses, concurs to show that the instruction, though elementary, is sound.

Elsewhere these classes scarcely exist. There are no such classes permanently established in the north-eastern, eastern, west midland, or southern counties, and in many parts of England the fact that Government aid is granted to them was unknown until public attention was drawn to it by the recent discussion of the subject of technical education, and by the appointment of this Committee. It is true that the Science and Art Directory shows numerous classes scattered over the country, but they are mostly confined to rudimentary instruction in chemistry, physiology, and botany, in various schools. Though not without value of their own, they have very little, if any, direct influence on the industrial occupations of any class.

In Scotland, where the superior primary instruction of the artisans removes one of the obstacles to their acquiring scientific instruction, the Watt Institution of Edinburgh and the Andersonian University of Glasgow have rendered good service, the former during nearly half a century, the latter for more than 20 years; they can boast amongst their scholars such names as those of Nasmyth, James Young, and many others. Technical objections have hitherto prevented these schools from receiving the grants of the Science and Art Department, but within the last 12 months these have been overcome.

The Mining School of Cornwall, as described by Mr. Robert Hunt, Keeper of Mining Records, is the only one of its kind: the mining population being scattered over a wide area, it is necessary to send a teacher to the villages in order to conduct the classes.

The miners are taught the elements of chemical and physical science with special reference to their occupations; and the school is producing results which are excellent, though limited as to their area by want of funds. The wages of the miners are inadequate to enable them to pay fees sufficiently high to support the school, even with the aid of payment on results from the Department of Science and Art, and the local subscriptions do not enable the promoters to provide instruction for all the villages which require or desire it.

The witnesses from the North of England, representing the coal trade,
Messrs.

Messrs. Dalglish and Cochrane, are anxious for the establishment of a similar peripatetic school in the pit villages of Durham and Northumberland. Until their attention was drawn to the Cornish Mining School, they were quite unaware of its existence. They state that the proprietors of collieries would be willing to provide the necessary buildings, and they consider it essential that the Department of Science and Art should give its advice, and the services of its organising master, to the local committees which may be formed to carry out science instruction amongst the mining population of those counties.

At the Working Men's College, Halifax, evening classes for scientific instruction in chemistry, as applied to the manufactures of the locality, and in machine drawing and practical geometry, were opened in August 1867. At Huddersfield special classes are now in course of formation for teaching chemistry, as applied to dyeing, to foremen and apprentices. These classes are supported by the principal manufacturers and merchants of the neighbourhood. At Bradford a subscription list has been opened for the erection of a School of Science and Art, at a cost of 50,000 £., to which one of its citizens has offered a contribution of 5,000 £. The munificent gift of 100,000 £. by Mr. Whitworth, for the endowment of scholarships in mechanical engineering is offered on conditions that give to the artizans, concurrently with men of other grades, and who have received a more liberal education, an opportunity of acquiring a scientific knowledge of their craft and profession.

The Hulme branch of the Amalgamated Society of Carpenters has been the first trade society to establish an adult school in which carpenters and joiners, whether members of the society or not, may be taught drawing, the principles of building, construction, and other branches of science having special reference to their trade.

The Bristol Trade School, and the Navigation School of Hull, both aided by grants on results from the Science and Art Department, are conspicuous examples of the successful introduction of science teaching into elementary schools of a superior kind for artizans. The Bristol School is fully described in the evidence of Mr. Thomas Comber. The building, formerly used as a national school, is rent free, and receives some 150 boys of the ages of 12 to 15, who are taught elementary mathematics, chemistry, physics, and mechanical drawing. They pay a fee of 3 £. per annum, which, together with the grant on results, covers the cost of conducting the school. The principal engineering and chemical establishments of the city accept for their vacant apprenticeships, with marked preference and partiality, the pupils of the Trade School.

A hindrance second only to that of the defective elementary instruction of the pupils is the scarcity of science teachers, and the want of schools for training them. The remuneration of the teachers, arising from pupils' fees and payment on results by the Department of Science and Art, is with few exceptions so scanty that science teaching is scarcely ever followed as a profession, but only as an addition to some more profitable employment. Hence classes are frequently suspended whenever the more important occupations of the teacher demand increased attention, or cause him to remove to other localities.

Nearly all the witnesses claim, as a means of augmenting their emoluments, some relaxation of the rule which prevents teachers being paid on the results of instruction given to persons who are not artizans.

As the demand for instruction increases, the incomes of the teachers will doubtless increase likewise, but the want of competent men will still remain. The offer, under a recent Minute of the Department, of sums of 25 £. per annum in aid of scholarships to be founded by localities contributing like sums, together with the remission of the fees of the Government Colleges of Science to the holders of such scholarships, will probably induce some young men to prepare themselves for the career of elementary science teachers.

II.—THE SCIENTIFIC INSTRUCTION OF THE SMALLER MANUFACTURERS AND MANAGERS.

Unfortunately, this division may be disposed of in a very few words. Its members have either risen from the rank of foremen and workmen, in which case all that has been stated of the first division will also apply to them; or

else they are an offshoot from the class of smaller tradesmen, clerks, &c, and have been educated in the ordinary secondary endowed, and so-called commercial schools. With some admirable exceptions, the instruction which they afford is certainly not superior to that of the best conducted elementary schools, and even in the better schools of this grade the principles of science are scarcely ever taught. The pupils have, however, generally remained at school till the age of 14 or 15, and they never lose the use of the elementary instruction which they had acquired at school. Hence, where the opportunity for instruction in adult science classes exists, they have not, like the artizans, to contend with the mere clerical obstacles to the acquisition of scientific knowledge.

III.—THE PROPRIETORS AND MANAGERS OF GREAT INDUSTRIAL UNDERTAKINGS.

In those not unfrequent cases where these persons also have risen from the rank of artizans, the same exceptional gifts, including more especially those of unconquerable perseverance and energy which had caused their elevation, have also enabled them generally to correct the deficiencies of their early literary training. Any knowledge of scientific principles which they may have acquired is generally the result of solitary reading, and of observation of the facts with which their pursuits have made them familiar.

More generally, however, the training of the capitalists, and of the managers of their class, has been that of the higher secondary schools, followed in rare, though in more recent years less unfrequent, instances, by a course of more or less systematic scientific instruction in colleges like the Royal School of Mines, the Royal College of Chemistry, University and King's Colleges, London, Owens' College, Manchester, and the Laboratories of the Universities of Edinburgh and Glasgow. The scientific courses of Oxford have been too recently instituted, and have hitherto been devoted too entirely to pure science, to have had any appreciable influence on the scientific instruction of this class, besides which, a feeling exists, to which expression was given by Mr Chance, the eminent manufacturer of Smethwick, himself a man of great scientific attainments, and a distinguished member of the University of Cambridge, that however suitable the Universities may be or become for the training of professors of science of the higher class, the habits at present, acquired there by the sons of wealthy men are not conducive to the successful prosecution of an industrial career.

The Military and Scientific Department of the Proprietary College of Cheltenham, and the City of London Endowed School, are exceptional instances of secondary schools in which instruction in science holds the first place. In the great public schools of Harrow and Rugby, instruction in one scientific subject, in addition to classics and mathematics, has only recently been made compulsory.

Any attempt to analyse briefly the evidence as to the degree of instruction given at King's College and University College, London, and Owens' College, Manchester, would probably fail to convey a correct impression, your Committee would therefore direct attention to the evidence. The same observation applies to the University of Edinburgh, where a Chair of Civil Engineering has recently been founded by Sir David Baxter, to the endowment of which the Government has agreed to contribute.

The engineers of Manchester and the neighbourhood have raised a fund for endowing a similar Chair at Owens' college in that city. To that fund, a single firm of mechanical engineers contributes 3,000 *l.*, besides a subscription of 250 *l.* per annum from one of its partners. The college is full to overflowing, and a proposed building fund of 150,000 *l.* has already received subscriptions amounting to 40,000 *l.*

The Royal School of Mines in Jermyn-street, in addition to its lectures to artizans, delivered by some of the most eminent men of science, has systematic courses of lectures in nearly every subject usually comprised in a higher technical course, with the important exception of mathematics.

The number of its matriculated students is under 20, its metallurgical laboratory, which has room for only 10 students, is always full. The Royal College of Chemistry in Oxford-street, which is connected with it, has about 40 students in its laboratory. It cannot accommodate more.

It has been possible, in consequence of the good preparatory teaching of elementary mathematics in the Dockyard Schools from which the pupils are drafted, to make mathematical instruction, which is wanting in Jermyn-street, one of the principal features of the Royal School of Naval Architecture at South Kensington, the only school of naval construction in the kingdom. According to the evidence of Mr. Reed, Chief Constructor to the Navy, this school is rendering most essential service to that department. The pupils are engaged during six months in constructive works in the various dockyards, and undergo a complete course of technical training at South Kensington in all that relates to their art, during the rest of the year.

Your Committee does not consider it desirable to refer in this report to the Royal College of Science in Dublin, or to the Queen's Colleges and science classes in Ireland, as the subject of the institutions for promoting science and art in Ireland is now undergoing separate investigation.

2. *The Relation of Industrial Education to Industrial Progress.*

The industrial system of the present age is based on the substitution of mechanical for animal power; its development is due in this country to its stores of coal and of metallic ores, to our geographical position, and temperate climate, and to the unrivalled energy of our population.

The acquisition of scientific knowledge has been shown by the witnesses to be only one of the elements of an industrial education and of industrial progress. Indeed, there is a preponderance of evidence to show that so far as the workmen, as distinguished from the managers, are concerned, it can be considered an essential element only in certain trades, or, generally, as enlarging the area from which the foremen and managers may be drawn.

In all cases another and an indispensable element of industrial success is the acquisition of practical experience and manipulative skill.

The evidence given before your Committee places beyond all doubt the fact, that these latter acquirements are possessed in a pre-eminent degree by our manufacturing population of every grade, according to their several necessities. They are obtained in our factories, our forges, our workshops, our shipyards, and our mines, which, in their organization and appliances, are the models which, with a few special exceptions, other nations have hitherto imitated and followed, but not surpassed.

Although the pressure of foreign competition, where it exists, is considered by some witnesses to be partly owing to the superior scientific attainments of foreign manufacturers, yet the general result of the evidence proves that it is to be attributed mainly to their artistic taste, to fashion, to lower wages, and to the absence of trade disputes abroad, and to the greater readiness with which handicraftsmen abroad, in some trades, adapt themselves to new requirements.

It is owing to one or more of these favourable conditions, rather than to superior education or technical skill, that the lacemakers of Calais, and the locomotive manufacturers of Creuzot and of Esslingen, are competing with this country in neutral markets, and even at home; and Mr. Cochrane states that the low rate of wages alone enabled the factory at Anzin to furnish him with pumping and winding engines, constructed according to his own design, but of excellent workmanship, for his collieries in Northumberland and Durham.

Only two witnesses from Birmingham, the one an eminent merchant, the other a manufacturing jeweller, and Mr. Gill, a woollen manufacturer, of Innerleithen, in Scotland, attribute the loss of certain trades to the superior skill, appliances, and education of the German, Belgian, and American manufacturers; and the great steel works of Krupp, in Westphalia, have been named as the only instance of a factory which is said to possess an organisation superior to that of any establishment in the same branch of industry in this country.

At the same time, nearly every witness speaks of the extraordinarily rapid progress of Continental nations in manufactures, and attributes that rapidity, not to the model workshops which are met with in some foreign countries, and are but an indifferent substitute for our own great factories, and for those which are rising up in every part of the Continent; but, besides other causes, to the scientific training of the proprietors and managers in France,

Switzerland, Belgium, and Germany, and to the elementary instruction which is universal amongst the working population of Germany and Switzerland. There can be no doubt, from the evidence of Mr. Mundella, of Professor Fleeming Jenkin, Mr. Kitson, and others, and from the numerous reports of competent observers, that the facilities for acquiring a knowledge of theoretical and applied science are incomparably greater on the Continent than in this country, and that such knowledge is based on an advanced state of secondary education.

All the witnesses concur in desiring similar advantages of education for this country, and are satisfied that nothing more is required, and that nothing less will suffice, in order that we may retain the position which we now hold in the van of all industrial nations. All are of opinion that it is of incalculable importance economically that our manufacturers and managers should be thoroughly instructed in the principles of their arts.

They are convinced that a knowledge of the principles of science on the part of those who occupy the higher industrial ranks, and the possession of elementary instruction by those who hold subordinate positions, would tend to promote industrial progress by stimulating improvement, preventing costly and unphilosophical attempts at impossible inventions, diminishing waste, and obviating in a great measure ignorant opposition to salutary changes.

Whilst all the witnesses concurred in believing that the economical necessity for general and scientific education is not yet fully realised by the country, some of them consider it essential that the Government should interfere much more actively than it has done hitherto, to promote the establishment of scientific schools and colleges in our great industrial centres.

In reference to the sufficiency, or the reverse, of voluntary efforts, it is stated, on the one hand, that premiums of several hundred pounds are paid for the admission into the offices of civil, and the workshops of mechanical engineers, of pupils, many of whom fail to avail themselves fully of the valuable instruction which they would obtain there, owing to the absence on their part of all preliminary instruction in mathematics and physical science. It is reasonably inferred that persons who are willing to pay those large sums, and who do not hesitate to send their sons to expensive schools, will be prepared to pay for instruction in science as soon as they are convinced of its utility. It is argued, on the other hand, that in all countries, and at all times, the offer of education of every kind has preceded the demand, and that any temporary sacrifice on the part of the State, in order to place scientific instruction within the reach of those who would be likely to appreciate it, will be amply and speedily repaid by the increase of the general intelligence and prosperity which it will produce.

A more general opinion on the part of the witnesses than either of these opposite views is, that wherever any locality in which, from its geographical position and industrial importance, it may be presumed that a scientific college or a higher secondary school of science is likely to be successful, is prepared to contribute largely to the creation and maintenance of such an institution, the State may fairly give assistance to such locality by liberal grants for building and apparatus, in addition to the existing payments on results and scholarships.

CONCLUSIONS.

The evidence which has been given before your Committee, and in part summarised in the preceding pages, together with the information which is accessible to them in common with other members of the community, has convinced them :

(1) That with the view to enable the working class to benefit by scientific instruction it is of the utmost importance that efficient elementary instruction should be within the reach of every child.

(2) That unless regular attendance of the children for a sufficient period can be obtained, little can be done in the way of their scientific instruction.

(3) That elementary instruction in drawing, in physical geography, and in the phenomena of nature, should be given in elementary schools.

(4.) That

(4.) That adult science classes, though of great use to artizans, to foremen, and to the smaller manufacturers, cannot provide all the scientific instruction which those should possess who are responsible for the conduct of important industrial undertakings. That all whose necessities do not oblige them to leave school before the age of 14, should receive instruction in the elements of science as part of their general education.

(5.) That the reorganisation of secondary instruction and the introduction of a larger amount of scientific teaching into secondary schools are urgently required, and ought to receive the immediate consideration of Parliament and of the country.

(6.) That it is desirable that certain endowed schools should be selected in favourable situations for the purpose of being reconstituted as science schools, having in view the special requirements of the district, such schools to be rendered available to the surrounding districts, by the establishment of exhibitions open to public competition, so that the children of every grade may be able to rise from the lowest to the highest school.

(7.) That superior colleges of science, and schools for special scientific instruction requiring costly buildings and laboratories, cannot be supported by fees alone, without aid from one or more of the following sources, namely, the State, the localities, and endowments or other benefactions.

(8.) That such colleges and special schools are most likely to be successful if established in centres of industry, because the choice of such centres tends to promote the combination of science with practice on the part both of the professors and of the pupils, and to enable many to attend them to whom the expense of living at a distance from home would otherwise be an insuperable barrier.

(9.) That the provinces of England, especially the agricultural districts, have not received a sufficient proportion of the State grants for scientific education.

(10.) That those provinces of England are entitled to such a modification of the public grants as will afford them increased aid, supplementary to the funds which they may raise in their own localities for the purpose of promoting scientific instruction. That grants of money from the national exchequer for local scientific instruction should be chiefly designed to promote local activity, and a better use of resources otherwise available, and should be regarded as occasional or temporary.

(11.) That some slight addition to the emoluments of science teachers would probably tend materially to promote the establishment and permanence of elementary science classes.

(12.) That the provisions of the Public Libraries and Museums Act should be altered so as to enable public bodies to levy a slightly increased rate for scientific purposes.

(13.) That the managers of training colleges for the teachers of elementary schools should give special attention to the instruction of those teachers in theoretical and applied science, where such instruction does not exist already.

(14.) That teachers in elementary day schools should be paid on results, for teaching science to the older scholars, in the same way as payment is now made for drawing in such schools. That the education of higher science teachers should be encouraged, by the granting of degrees in science at Oxford and Cambridge as at other Universities, and by the opening of a greater number of fellowships to distinction in natural science as well as in literature, and mathematical and moral science.

(15.) That a more intimate connection between the various Government institutions for scientific instruction in London would increase the efficiency of each of those institutions, and that the constitution and management of those institutions and their future relations to each other requires further investigation.

PROCEEDINGS OF THE COMMITTEE.

Thursday, 2nd April 1868.

MEMBERS PRESENT:

Mr. Samuelson.	Mr. Read.
Mr. Akroyd.	Mr. Acland.
Mr. E. Potter.	Mr. Dixon.
Mr. Powell.	Mr. Gregory.
Mr. M'Lagan.	Lord Frederic Cavendish.
Mr. William Lowther.	Mr. Graves.
Mr. Bagnall.	

Mr. *Samuelson* was called to the Chair.

The Committee deliberated.

[Adjourned to Thursday, 23rd April, at Twelve o'clock.

Thursday, 23rd April 1868.

MEMBERS PRESENT:

Mr. SAMUELSON in the Chair.

Mr. Gregory.	Lord Frederic Cavendish.
Mr. Dixon.	Lord Robert Montagu.
Mr. Potter.	Sir Charles Lanyon.
Mr. Bazley.	Mr. Austin Bruce.
Mr. M'Lagan.	Mr. Bagnall.
Mr. Lowther.	Mr. Graves.

Mr. *Henry Cole*, C.B., and Captain *Donnelly*, R.E., were severally examined.

[Adjourned to Monday next, at Twelve o'clock.

Monday, 27th April 1868

MEMBERS PRESENT:

Mr. SAMUELSON in the Chair.

Mr. Akroyd.	Mr. Austin Bruce.
Mr. Bagnall.	Mr. Gregory.
Lord Robert Montagu.	Lord Frederic Cavendish.
Mr. Read.	Sir Charles Lanyon.
Mr. M'Lagan.	Mr. William Lowther.
Mr. Bazley.	Mr. Dixon.
Mr. Potter.	Mr. Acland.

Captain *Donnelly*, R.E., further examined.

Mr. *R. R. W. Lingen* examined.

[Adjourned to Thursday next, at Twelve o'clock.

Thursday, 30th April 1868.

MEMBERS PRESENT.

Mr. SAMUELSON in the Chair.

Mr. Akroyd.	Mr. Austin Bruce.
Mr. Read	Mr. Gregory
Mr. Potter.	Mr. M'Lagan,
Lord Robert Montagu.	Mr. Bazley.
Lord Frederic Cavendish	Mr. Dixon.
Sr Charles Lanyon.	Mr. Bagnall.
Mr Acland.	Mr. Lowther

Mr. Henry Cole and Captain Donnelly, R E, further examined

Dr. Lyon Playfair examined

[Adjourned to Monday next, at Twelve o'clock.

Monday, 4th May 1868.

MEMBERS PRESENT:

Mr SAMUELSON in the Chair

Mr. Bazley	Lord Frederic Cavendi
Mr. Potter	Lord Robert Montagu.
Mr Akroyd	Mr Dixon.
Mr. Lowther.	Mr. Read
Mr Bagnall.	Mr Austin Bruce
Mr. Graves	

Mr. Trenham Reeks, Mr. J. F. Lelan, and Dr. J. Percy, were severally examined.

[Adjourned till Thursday next, at Twelve o'clock.

Thursday, 7th May 1868.

MEMBERS PRESENT.

Mr. SAMUELSON in the Chair.

Mr. Bazley.	Lord Frederic Cavendish.
Mr. Potter.	Mr. Austin Bruce
Mr. Akroyd.	Mr Graves.
Mr. Dixon.	Mr M'Lagan.
Mr. Acland.	Mr Read.
Mr. Lowther.	

Mr. Joseph Whitworth and Mr. Robert Hunt, F R S., were severally examined.

[Adjourned till Monday next, at Twelve o'clock.

Monday, 11th May 1868.

MEMBERS PRESENT:

Mr SAMUELSON in the Chair

Mr. Lowther.
Mr. Acland.
Mr Austin Bruce.
Mr Akroyd.
Mr. Potter. .

Mr. Bazley.
Sir Charles Lanyon.
Mr M'Lagan
Lord Frederic Cavendish.
Mr Read.

Dr. *W. B. Carpenter* and Professor *John Tyndall* were severally examined

[Adjourned to Thursday next, at Twelve o'clock.

Thursday, 14th May 1868.

MEMBERS PRESENT:

Mr. SAMUELSON in the Chair.

Mr. Graves.
Mr. Bazley.
Mr. Potter.
Mr. Dixon.
Mr. Lowther.
Mr. Acland.
Mr. Akroyd.

Lord Frederic Cavendish.
Mr Read
Mr. M'Lagan
Lord Robert Montagu.
Mr. Austin Bruce.
Sir Charles Lanyon.

Room cleared—The Committee deliberated.

Professor *Fleming Jenkin* examined.

[Adjourned to Monday next, at Twelve o'clock.

Monday, 18th May 1868.

MEMBERS PRESENT:

Mr. SAMUELSON in the Chair

Mr. Gregory.
Mr Lowther.
Mr Acland.
Lord Robert Montagu.
Mr. Akroyd.
Mr Potter.

Mr Bazley.
Mr. M'Lagan
Sir Charles Lanyon.
Mr. Read.
Mr. Powell.
Mr. Dixon

Professor *R. B. Clifton* and Sir *R. Kane* were severally examined.

[Adjourned till Thursday next, at Twelve o'clock.

Thursday, 21st May 1868.

MEMBERS PRESENT:

Mr. SAMUELSON in the Chair.

Mr Graves
Mr. Dixon.
Mr. Acland.
Mr. Bagnall.
Mr. Bazley.

Mr William Lowther.
Mr. Potter.
Mr. Read.
Mr. M'Lagan.

Rev Dr. *Joseph Woolley* and Mr. *E. J. Reed* were severally examined.

[Adjourned till Monday next, at Twelve o'clock.

Monday, 25th May 1868.

MEMBERS PRESENT:

Mr SAMUELSON in the Chair

Mr. Graves.	Mr. Bazley.
Mr. Gregory.	Mr. Bagnall.
Mr. Potter.	Mr. Acland.
Mr. Dixon.	Mr. M'Lagan.
Mr. Akroyd.	Mr. Read.
Lord Frederic Cavendish.	Sir Charles Lanyon.

Mr *J. W. Cunningham*, Dr. *W. A. Miller*, and Rev. *E. A. Abbott*, M.A., were severally examined.

[Adjourned till Thursday next, at Twelve o'clock.]

Thursday, 28th May 1868.

MEMBERS PRESENT.

Mr SAMUELSON in the Chair.

Mr. Gregory.	Mr. Dixon.
Mr. Bazley.	Mr. Acland.
Mr. Potter.	Mr. William Lowther.
Mr. Akroyd.	Mr. Bagnall.

Rev. Canon *Moseley*, Mr. *Thomas Coomber*, and Rev. *John G. Cromwell*, M.A., were severally examined.

[Adjourned till Monday, 8th June, at Twelve o'clock.]

Monday, 8th June 1868.

MEMBERS PRESENT

Mr. SAMUELSON in the Chair

Mr. Lowther.	Mr. Read.
Lord Frederic Cavendish.	Mr. M'Lagan.
Mr. Akroyd.	Mr. Dixon.
Mr. Potter.	

Mr. *Henry William Ripley*, Mr. *George Gibb*, Mr. *William Henry Stopford*, and Mr. *George Jarman*, were severally examined.

[Adjourned till Thursday next, at Twelve o'clock]

Thursday, 11th June 1868.

MEMBERS PRESENT.

Mr. SAMUELSON in the Chair.

Mr. Potter.	Lord Frederic Cavendish.
Mr. Dixon.	Mr. Akroyd.
Mr. Bazley.	Mr. Powell.
Mr. Graves.	Mr. Austin Bruce.
Mr. Lowther.	Sir Charles Lanyon.
Mr. Bagnall.	Mr. Beecroft.

Mr. *Anthony John Mundella*, Mr. *Henry Ashwell*, Mr. *Thomas Isaac Birkin*, Mr. *James Kitson*, jun., and Mr. *Henry H. Sales*, were severally examined.

[Adjourned till Monday next, at Twelve o'clock.]

Monday, 15th June 1868.

MEMBERS PRESENT :

Mr. SAMUELSON in the Chair.

Mr. Acland.		Mr. Bagnall.
Mr. Akroyd.		Mr. M'Lagan.
Mr. Lowther.		Mr. Read.
Mr. Potter		Mr. Dixon.
Mr. Bazley.		Mr. Powell.

Dr. J. Watts, Mr. Thomas Lawton, and Mr. John Angell, were severally examined.
Mr. J. F. Ischn further examined.

[Adjourned till Thursday next, at Twelve o'clock.

Thursday, 18th June 1868

MEMBERS PRESENT :

Mr. SAMUELSON in the Chair.

Mr. Potter		Mr. Lowther
Mr. Bazley.		Mr. Powell.
Mr. Akroyd.		Sir Charles Lanyon.
Mr. Acland		Mr. Dixon.
Mr. Bagnall.		Mr. M'Lagan.

Professor Henry E. Roscoe, F.R.S., and Mr. John Platt (a Member of the House) were severally examined.

[Adjourned till To-morrow, at Twelve o'clock.

Friday, 19th June 1868

MEMBERS PRESENT :

Mr. SAMUELSON in the Chair.

Mr. Read.		Mr. Dixon.
Mr. Potter.		Mr. Powell
Mr. Acland.		Mr. Bagnall.
Mr. Lowther.		Lord Frederic Cavendish.

Mr. Robert Rumney examined.

[Adjourned till Monday next, at Twelve o'clock.

Monday, 22nd June 1868.

MEMBERS PRESENT :

Mr. SAMUELSON in the Chair.

Mr. Dixon.		Mr. Bagnall.
Mr. Potter		Mr. Acland.
Mr. Lowther.		Lord Frederic Cavendish.
Mr. Akroyd.		Mr. Powell.

Mr. John Henry Chamberlann, Mr. W. C. Aitken, Mr. John Bragg, and Mr. C. Hibbs were severally examined.

[Adjourned till Thursday next, at Twelve o'clock

Thursday, 25th June 1868

MEMBERS PRESENT.

Mr. SAMUELSON in the Chair.

Lord Robert Montagu.	Mr Graves.
Mr Dixon.	Mr Acland.
Mr. Potter.	Mr Lowther.
Mr. Powell.	Mr M'Lagan
Mr. Akroyd.	Mr. Read.

Captain *Donnelly*, R. E., further examined.

Mr. *James Chance*, Mr. *Alfred Field*, Dr. *George Lloyd*, and Mr. *John Sharrow Wright*, were severally examined

[Adjourned till Monday next, at Twelve o'clock.

Monday, 29th June 1868.

MEMBERS PRESENT.

Mr. SAMUELSON in the Chair

Mr Akroyd.	Mr. Powell
Mr. M'Lagan.	Lord Frederic Cavendish.
Mr. Bazley.	Mr. Dixon
Mr. Potter	Mr. Read.
Sir Charles Lanyon.	

Sir *C Lanyon* (a Member of the Committee), Mr *R Calvert Clapham*, Mr. *William Cochrane*, Mr. *John Daglish*, and Mr. *Henry Watson*, were severally examined.

[Adjourned till Thursday next, at Twelve o'clock

Thursday, 2nd July 1868

MEMBERS PRESENT :

Mr. SAMUELSON in the Chair.

Mr. Gregory	Mr. M' Lagan.
Mr M'Lagan . ,	Mr. Austin.
Mr. Lowther.	Lord Frederic Cavendish.
Mr. Akroyd.	Mr. Dixon.
Mr. Bazley.	Mr. Graves.
Mr. Powell.	

Dr. *Stevenson Macadam*, Mr. *John Mayer*, F C S., Mr. *Robert Gill*, and Mr. *William Bann*, were severally examined.

[Adjourned till To-morrow, at Twelve o'clock.

Friday, 3rd July 1868.

MEMBERS PRESENT:

Mr SAMUELSON in the Chair.

Lord Robert Montagu	Mr. M'Lagan.
Mr. Dixon	Mr. Akroyd.
Mr. Potter	Mr. Acland.
Mr. Bazley	Mr. Lowther.
Mr. Powell.	Lord Frederic Cavendish.

Captain *Donnelly*, R E, further examined.

Lord *Robert Montagu* (a Member of the Committee), Professor *T H. Huxley*, F.R.S., Dr *E Frankland*, F R S, and Mr *J. C Buchmaster*, were severally examined.

[Adjourned to Tuesday, 14th, at Twelve o'clock (to consider Report).

Tuesday, 14th July 1868.

MEMBERS PRESENT

Mr SAMUELSON in the Chair.

Mr Powell.	Sir Charles Lanyon
Mr Potter	Lord Robert Montagu.
Mr Akroyd	Mr. Acland.
Mr. Bazley	Mr. Read.
Mr. Dixon.	

DRAFT REPORT proposed by the Chairman, read a first time as follows—

“ 1. In order to ascertain the state of scientific instruction amongst the industrial classes, your Committee has called before it witnesses representing the following bodies.—

“ 1st. The Department of Science and Art of South Kensington, the Committee of Council for Education, and the Government Colleges of Science and Naval Architecture

“ 2nd. The University of Oxford, the University of London, and certain institutions unconnected with the State, in which science is taught exclusively, or holds a prominent position

“ 3rd. The few secondary schools in which science has been for some time systematically taught.

“ 4th. The managers and teachers of science classes and mechanics' institutes receiving aid from the State, or supported exclusively by voluntary efforts.

“ 5th. The population engaged in the great staple industries carried on in the principal manufacturing towns and districts

“ 2. Their evidence may be included under two heads —

“ 1st. The state of scientific instruction of,

“ (1) The foremen and workmen engaged in manufactures

“ (2) The smaller manufacturers and managers.

“ (3) The proprietors and managers-in-chief of large industrial undertakings, and—

“ 2nd. The relation of industrial education to industrial progress.

“ I.—THE STATE OF SCIENTIFIC INSTRUCTION OF FOREMEN AND WORKMEN.

“ 3. It is stated that the foremen are almost, without exception, persons who have been selected from the class of workmen by reason of their superior natural aptitude, *steadiness*, and industry. Their education, and that of the workmen, during the school age, has been received in elementary schools; and owing both to the defective character of the instruction

instruction in those schools, and to the early age at which the children go to work, it is rarely sufficient to enable them to take advantage of scientific instruction at a later period.

" 4. In this statement the children educated as half-timers under the Factory Acts must, as a rule, be included. The evidence of Mr Mundella and other witnesses tends to show, that the primary education received in the factory schools is insufficient, except where the employment and education are both uninterrupted between the ages of eight and 13, and where the instruction is given in good schools established or supported by manufacturers who take an active and intelligent interest in the welfare of the children whom they employ.

" 5 As a rule, the little rudimentary knowledge acquired at school is rarely retained after the young people have been at work two or three years, and elementary scientific instruction is thus entirely beyond the reach of a large portion of our industrial population. The series of schools at Halifax, at Oldham, &c., are exceptional instances of fair elementary education to children, followed by elementary instruction in theoretical and applied science to young persons and adults.

" 6. It is stated by nearly every witness (and on this subject your Committee would direct particular attention to the evidence of the Rev Thos. Cromwell, principal of the training school at Chelsea) that the tendency of the Revised Code has been to diminish the efficiency of elementary education. It is hoped that the recent introduction of a seventh standard of examination may have a contrary and beneficial effect, and it is contended that physical geography, the elements of drawing, of the properties of matter, and of the laws of health, may be taught to young children in every elementary school.

" 7. The existing elementary classes in experimental science are generally held in connection with mechanics or literary institutions, although their number has increased of late, they are confined chiefly to the Metropolis and its neighbourhood, and to Lancashire, the West Riding of Yorkshire and Cornwall, and to Edinburgh and Glasgow.

" The pupils may present themselves for the examinations of the Society of Arts, and of the Department of Science and Art at South Kensington. When such pupils are of the artisan class, and are successful, payment according to results is made to the teachers by the Department, and Queen's prizes or medals are given to the pupils themselves.

" Besides artisans, draughtsmen, clerks, teachers, and other persons of various grades, attend these classes, and the evidence of Professor Tyndall, Professor Huxley, and the other examiners, as well as of many other competent witnesses, concurs to show that the instruction, though elementary, is sound.

" 8 Elsewhere than in the districts named, these classes scarcely exist. In the midland counties, the Midland Institution of Birmingham is the only one in which experimental science is systematically taught. There are no such classes permanently established in the north-eastern, eastern, west midland, or southern counties, and in many parts of England, the fact that Government aid is granted to them was unknown, until public attention was drawn to it by the recent discussion on the subject of technical education, and by the appointment of this Committee. It is true that the Science and Art Directory shows numerous classes scattered over the country, but they are mostly confined to rudimentary instruction in chemistry, physiology, and botany, in various schools. Though not without value of their own, they have very little, if any, direct influence on the industrial occupations of any class.

" 9 In Scotland, where the superior primary instruction of the artisans removes one of the obstacles to their acquiring scientific instruction, the Watt Institution of Edinburgh, and the Andersonian University of Glasgow have rendered good service, the former during nearly half a century, the latter for more than 20 years, they can boast amongst their scholars such names as those of Nasmyth, James Young, and many others. Technical objections have hitherto prevented these schools from receiving the grants of the Science and Art Department, but within the last 12 months these have been overcome.

" 10. The Mining School of Cornwall, as described by Mr Robert Hunt, Keeper of Mining Records, is the only one of its kind; the mining population being scattered over a wide area, it is necessary to send a teacher to the villages in order to conduct the classes.

" The miners are taught the elements of chemical and physical science with special reference to their occupations; and the school is producing results which are excellent, though limited as to their area by want of funds. The wages of the miners are inadequate to enable them to pay fees sufficiently high to support the school, even with the aid of payment on results from the Department of Science and Art, and the local subscriptions do not enable the promoters to provide instruction for all the villages which require or desire it.

" 11. The witnesses from the north of England, representing the coal trade, Messrs. Dalglish & Cochrane, are anxious for the establishment of a similar peripatetic school in the

pit villages of Durham and Northumberland. Until their attention was drawn to the *Corman Mising School*, they were quite unaware of its existence. They state that the proprietors of collieries would be willing to provide the necessary buildings, and they consider it essential that the Department of Science and Art should give its advice, and the services of its organising master, to the local matter which may be formed to carry out science instruction amongst the mining population of those counties.

"12 At Huddersfield special classes are now in course of formation for teaching chemistry, as applied to dyeing, to foremen and apprentices. These classes are supported by the principal manufacturers and merchants of the neighbourhood. At Bradford a subscription list has been opened for the erection of a school of Science and Art, at a cost of 50,000 £, to which one of its citizens has offered a contribution of 5,000 £; and the munificent gift of 10,000 £ by Mr. Whitworth, for the endowment of scholarships in mechanical engineering, is offered on conditions that give to the artisans, concurrently with men of other grades, and who have received a more liberal education, an opportunity of acquiring a scientific knowledge of their craft and profession.

"13. The Hulme branch of the Amalgamated Society of Carpenters has been the first trade society to establish an adult school in which carpenters and joiners, whether members of the society or not, may be taught drawing, the principles of building, construction, and other branches of science having special reference to their trade.

"14. The Bristol Trade School, and the Navigation School of Hull, both aided by grants on results from the Science and Art Department, are conspicuous examples of the successful introduction of science teaching into elementary schools of a superior kind for artisans. The Bristol school is fully described in the evidence of Mr Thomas Comber. The building, formerly used as a national school, is rent free, and receives some 150 boys of the ages of 12 to 15, who are taught elementary mathematics, chemistry, physics, and mechanical drawing. They pay a fee of 3 £. per annum, which, together with the grant on results, covers the cost of conducting the school.

"15. A hindrance second only to that of the defective elementary instruction of the pupils is the scarcity of science teachers, and the want of schools for training them. The remuneration of the teachers, arising from pupils' fees and payment on results by the Department of Science and Art, is, with few exceptions, so scanty that science teaching is scarcely ever followed as a profession, but only as an addition to some more profitable employment. Hence, classes are frequently suspended whenever the more important occupations of the teacher demand increased attention, or cause him to remove to other localities.

"Nearly all the witnesses claim, as a means of augmenting their emoluments, some relaxation of the rule which prevents teachers being paid on the results of instruction given to persons who are not artisans.

"16 As the demand for instruction increases, the incomes of the teachers will doubtless increase likewise, but the want of competent men will still remain. The offer, under a recent Minute of the Department, of sums of 25 £ per annum in aid of scholarships to be founded by localities contributing like sums, together with the remission of the fees of the Government Colleges of Science, to the holders of such scholarships, will probably induce some young men to prepare themselves for the career of elementary science teachers.

" II. THE SCIENTIFIC INSTRUCTION OF THE SMALLER MANUFACTURERS AND MANAGERS.

"17 Unfortunately, this division may be disposed of in a very few words. Its members have either risen from the rank of foremen and workmen, in which case all that has been stated of the first division will also apply to them; or else they are an offshoot from the class of smaller tradesmen, clerks, &c, and have been educated in the secondary endowed, and so-called commercial schools. With some advantage the instruction which they afford is certainly not superior to that of elementary schools; and even in the better schools of this grade the principles of science are scarcely ever taught. The pupils have, however, generally remained at school till the age of 14 or 15, and they never lose the use of the elementary instruction which they had acquired at school. Hence, where the opportunity for instruction in adult science classes exist, they have not, like the artisans, to contend with the mere clerical obstacles to the acquisition of scientific knowledge.

" III.—THE PROPRIETORS AND MANAGERS OF GREAT INDUSTRIAL UNDERTAKINGS.

"18. In those not unfrequent cases where these persons also have risen from the rank of artisans, the same exceptional gifts, including more especially those of unconquerable perseverance and energy which had caused their elevation, have also enabled them generally to correct the deficiencies of their early literary training. Any knowledge of scientific

scientific principles which they may have acquired is generally the result of solitary reading, and of synthetical observation of the facts, with which their pursuits have made them familiar.

" 19 More generally, however, the training of the capitalists, and of the managers of their class, has been that of the higher, secondary, or public schools, followed in rare, though in more recent years less unfrequent, instances, by a course of more or less systematic scientific instruction in colleges like the Royal School of Mines, the Royal College of Chemistry, University and King's Colleges, London, Owens' College, Manchester, and the laboratories of the Universities of Edinburgh and Glasgow. The scientific courses of Oxford have been too recently instituted, and have hitherto been devoted too entirely to pure science, to have had any appreciable influence on the scientific instruction of this class, besides which, a feeling exists, to which expression was given by Mr Chance, the eminent manufacturer of Smethwick, himself a man of great scientific attainments, and a distinguished member of the University of Cambridge, that however suitable the universities may be or become for the training of professors of science of the higher class, the habits at present acquired there by the sons of wealthy men are not conducive to the successful prosecution of an industrial career.

" 20 The Military and Scientific Department of the Proprietary College of Cheltenham, and the City of London Endowed School, are exceptional instances of secondary schools in which instruction in science holds the first place. In the great public schools of Harrow and Rugby, instruction in one scientific subject, in addition to classics and mathematics, has only recently been made compulsory.

" 21. Any attempt to analyse briefly the evidence as to the degree of instruction given at King's College and University College, London, and Owens' College, Manchester, would probably fail to convey a correct impression your Committee would therefore direct attention to the evidence *in extenso*. The same observation applies to the University of Edinburgh, where a Chair of Civil Engineering has recently been founded by Sir David Baxter, to the endowment of which the Government has agreed to contribute.

" 22 The inhabitants of Manchester have raised a fund for endowing a similar Chair at Owens' College in that city. To that fund, a single firm of mechanical engineers contributes 3,000 *l.*, besides a subscription of 250 *l.* per annum from one of its partners. The college is full to overflowing, and a proposed building fund of 150,000 *l.* has already received subscriptions amounting to 40,000 *l.*

" 23. The Royal School of Mines, in addition to its lectures to artisans delivered by some of the most eminent men of science, has systematic courses of lectures in nearly every subject usually comprised in a higher technical course, with the important exception of mathematics.

" The number of its matriculated students is under 20; its metallurgical laboratory, which has room for only 10 students, is always full. The Royal College of Chemistry in Oxford-street, which is connected with it, has about 40 students in its laboratory. It cannot accommodate more.

" 24 It has been possible, thanks to the good preparatory teaching of elementary mathematics in the Dockyard schools from which the pupils are drafted, to make mathematical instruction, which is wanting in Jermyn-street, one of the principal features of the Royal School of Naval Architecture at South Kensington, the only school of naval construction in the kingdom. According to the evidence of Mr Reed, Chief Constructor to the Navy, this school is rendering most essential service to that department. The pupils are engaged during six months in constructive works in the various dockyards, and undergo a complete course of technical training at South Kensington in all that relates to their art, during the rest of the year.

" 25 Your Committee does not consider it desirable to refer in this Report to the Royal College of Science in Dublin, or to the Queen's Colleges and science classes in Ireland, as the subject of the institutions for promoting science and art in Ireland is now undergoing separate investigation.

" 26 The following abstracted statement of the cost of instruction in some of the preceding schools or institutions, though only approximate, may be of service—

" Royal School of Mines, 30 *l.* for three years, exclusive of laboratory fees, which are from to per annum.

" Royal College of Chemistry, 6 *l.* per annum, exclusive of laboratory fees, which are

" King's College Scientific Department,

" University College,

" Owens' College, Manchester; evening classes to working men, at per course

" Cheltenham College Military Department, 28 *l.* per annum, books, laboratory, &c., 8 *l.* per annua.

" City of London School, 9 £ per annum.

" Bristol Diocesan Trade School, 3 £ per annum.

" *Note.*—King's College is self-supporting; the ground having been contributed by the State, and the building, for all departments, having cost £

" Owens' College is endowed by very large benefactions of the late Mr. Owens and others.

" The City of London School, according to the evidence of the head master, the Rev. E. Abbott, would be compelled to raise the fees from 9 £ to 13 £, if it had to pay rent for its buildings, and received no aid from endowments; and the masters are said to be inadequately remunerated.

" The Bristol Trade School has no endowment, except the free use of the buildings

" The fees in the adult science classes usually vary from 5 s to 10 s. per course, the State contributes to the maintenance of the teachers by payments on the results of the May examination of artizan pupils, in addition to which there is in nearly all cases considerable aid from local subscriptions, and from the general funds of mechanics' and other similar institutions.

" 2 *The Relation of Industrial Education to Industrial Progress*

" 27. The industrial system of the present age is based on the substitution of mechanical for animal power; its development is due in this country to its stores of coal and of metallic ores, to our geographical position and temperate climate, and to the unrivalled energy of our population.

" 28. The acquisition of scientific knowledge has been shown by the witnesses to be only one of the elements of an industrial education and of industrial progress. Indeed there is a preponderance of evidence to show that, so far as the workmen, as distinguished from the managers, are concerned, it can be considered an essential element only in certain exceptional trades, or, generally, as enlarging the area from which the foremen and managers may be drawn

" 29. In all cases another and an indispensable element of industrial success is the acquisition of practical experience and manipulative skill.

" 30. The evidence given before your Committee places beyond all doubt the fact, that these latter acquirements are possessed in a pre-eminent degree by our manufacturing population of every grade, according to their several necessities. They are obtained in our factories, our forges, our workshops, our shipyards, and our mines, which, in their organization and appliances, are the models which, with a few special exceptions, other nations have hitherto imitated and followed, but not surpassed.

" 31. The pressure of foreign competition, where it exists, is attributed mainly to the artistic taste of foreign nations, to fashion, to lower wages, and to the absence of trade disputes abroad.

" 32. It is owing to one or more of these favourable conditions, rather than to superior education or technical skill, that the lacemakers of Calais, and the locomotive manufacturers of Creuzot and of Esslingen, are competing with this country in neutral markets, and even at home; and Mr. Cochrane states that the low rate of wages alone enabled the factory at Anzin to furnish him with pumping and winding engines, constructed according to his own design, but of excellent workmanship, which he has erected at his collieries in Northumberland and Durham.

" 33. Only two witnesses from Birmingham, the one an eminent merchant, the other a manufacturing jeweller, and Mr. Gill, a woollen manufacturer, of Innerleithen, in Scotland, attribute the loss of certain trades to the superior skill, appliances, and education of the German, Belgian, and American manufacturers, and the great steel works of Krupp, in Westphalia, have been named as the only instance of a factory which is said to possess an organization superior to that of any establishment in the same branch of industry in this country

" 34. At the same time, nearly every witness speaks of the extraordinarily rapid progress of Continental nations in manufactures, and attributes that rapidity, not to the model workshops which are met with in some foreign countries, and are but an indifferent substitute for our own great factories, and those which are rising up in every part of the Continent; but, besides other causes, to the scientific training of the proprietors and managers in France, Switzerland, Belgium, and Germany, and to the elementary instruction which is universal amongst the working population of Germany and Switzerland. There can be no doubt, from the evidence of Mr. Mundella, of Professor Fleeming Jenkin, Mr. Kitson, and others, and from the numerous reports of competent observers, that the facilities for acquiring a knowledge of theoretical and applied science are incomparably greater on the Continent than in this country, and that such knowledge is based on an advanced state of secondary education.

"35. All the witnesses concur in deaving similar advantages of education for this country, and are satisfied that nothing more is required, and that nothing less will suffice, in order that we may retain the position which we now hold in the van of all industrial nations. All are of opinion that it is of incalculably greater importance economically that our manufacturers and managers should be thoroughly instructed in the principles of their arts than that the artizans themselves should possess the elements of such knowledge; and all are agreed that good primary instruction is what is to be chiefly desired for the working class.

"36 They are convinced that a knowledge of the principles of science on the part of those who occupy the higher industrial ranks, and the possession of elementary instruction by those who hold subordinate positions, would tend to promote industrial progress by stimulating improvement, preventing costly and unphilosophical attempts at impossible inventions, diminishing waste, and obviating in a great measure ignorant opposition to salutary changes.

"37. At the same time, the witnesses are far from believing that the economical necessity for general and scientific education is as yet fully realised by the country, and some of them consider it essential that the Government should interfere much more actively than it has done hitherto, to promote the establishment of scientific schools and colleges in our great industrial centres.

"38. In reference to the sufficiency, or the reverse, of voluntary efforts, it is stated, on the one hand, that premiums of several hundred pounds are paid for the admission into the offices of civil, and the workshops of mechanical engineers, of pupils, many of whom fail to avail themselves fully of the valuable instruction which they would obtain there, owing to the absence on their part of all preliminary instruction in mathematics and physical science, and it is reasonably inferred that persons who are willing to pay those large sums, and who do not hesitate to send their sons to expensive schools, will be prepared to pay for instruction in science as soon as they are convinced of its utility; whilst it is argued, on the other hand, that in all countries, and at all times, the offer of education of every kind has preceded the demand, and that any temporary sacrifice on the part of the State, in order to place scientific instruction within the reach of those who would be likely to appreciate it, will be amply and speedily repaid by the increase of the general intelligence and prosperity which it will produce

"39 A more general opinion on the part of the witnesses than either of these extreme views is, that wherever any locality in which, from its geographical position and industrial importance, it may be presumed that a scientific college or a higher secondary school of science is likely to be successful, is prepared to contribute largely to the creation and maintenance of such an institution, the State may fairly give assistance to such locality by moderate grants, and by testing the results of the school

CONCLUSIONS.

"40. The evidence which has been given before your Committee, and in part summarised in the preceding pages, together with the information which is accessible to them in common with other members of the community, has convinced them—

"(1.) That it is of the most vital importance that increased efforts should be made to place efficient elementary instruction within the reach of every child.

"(2) That whilst every assistance should be afforded by parochial aid, or otherwise, to enable poor parents to send their children to school, the cupidity or indifference of those who are placed above want should not be permitted to interfere with the claims of every child to receive such instruction.

"(3) That elementary instruction in drawing, in physical geography, and in the phenomena of nature, should be given in all the larger elementary schools

"(4.) That adult science classes, though of great use to artizans, to foremen, and to the smaller manufacturers, cannot be deemed a substitute for the scientific instruction which those should possess who are responsible for the conduct of important industrial undertakings. That these, in common with all whose necessities do not oblige them to leave school before the age of 16, should receive instruction in the elements of science as part of their general education

"(5) That the reorganization of secondary instruction is urgently required, and that the elaborate reports of the Schools Inquiry Commission, which prove the instruction in those schools to be lamentably defective, whilst abundant funds for efficient education are shown to exist, together with the recommendations of that Commission, ought to receive the immediate consideration of Parliament and of the country.

"(6) That superior primary schools, and secondary schools of various grades, in which science would more or less take the place of classics as an instrument of culture as well as of direct instruction, can be established, and would be self-supporting, if the fees are equal to those paid for literary instruction in good proprietary or adventure schools of similar grade.

"(7.) That superior colleges of science, and special schools for technical instruction requiring costly buildings and laboratories, cannot be supported by fees alone, but must receive aid from one or more of the following sources—from the State, from the localities, and from benefactions.

"(8.) That such colleges and special schools are, for various reasons, most likely to be successful if established in large centres of industry, and more especially for the reason that the choice of such centres tends to promote the combination of science with practice on the part both of the professors and of the pupils

"(9.) That the taxpayers of the provinces of England have not received a full share of the benefit of their contributions to the common fund, out of which the large grants to South Kensington, to Jermyn-street, to the Scottish and Irish Universities, and to the Irish Colleges, have been made.

"(10.) That, therefore, if the principal of sustaining Government Colleges of Science and Museums, and of giving aid to Scottish Universities and Irish Colleges be maintained, the large manufacturing and mining centres of England may fairly ask for such a redistribution of the public grants as will afford them increased aid supplementary to the funds which they may raise in their own localities for the purpose of promoting scientific instruction.

"(11.) That some slight addition to the emoluments of science teachers would probably tend materially to promote the establishment and permanence of elementary science classes. It will be for the department to consider whether such addition, if made, should be by increased payment on results in all or some of the subjects taught, or in other ways which may not appear to be open to abuse

"(12.) That the provisions of the Public Libraries' and Museums' Act should be altered so as to enable public bodies to levy a slightly increased rate for scientific purposes.

"(13.) That the managers of training colleges for the teachers of elementary schools be invited to give special attention to the instruction of those teachers in theoretical and applied science, where such instruction does not exist already

"(14.) That teachers in elementary day schools should be paid on results, for teaching science to the older scholars, in the same way as payment is now made for drawing in such schools.

"(15.) That a more intimate connection between the various Government institutions for scientific instruction in London would increase the efficiency of each of those institutions; but that, having considered the plan of a central college of science at South Kensington, proposed by the Science and Art Department, your Committee would not recommend its adoption until Parliament shall have referred it to the consideration of competent persons "

DRAFT REPORT, proposed by Mr *Acland*, read as follows

" I.—IMPORTANCE OF SCIENTIFIC INSTRUCTION TO THE INDUSTRIAL COMMUNITY.

"(1) *To Firms and Managers*—Scientific instruction is important to the heads and principal managers of manufacturing firms, generally, as one among other branches of a liberal education, and, in particular cases, as supplying information necessary for the economical conduct of business.

"(2) *To the Artizans*—As regards artizans, scientific instruction is desirable, firstly, as a means of cultivating intelligent habits of observation, secondly, as tending to set trades free from obstinate adherence to traditional rules of practice inapplicable to modern requirements; thirdly, scientific instruction is important to the artizan, who has the practical and moral qualities which might fit him to rise to the post of foreman or manager, because the absence of such knowledge might operate as an obstacle to the progress of a man otherwise well qualified for promotion.

" II.—SCIENTIFIC INSTRUCTION, HOW CONNECTED WITH GENERAL EDUCATION, AND TECHNICAL PRACTICE.

" The practical course to be taken in making systematic provision for scientific instruction cannot be decided without taking into account the existing arrangements for general education, and for the acquirement of the technical information commonly required for the practice of particular professions and branches of business.

" These arrangements are in part dependent on certain legal restrictions affecting public endowed institutions (such as the grammar schools), and partly on social, profes-

sional,

sional, and commercial usages, which have created a demand for instruction in private establishments.

"Very large sums are expended in England on *general education*; these sums are derived in part from ancient endowments, in part from modern contributions to proprietary and other schools, and to a very large extent from the payments of parents in the upper and middle classes.

"*Technical instruction* in England exists chiefly in the form of apprenticeship and pupilage, and for the advantage supposed to be derived from seeing practice in those forms, very large sums are paid, in the form of premiums, by persons who desire their sons to enter upon professional, manufacturing, commercial, or agricultural pursuits.

"For *scientific instruction*, either as a part of *general education* or as introduction to *technical training*, the expenditure at present is very small. It is obvious that the success of any course to be pursued with a view to make provision for scientific instruction must depend in great measure on the co-operation of parents; and that such co-operation must be founded on a general conviction of the practical advantage of the means offered. It is probable that, when such conviction shall have been established, private resources may be relied upon for supplying a considerable portion of the necessary expenses.

"It has, however, been frequently asserted that the higher branches of learning, which may not seem to the public at large to produce immediate results, require the sustentation of public funds in order to place the highest talent at the service of the nation. The same statement is probably not less true of many branches of science, the ultimate results of which to the nation, though most beneficial, may not be obvious or generally recognised.

III — PRACTICAL FORMS IN WHICH SCIENTIFIC INSTRUCTION IS NEEDED

"1. The universal establishment of primary schools, in which some of the elements of natural history may form a part of the instruction, accompanied by measures tending to prevent the rising generation from suffering from the neglect or ignorance of their parents or guardians.

"2. The establishment in all towns of secondary schools for artisans and tradesmen willing to keep their children at school to the age of 14 or 15. Drawing, and the elements of mathematics and natural science to be taught in such schools, and the school fees not to exceed 1 l. per quarter.

"3. The further extension and encouragement of evening classes, and the appointment of circulating or organising teachers.

"4. The introduction of the elements of natural science into all endowed secondary schools in which scholars continue their education up to the age of 16 or 18.

"5. The selection of certain endowed schools, in favourable situations in the manufacturing districts, as special science schools, having in view the special requirements of the district; such schools to be rendered available as boarding schools to the surrounding towns, by the establishment of Exhibitions open to public competition; so that the children of the artisan may be promoted from the lowest to the highest school.

"6. The establishment of a small number of colleges for adults more or less corresponding to Owen's College, Manchester, in which advanced science teaching may be given on a scale parallel to that of the Universities, but in more direct relation to the industry of the particular district in which each college is situated. The annual cost of such instruction is estimated at about 30 l. per head, it being presumed that there are 200 pupils, and that good buildings are provided.

"7. The encouragement and certification of trained science teachers by the recognition of natural science as one element in the curriculum of the training colleges or normal schools aided and inspected by Government. It deserves also to be considered whether teachers of secondary schools should be admitted into the training schools on payment of the expense of their instruction.

"8. The encouragement by examination and certificate of self-taught science teachers in the industrial classes.

"9. The encouragement of higher science teachers by the granting of degrees in science at Oxford, Cambridge, and opening fellowships to distinction in natural science as well as in mathematics and moral science.

"10. The organisation, by the State, of the secondary education of the country, as a whole, as regards the government and inspection of all publicly-endowed institutions, and the establishment of a recognised standard of attainment for teachers, whether public or private.

“ IV.—SOURCES FROM WHICH THE FUNDS MAY BE DERIVED FOR THE EXPENSES OF SCIENTIFIC INSTRUCTION.

“ The expenses are of three kinds.—

“ *a* *Current Expenses*—Salaries, text-books, materials, chemicals, &c.; repair of apparatus.

“ *b* *Permanent Objects*.—Buildings, new apparatus, museums, libraries of reference.

“ *c* *Official Expenses*.—Inspection; organizing staff for stimulating local action and diffusing information.

“ These expenses may be met by funds derived from the following sources:—

“ The sources of income are as follows:—

“ 1. Fees paid by pupils.

“ 2. Endowments devoted to education.

“ 3. Other public funds, such as obsolete charities, and others of doubtful or mischievous tendency.

“ 4. Voluntary contributions.

“ 5. Local rates.

“ 6. Grants from the public exchequer, or loans advanced on local or personal security.

“ V.—GENERAL PRINCIPLES

“ It is submitted that it is premature to lay down, as applicable to all places, the proportions in which the expenses of scientific instruction may be provided from the above-named sources, but the following general principles are suggested for discussion.—

“ (1) That while moral and economical considerations may justify the expenditure from the national exchequer of considerable sums on general, and especially on primary education, with a view to the diminution of crime, pauperism, and disease, the payment, in whole or in part, of the expense of instruction in science for particular classes is open to *prima facie* objection, and requires some special justification.

“ (2) That such justification for temporary grants from the national funds may to a certain limited extent be sought in present circumstances, which suggest the expediency of measures tending to awaken local activity, and to promote a better use of existing resources.

“ (3) That on this ground some extension of the action of the Department of Science and Art may be deserving of consideration as a temporary measure.

“ (4) That in any extended action of the Government the following principles should be borne in mind —

“ *a*. That expenditure on scientific instruction on the part of the Government is useless without local co-operation, and therefore that the initiative should be taken on the spot, the Government aiding in providing the means, and testing the results.

“ *b*. That endowments for the annual expense of instruction are more effectual when used to stimulate and reward exertion than when they are expended on fixed salaries with a view to make instruction cheap. Therefore, that any portion of existing endowments which may be rightly applicable to scientific instruction should be applied to that object, in the form of exhibitions tenable at good schools or colleges giving scientific instruction.

“ *c*. That the administration of local funds for scientific instruction should be vested in responsible bodies, representing a sufficiently wide area, with a view to guard against undue local influence, and to secure the free action of enlightened public opinion.

“ *d*. That while the evidence before the Committee shows that there is in some quarters great indifference to the importance of scientific instruction, it proves, at the same time, that enlightened individuals and communities, when they are convinced of its necessity, have shown a disposition and ability to make contributions as great as, if not greater than, any which a Government could venture to propose to Parliament to sanction, and therefore that it is more expedient to awaken and direct local exertion than to supersede the necessity for its exercise.

“ *e*. That

"e. That all classes of pupils seeking scientific instruction should be called upon to contribute, according to their means, to the expense of such instruction.

"f. That as regards the special interests of manufacturers, the nation has no more interest in providing for the technical instruction of artizans, and foremen, and managers, than it has in providing agricultural instruction for farm labourers, and hinds, and land agents, with a view to the increase of the production of food

CONCLUSION.

"The general conclusion to be drawn from the inquiries of the Committee is, that Parliament should be urged to proceed without delay—

"1. To organise secondary education.

"2. To recognise instruction in natural science as an indispensable element in such education.

"3. To provide for the central, provincial, and local administration of existing funds, with due regard to the wants and capabilities of each branch of industry.

"4. To press forward further measures for primary education."

Draft Report, proposed by the Chairman, read a second time, paragraph by paragraph

Motion made, and Question put, That paragraphs 1 to 39 inclusive, be postponed—The Committee divided

Ayes, 5.		Noes, 2.
Mr. Acland.		Mr. Akroyd
Mr. Bazley.		Lord R. Montagu
Mr. Dixon.		
Sir C. Lanyon.		
Mr. Powell		

Paragraph 40—Section 1; Amendments made Another Amendment proposed, at the end of the section, to add the words, "And that greater regularity of attendance at school, and a lengthened duration of school life should be secured"—(Mr. Dixon)—Question, That those words be there added—put, and *negatived*.

Section 1, as amended, *agreed to*.

Section 2—Amendments made

Another Amendment proposed, by leaving out the words, "by parochial aid"—(Mr. Acland).—Question put, That those words stand part of the section—The Committee divided

Ayes, 5.		Noes, 2.
Mr. Akroyd.		Mr. Acland.
Mr. Dixon.		Mr. Bazley.
Sir C. Lanyon.		
Lord R. Montagu.		
Mr. Powell.		

Another Amendment proposed, by leaving out the word "poor," in order to insert the word "pauper"—(Lord R. Montagu) instead thereof—Question put, That the word "poor" stand part of the section.—The Committee divided

Ayes, 3.		Noes, 4.
Mr. Acland.		Mr. Akroyd.
Mr. Bazley.		Sir C. Lanyon
Mr. Dixon		Lord R. Montagu.
		Mr. Powell.

Word inserted.

Question, That the section, as amended, stand part of the paragraph.—The Committee divided:

Ayes, 3.		Noes, 4.
Mr. Akroyd.		Mr. Acland.
Mr. Dixon		Mr. Bazley.
Lord R. Montagu.		Sir C. Lanyon.
		Mr. Powell

Section 4.—Amendment proposed, by leaving out " 16 " in order to insert " 14 "—(Mr. Acland), instead thereof.—Question, That 16 stand part of the section—put, and *negatived*.—Question put, That the word " 14 " be there inserted.—The Committee divided :

<p>Ayes, 6.</p> <p>Mr Acland. Mr Akroyd. Mr Bazley. Mr Powell. Sir C. Lanyon Mr Read.</p>	<p>Noes, 2.</p> <p>Mr Dixon. Lord R Montagu.</p>
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Section, as amended, *agreed to*.

Section 5 amended, and *agreed to*

Section 6 —Amendment proposed, by leaving out the section, in order to insert the following section —That it is desirable that certain endowed schools should be selected in favourable situations for the purpose of being reconstituted as science schools, having in view the special requirements of the district, such schools to be rendered available to the surrounding districts by the establishment of exhibitions open to public competition, so that the children of every grade may be able to rise from the lowest to the highest school—(Mr Acland), instead thereof.—Question, That Section 6 stand part of the paragraph—put, and *negatived*. Proposed section inserted.

Sections 7 and 8 amended, and *agreed to*.

Section 9 —Amendment proposed, by leaving out from the word " received " to the end of section, in order to add the words " a sufficient proportion of the State Grant for scientific education "—(Mr Dixon), instead thereof.—Question, That the words proposed to be left out stand part of the section—put, and *negatived*.—Question put, That those words be there added.—The Committee divided .

<p>Ayes, 5.</p> <p>Mr Akroyd Mr Bazley. Mr Dixon. Sir C Lanyon. Mr. Read</p>	<p>Noes, 2.</p> <p>Lord R. Montagu. Mr Acland.</p>
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Question, That the section as amended, stand part of paragraph.— The Committee divided .

<p>Ayes, 5</p> <p>Mr Akroyd. Mr Bazley. Mr. Dixon. Sir C. Lanyon. Mr. Read</p>	<p>Noes, 2</p> <p>Mr. Acland. Lord R Montagu.</p>
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Section 10 —Amendment proposed, by leaving out the words " such a redistribution of the public grants as will afford them increased aid, supplementary to the funds which they may raise in their own localities for the purpose of promoting scientific instruction," in order to add the words, " increased Government aid for the promotion of scientific instruction "—(Mr Dixon), instead thereof.—Question put, That the word " such " stand part of the paragraph.—The Committee divided .

<p>Ayes, 4.</p> <p>Mr Acland. Mr. Bazley. Sir C Lanyon. Mr. Read.</p>	<p>Noes, 3.</p> <p>Mr. Akroyd. Mr. Dixon. Lord B. Montagu.</p>
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Further Amendments made.—Question put, That the section as amended, stand part of the paragraph.—The Committee divided :

<p>Ayes, 4.</p> <p>Mr Akroyd. Mr. Bazley. Mr Dixon. Mr. Read.</p>	<p>Noes, 3.</p> <p>Mr. Acland. Sir C. Lanyon. Lord B. Montagu.</p>
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Amendment proposed, after last section, to insert the following section: "The grants of money from the National Exchequer for local scientific instruction should be chiefly designed to promote local activity and a better use of resources otherwise available, should be regarded as occasional or temporary"—(Mr. Acland).—Question proposed, That this section be there inserted—Amendment proposed, To leave out from the word "available," to the end of the proposed section—(Mr. Akroyd)—Question put, That the words proposed to be left out, stand part of the proposed section—The Committee divided:

Ayes, 3	Noes, 2
Mr. Acland. Mr. Bazley Mr. Read.	Mr. Akroyd Mr. Dixon

Question put, That the proposed Section be there inserted—The Committee divided

Ayes, 3	Noes, 2
Mr. Acland. Mr. Bazley. Mr. Read.	Mr. Akroyd. Mr. Dixon.

Sections 11, 12, 13, 14, 15, *agreed to*, some with Amendments.

Paragraph (40), as amended, *agreed to*.

Postponed paragraph 1, amended, and *agreed to*

Paragraph 2, postponed.

Paragraph 3—Amendment proposed, by leaving out from the words "elementary schools" to the end of the paragraph, in order to add the words "but the amount of education which they, in many instances, possess, is not sufficient to enable them to profit by a scientific instruction"—(Mr. Akroyd), instead thereof.—Question, That the words proposed to be left out, stand part of the paragraph—put, and *agreed to*

Paragraph amended, and *agreed to*

Paragraph 4.—Amendment proposed, to leave out the words "in this statement the children educated as half-timers under the Factory Acts, must, as a rule, be included," in order to insert the words, "these defects are but partially removed by the Factory Acts"—(Mr. Akroyd), instead thereof—Question put, that the words proposed to be left out, stand part of the paragraph.—The Committee divided.

Ayes, 3.	Noes, 2
Mr. Acland. Mr. Bazley. Sir Charles Lanyon.	Mr. Akroyd. Mr. Dixon.

Paragraph *agreed to*.

Amendment proposed, after paragraph 4, to insert the following paragraph—

"In many instances the educational provisions of the Factory Acts are rendered practically inoperative by the short and uncertain attendance of children at school during the half-time period, and in other cases, where a sufficient supply of children above 13 can be obtained, employers refuse to take any short-timers, or to provide means for their education. It has been stated, by Mr. Wright, of Birmingham, that the new Factory and Hours of Labour Regulation Acts have had the effect of throwing out of employment 2,000 to 3,000 hands in Birmingham, and that there are not more than 200 to 250 receiving education under the half-time system; so desirous are employers of ridding themselves of all trouble as to the educational clauses of these Acts.

"It has, however, been admitted by several witnesses, that if children at and above the age of 13 were not allowed to work full time until they had passed an elementary examination in reading, writing, and arithmetic, and obtained a certificate of competency, then the parents and employers of such children, out of regard to their joint interests,

would endeavour to secure the requisite standard of elementary knowledge at an earlier age.

"It has further been suggested that as an incentive to attendance at infant schools previously to entrance on half-time work, a rudimentary examination in simple reading might be deemed a necessary qualification for a half-timer.

"With these additional safeguards against the evasion of the educational provisions of the Factory and Hours of Labour Regulation Acts, it is contended by the advocates of factory education, that these Acts, so amended, might be the means of extending primary education amongst the labouring classes generally."—(Mr. Akroyd)

Question, That this paragraph be there inserted—put, and *negatived*.

Paragraphs 5, 6, amended, and *agreed to*

Amendment proposed, after paragraph 6, to insert the following paragraph —

"(7.) *As respects the Instruction of the Industrial or Artizan Classes in Elementary Science*—After the formation of the Science and Art Department in 1853, attempts were made in various forms to afford the working classes opportunities for instruction in the elements of science. These experiments do not appear to have met with much success till, in 1859, a general minute on the subject was passed by the Lords of the Committee of Council on Education. This minute, greatly enlarged, and with various modifications which experience has suggested from time to time, forms the code of rules termed the Science Directory, and according to its provisions the grants in aid of science schools are administered. It is a pure system of payments on the results of instruction, as tested by the annual examinations of the department. The payments are only made on account of the instruction of students of the artizan or industrial classes. The prizes are open to all. Under this system a steady and rapid increase has been maintained, both in the number of classes and the students under instruction. This will appear from the following Table :

	Number of Schools.	Number under Instruction.
1860	9	500
1861	38	1,330
1862	70	2,543
1863	75	3,111
1864	91	4,668
1865	120	5,479
1866	153	6,835
1867	212	10,230
1868	300	14,600

"In this each separate institution in which scientific instruction is given is treated as a school, but the subjects taught and the number of classes in the different schools vary much. In some cases a school consists of but one class, and there is only one subject taught, in others there are as many as nine and ten classes in different subjects. The general results, as compared with the two previous years, are given below "

"RESULTS of the SCIENCE SCHOOL EXAMINATIONS, May 1866, 1867, and 1868.

	1866.	1867.	1868.
Number of schools under certificated teachers	153	212	300
Number of classes in the same	400	560	789
Number of individuals under instruction in certificated teachers	6,835	10,230	14,600
Number of the above who came up for examination	2,960	4,520	—
Number examined in addition to the above in schools under certificated teachers	170	400	300

" Results of the Science School Examinations, May 1866, 1867, and 1868—continued

	1866.	1867.	1868.
Number of Papers worked in —			
Subject			
I Practical, Plane, and Descriptive Geometry -	517	783	1,337
II Mechanical and Machine Drawing -	469	764	1,671
III Building, Construction, and Naval Architecture -	233	467	1,206
IV. Elementary Mathematics -	290	778	1,890
V Higher Mathematics -	24	36	33
VI. Theoretical Mathematics -	178	228	353
VII Applied Mechanics -	86	110	167
VIII Acoustics, Light and Heat -	327	590	769
IX Magnetism and Electricity -	352	738	1,038
X Inorganic Chemistry -	1,043	1,082	964
XI Organic Chemistry -	121	121	123
XII Geology -	194	207	309
XIII. Mineralogy -	21	34	38
XIV. Animal Physiology -	497	599	1,182
XV Zoology -	79	127	298
XVI Vegetable Physiology and Economic Botany -	138	100	112
XVII. Systematic Botany -	114	79	73
XVIII. Mining -	22	38	41
XIX. Metallurgy -	62	63	81
XX Navigation -	118	144	219
XXI. Nautical Astronomy -	77	88	87
XXII. Steam -	95	121	106
XXIII. Physical Geography -	409	931	1,516
TOTAL Number of Papers worked -	5,466	8,213	13,113
Number of provincial centres where examinations were held -	121	152	241
Number of metropolitan centres where examinations were held (including South Kensington Museum) -	13	15	23
Number of 5th Class -	778	1,587	2,359
" 4th " -	713	973	1,044
" 3rd Queen's Prizes -	1,228	1,576	2,475
" 2nd Queen's Prizes -	501	1,122	1,692
" 1st Queen's Prizes -	342	755	1,079
TOTAL Number of Successes -	3,562	6,013	8,649
Failures -	1,904	2,200	4,464

" From the evidence we have had before us, and from the reports made by the examiners to the Science and Art Department, it appears that there is a marked improvement as well in the nature of the instruction given as in the number of students. That this progress should have been made in eight years, cannot but be considered highly satisfactory, when it is remembered that during that time a knowledge of the existence of the system has had to be diffused in the country, necessarily a slow operation, and not only the classes, but the teachers to be treated. The payments on the results of the May 1867 examination amounted to 7,976 *l.*, being at the rate of 15 *s* 7 *d.* per person under instruction, or nearly 1 *l.* per examination paper worked, or nearly 1 *l.* 15 *s.* per individual student examined. In recent months these payments are increased at least 10 per cent.

" That the country has not more generally taken advantage of the aid offered by the State can be due only to the apathy and indifference on the subject which has unfortunately hitherto obtained.

" We find that under existing rules large payments can be earned in well-organised secondary schools, such as the Bristol Trade School; and in night classes, as at Heywood, Droydsden, Bolton, and Bury, though these do not occupy the whole time of the teacher, who may devote his day to other occupations."—(Lord Robert Montagu.)

Question, That this paragraph be there inserted—put, and *negatived*.

XXX PROCEEDINGS OF SELECT COMMITTEE ON SCIENTIFIC INSTRUCTION.

Remaining paragraphs *agreed to*, some with Amendments.

Postponed paragraph 2, further considered.

Amendment proposed, at the end of the paragraph, to add the words—"3rd. The duty of the State with reference to the promotion of scientific instruction"—(Mr. Dixon).—
Question, That those words be there added—put, and *negatived*.

Question, That this Report be the Report of the Committee to the House—put, and *agreed to*

Ordered, To Report, together with Minutes of Evidence and Appendix.

EXPENSES OF WITNESSES.

NAME OF WITNESS	Profession or Condition.	From whence Summoned	Number of Days absent from Home, under Orders of Committee	Expenses of Journey to London and back.	Allowances during Absence from Home.	Total Expenses allowed to Witnesses
Sir Robert Kane	President, Queen's College, Cork	Cork	4	£ 9 - -	£ 4 4 -	£ 13 4 -
Mr Thomas Coomber	Head Master, Trade School	Bristol	2	1 18 -	2 2 -	4 0 -
Mr Thomas Lawton	Agent of Lancashire and Cheshire Union	Manchester	4	3 10 -	4 4 -	7 14 -
Mr John Angell	Head Master, Mechanics' Institution	Manchester	4	3 10 -	4 4 -	7 14 -
Dr John Watts	Ph D	Manchester	4	3 10 -	4 4 -	7 14 -
Mr John Henry Chamberlain	Architect	Birmingham	1	1 18 6	3 8 -	5 1 6
Mr Charles Hibbs	Gunmaker	Birmingham	2	1 10 -	2 2 -	3 12 -
Mr W H Stopford	Schoolmaster	Halifax	4	3 7 6	4 4 -	7 11 6
Mr George Grubb	ditto	Halifax	4	3 7 6	4 4 -	7 11 6
Mr G Jarman	Science Teacher	Huddersfield	4	3 4 -	4 4 -	7 8 -
Mr. W Cochrane	Engineer	Newcastle-on-Tyne	3	4 13 -	9 9 -	14 2 -
Mr Henry Watson	ditto	Newcastle-on-Tyne	3	4 13 -	9 9 -	14 2 -
Mr J Daglish	ditto	Newcastle-on-Tyne	3	4 13 -	9 9 -	14 2 -
Mr R. C. Clapham	Chemical Manufacturer	Newcastle-on-Tyne	3	4 13 -	3 3 -	7 16 -
Dr Stevenson Macadam	Lecturer on Chemistry	Edinburgh	3	6 6 -	3 3 -	9 9 -
Mr. John Mayer	Science Teacher	Glasgow	3	6 6 -	3 3 -	9 9 -
Mr William Baird	Ironwork Contractor	Edinburgh	3	6 6 -	3 3 -	9 9 -
Mr Robert Gill	Manufacturer	Inverleithan, Glasgow	3	6 18 -	3 3 -	9 19 -
Mr Henry Sales	-	Leeds	-	2 15 -	-	2 15 -
						162 13 6

MINUTES OF EVIDENCE.

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<i>Thursday, 23rd April 1868.</i>		<i>Thursday, 11th June 1868.</i>	
Henry Cole, Esq, C.B., and Captain Donnelly, R.E. - - - -	PAGE - - - - 1	Mr. Anthony John Mundella - -	PAGE - - 232
<i>Monday, 27th April 1868.</i>		Mr. Henry Ashwell and Mr. Thomas Isaac Birkin - - - -	243
Captain Donnelly, R.E. - - - -	22	Mr. James Kitson, jun. - - - -	247
R. R. W. Lingen, Esq. - - - -	37	Mr. Henry H. Sales - - - -	251
<i>Thursday, 30th April 1868.</i>		<i>Monday, 15th June 1868.</i>	
Henry Cole, Esq, C.B. - - - -	45	Mr. John Watts, PH. D. - - - -	256
Captain Donnelly, R.E. - - - -	56	Mr. Thomas Lawton - - - -	266
Dr. Lyon Playfair, C.B. - - - -	57	Mr. John Angell - - - -	269
<i>Monday, 4th May 1868.</i>		Mr. J. F. Iselin, M.A. - - - -	273
Trenham Reeks, Esq. - - - -	69	<i>Thursday, 18th June 1868.</i>	
John Frederick Iselin, Esq. - - - -	74	Professor Henry E. Roscoe, F.R.S. - -	276
Dr. John Percy - - - -	76	John Platt, Esq, M.P. - - - -	290
<i>Thursday, 7th May 1868.</i>		<i>Friday, 19th June 1868.</i>	
Joseph Whitworth, Esq. - - - -	85	Mr. Robert Rumney - - - -	297
Robert Hunt, Esq, F.R.S. - - - -	94	<i>Monday, 22nd June 1868.</i>	
<i>Monday, 11th May 1868.</i>		Mr. John Henry Chamberlain - -	308
Dr. W. B. Carpenter - - - -	104	Mr. William C. Aitken - - - -	315
Professor John Tyndall - - - -	118	Mr. John Bragg - - - -	319
<i>Thursday, 14th May 1868.</i>		Mr. Charles Hibbs - - - -	324
Professor Fleeming Jenkin - - - -	122	<i>Thursday, 25th June 1868.</i>	
<i>Monday, 18th May 1868.</i>		Captain Donnelly, R.E. - - - -	330
Professor Robert Bellamy Clifton -	143	Mr. James Chance - - - -	330
Sir Robert Kane - - - -	152	Mr. Alfred Field - - - -	335
<i>Thursday, 21st May 1868.</i>		Dr. George Lloyd - - - -	341
Rev. Dr. Joseph Woolley - - - -	164	Mr. John Skurrow Wright - - - -	343
Edward J. Reed, Esq. - - - -	168	<i>Monday, 29th June 1868.</i>	
<i>Monday, 25th May 1868.</i>		Sir Charles Lanyon, M.P. - - - -	349
John William Cunningham, Esq., and Dr. William Allen Miller - - - -	173	Mr. R. Calvert Clapham - - - -	351
Rev. Edwin Abbott Abbott, M.A. -	182	Mr. William Cochrane - - - -	357
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Rev. Canon Moseley - - - -	192	Mr. Henry Watson - - - -	368
Thomas Coomber, Esq. - - - -	199	<i>Thursday, 2nd July 1868.</i>	
Rev. John G. Cromwell, M.A. - -	206	Dr. Stevenson Macadam - - - -	370
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Mr. Henry William Rapley - - - -	210	Mr. Robert Gill - - - -	386
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Mr. William Henry Stopford - - -	225	<i>Friday, 3rd July 1868.</i>	
Mr. George Jarman - - - -	227	Captain Donnelly, R.E. - - - -	392
		Right Hon. Lord Robert Montagu, M.P.	395
		Professor Thomas H. Huxley, L.L.D., F.R.S. - - - -	397
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A P P E N D I X.

Appendix, No. 1.

PAPERS handed in by Captain *Donnelly*, 28 April 1868.

SCHOOLS IN ENGLAND AND WALES.

COUNTIES.		No of Schools.	No of Students	COUNTIES		No of Schools.	No of Students.
ENGLAND:							
1	Bedfordshire	1	13	33	Suffolk	None	None.
2	Berkshire	1	46	34	Surrey	9	812
3	Buckinghamshire	2	87	35	Sussex	None	None.
4	Cambridgeshire	1	24	36	Warwickshire	6	371
5	Cheshire	9	278	37	Westmoreland	None	None.
6	Cornwall	7	140	38	Wiltshire	None	None.
7	Cumberland	None	None.	39	Worcestershire	4	164
8	Derbyshire	3	61	40	Yorkshire	16	476
9	Devonshire	10	*752				
10	Dorsetshire	2	50	WALES			
11	Durham	2	49	NORTH			
12	Essex	7	153	1	Anglesea	None	None
13	Gloucestershire	7	496	2	Carnarvonshire	None	None
14	Hampshire	2	88	3	Denbighshire	None	None
15	Herefordshire	None	None	4	Flintshire	None	None.
16	Hertfordshire	None	None	5	Merionethshire	None	None.
17	Huntingdonshire	1	16	6	Montgomeryshire	None	None.
18	Kent	13	662	SOUTH			
19	Lancashire	60	2,520	1	Brecknockshire	None	None.
20	Leicestershire	3	77	2	Cardiganshire	None	None.
21	Lincolnshire	1	6	3	Carmarthenshire	1	73
22	Middlesex	20	†1,246	4	Glamorganshire	3	121
23	Monmouthshire	None	None.	5	Pembrokeshire	None	None.
24	Norfolk	1	81	6	Radnorshire	None	None.
25	Northamptonshire	3	196	TOTAL			
26	Northumberland	1	28			210	9,480
27	Nottingham	4	183				
28	Oxfordshire	2	75				
29	Rutlandshire	None	None.				
30	Shropshire	1	45				
31	Somersetshire	None	None				
32	Staffordshire	6	111				

* Includes Plymouth Navigation School, with 344 Students } Not examined in May
 † Includes Dock Street Navigation School, with 328 Students }

SCHOOLS IN SCOTLAND.

COUNTIES.		No of Schools.	No of Students	COUNTIES		No of Schools.	No of Students.
1	Aberdeen	3	*395	7	Kincardine	1	13
2	Ayr	2	83	8	Kircudbright	1	13
3	Dumbarton	1	12	9	Lanark	3	†1,760
4	Edinburgh	1	228	10	Orkney	1	10
5	Forfarshire	1	70				
6	Inverness	1	27	TOTAL			
						15	2,611

The following Scotch Counties do not contain any Science Schools—Argyle, Banff, Berwick, Bute, Caithness, Clackmannan, Cromarty, Dumfries, Fife, Haddington, Kinross, Linlithgow, Moray, Nairn, Peebles, Perth, Renfrew, Ross, Roxburgh, Selkirk, Stirling, Sutherland, and Wigtown.

* Includes Aberdeen Navigation School, with 317 Students, not examined in May.
 † Only about 10 per cent. of these apply for examination.

SCHOOLS IN IRELAND.

COUNTIES.		No. of Schools	No. of Students	COUNTIES.		No. of Schools.	No. of Students.
1	Antrim - - - - -	27	788	18	Roscommon - - - - -	9	69
2	Armagh - - - - -	9	290	14	Wexford - - - - -	1	40
3	Carlow - - - - -	2	60	15	Donegal - - - - -	1	18
4	Cavan - - - - -	1	84	16	Fermanagh - - - - -	2	30
5	Clare - - - - -	1	40	17	Galway - - - - -	1	48
6	Cork - - - - -	1	65	18	Kilkenny - - - - -	1	46
7	Down - - - - -	10	493	19	Mayo - - - - -	1	7
8	Dublin - - - - -	4	251	20	Tipperary - - - - -	1	9
9	Londonderry - - - - -	1	60	21	Tyrone - - - - -	2	31
10	Louth - - - - -	1	62	22	Waterford - - - - -	2	64
11	Meath - - - - -	3	281				
12	Monaghan - - - - -	2	89		TOTAL - - - - -	76	2,870

The following Irish Counties do not contain any Schools:— Kerry, Kildare, King's County, Leitrim, Limerick, Longford, Queen's County, Sligo, Westmeath, and Wicklow

S · I · P · M · I · M · A · R · Y .

	Number of Schools.	Number of Students.
ENGLAND AND WALES	210	9,480
IRELAND - - - - -	76	2,870
SCOTLAND - - - - -	15	2,611
GRAND TOTAL.	301	14,961

STUDENTS IN ENGLAND AND WALES:

No. of Schools		No. of Students.	No. of Schools.		No. of Students.
	Bedfordshire			Cornwall	
1	Tebworth - - - - -	18		Bodmin - - - - -	31
				Breage - - - - -	23
	Berkshire			Camborne - - - - -	24
1	Abingdon - - - - -	46		Falmouth - - - - -	14
				Penzance - - - - -	24
	Bucks.		7	Redruth - - - - -	10
	Slough - - - - -	22		St. Just - - - - -	14
	Wolverton - - - - -	65			140
2		87		Derbyshire	
	Cambridgeshire:			Derby - - - - -	12
1	Wisbech - - - - -	24	3	New Mills - - - - -	30
				Whaleybridge - - - - -	19
	Carmarthen.				61
1	Llanelly - - - - -	78		Devonshire.	
				Dartmouth - - - - -	28
	Chester			Exeter - - - - -	32
	Alderley Edge - - - - -	18		Kingsbridge - - - - -	17
	Chester - - - - -	30		Modbury - - - - -	10
	Compstall - - - - -	27		Plymouth (two schools) - - - - -	176
	Congleton - - - - -	12		Tavistock (two schools) - - - - -	84
	Crewe - - - - -	44	10	Torquay - - - - -	63
	Hyde - - - - -	41		Plymouth* - - - - -	34
	Macclesfield - - - - -	43			742
	Stockport (two schools) - - - - -	63		Dorsetshire.	
9		278	2	Blandford - - - - -	20
				Portland - - - - -	30
					50

* Navigation School, not examined in May.

STUDENTS IN ENGLAND AND WALES—continued

No. of Schools.		No. of Students.	No. of Schools.		No. of Students.
	Durham:			Lancashire—continued.	
	-Darlington	10		-Denton	33
	-Gateshead	39		-Droydsden	58
2		49		-Eagley	61
	Essex			-Earlestown	17
	-Canning Town	12		-Faiisworth	8
	-Cold Norton	13		-Haslingden	18
	-Maldon	12		-Heywood	24
	-Purleigh	24		-Hollinwood	31
	-Southminster	21		-Lancaster	48
	-Stratford	58		-Lees	33
	-Rochford	13		-Liverpool, (two schools)	147
7		153		-Manchester (seven schools)	363
	Glamorgan			-Middleton	22
	-Cardiff	63		-Mossley	23
	-Swansea	45		-Nelson-in-Marston	36
	-Pontypridd	13		-Newton Heath	18
3		121		-Oldham (five schools)	199
	Gloucestershire:			-Padiham	10
	-Brimacombe	17		-Patricroft	27
	-Bristol	145		-Pendleton	20
	-Cheltenham	212		-Preston	57
	-Eastington	15		-Ramsbottom	17
	-Gloucester (two schools)	78		-Rawtenstall	55
	-Stroud	29		-Rochdale	47
7		496	.60	-Royton	54
	Hampshire.			-St Helens	23
	-Andover	39		-Salford (two schools)	77
	-Southampton	49		-Southport	19
2		88	3	-Ulverstone	18
	Huntingdonshire:			-Warrington	102
1	-Huntingdon	16	1	-Werneth	33
	Kent			-Wigan	71
	-Chatham (two schools)	67			2,520
	-Dartford	36		Leicestershire.	
	-Deptford (two schools)	48		-Ashby-de-la Zouch	19
	-Greenwich (two schools)	62		-Leicester (two schools)	58
	-Plumstead	57			77
	-Woolwich (five schools)	392		Lincolnshire.	
13		662		-Grantham	6
	Lancashire.			Middlesex.	
	-Accrington	29		-Limehouse	24
	-Ashton-under-Lyne (two schools)	44		-Finsbury (Bath-street)	42
	-Baou	42		-Bethnal Green (two schools)	221
	-Blackburn (two schools)	25	30	-Chelsea and Brompton (six schools)	212
	-Bolton (two schools)	260		-Great Ormond-street, London	15
	-Burnley (five schools)	228		-Hackney	48
	-Bury	79		-Islington	146
	-Chorley	20	1	-Leadenhall-street, London	30
	-Darwen	14		-Marylebone	48
				-Paddington	31
				-Regent-street, London	46
				-Westminster	29
				-Whitechapel	27
				-Dock-street, London*	328
					1,246
				Norfolk:	
				-Great Yarmouth	81

* Navigation School, not examined in May.

STUDENTS IN ENGLAND AND WALES—continued.

No of Schools.		No of Students.	No. of Schools.		No. of Students.
3	Northampton.			Surrey:	
	Kettering - - - - -	51		Croydon - - - - -	32
	Northampton - - - - -	116		Battersea (two schools) - - - - -	133
	Wellingborough - - - - -	30		Bermondsey - - - - -	22
		196		Brixton Hill - - - - -	9
1	Northumberland:			Lambeth - - - - -	155
	Alnwick - - - - -	28	9	Peckham - - - - -	363
				Southwark - - - - -	69
				Waterloo-road, London - - - - -	80
					812
4	Nottinghamshire:			Warwickshire:	
	East Retford - - - - -	55	6	Birmingham (five schools) - - - - -	350
	Eastwood - - - - -	13		Saltley - - - - -	21
	Newark - - - - -	34			371
	Nottingham - - - - -	61		Worcestershire:	
		163		Bromsgrove - - - - -	26
2	Oxfordshire:			Cradley - - - - -	6
	Banbury - - - - -	48	4	Oldbury - - - - -	61
	Culham - - - - -	27		Worcester - - - - -	71
		75			164
1	Shropshire:			Yorkshire:	
	Shrewsbury - - - - -	45		Almondbury - - - - -	26
6	Staffordshire:			Barnsley - - - - -	18
	Kinver - - - - -	25		Bingley - - - - -	17
	Walsall - - - - -	24		Birstall - - - - -	26
	Wolverhampton (four schools) - - - - -	62		Dewsbury - - - - -	17
		111	16	Elland - - - - -	22
			Halifax - - - - -	35	
			Huddersfield - - - - -	23	
			Hull (two schools) - - - - -	95	
			Leeds - - - - -	47	
			Middlesborough - - - - -	11	
			North Ormsby - - - - -	7	
			Ripon - - - - -	35	
			Thorne - - - - -	17	
			York - - - - -	80	
				476	

STUDENTS IN IRELAND.

No of Schools.		No of Students.	No. of Schools.		No. of Students.
27	Antrim:			Armagh:	
	Antrim - - - - -	66		Armagh - - - - -	13
	Ballycarry - - - - -	24		Ballywilly - - - - -	19
	Ballymena - - - - -	18		Bessbrook - - - - -	21
	Belfast (15 schools) - - - - -	480		Eglisk - - - - -	51
	Braidwater - - - - -	15		Lurgan - - - - -	61
	Carnunny - - - - -	16		Markethill - - - - -	20
	Carrickfergus - - - - -	42		Newry - - - - -	41
	Galgorm - - - - -	36		Portadown - - - - -	30
	Larne (two schools) - - - - -	90		Tandragee - - - - -	34
	Newtownbreda - - - - -	33	9		290
	Whitehouse - - - - -	18		Carlow:	
				Bagenalstown - - - - -	39
				Carlow - - - - -	21
			789		60

STUDENTS IN IRELAND—continued.

No. of Schools		No of Students	No of Schools		No of Students
1	Cavan . Baileborough - - - -	84	1	Londonderry . Coleraine - - - -	60
1	Clare . Cooraclare - - - -	40	1	Louth Dundalk - - - -	62
1	Cork : Cork - - - -	65	1	Mayo Newport - - - -	7
1	Donegal : Raphoe - - - -	18		Meath : Drogheda Oldcastle Trim - - - -	29 190 62
	Down Ballyboley - - - - Banbridge - - - - Comber (two schools) Crossgar - - - - Downpatrick - - - - Gilford - - - - Holywood - - - - Loughinisland - - - - Newtownards - - - -	84 64 96 16 20 35 76 18 184	3	Monaghan Castleshane - - - - Monaghan - - - -	281 16 23
10		493	2	Roscommon : Athlone (two schools) - - - -	69
	Dublin . Dublin (three schools) Santry - - - -	191 60	1	Tipperary Roscrea - - - -	9
4		961		Tyrone . Fintona - - - - Strabane - - - -	8 23
	Fermanagh . Enniskillen - - - - Garrison - - - -	17 13	2		31
2		80		Waterford : Portlaw - - - - Waterford - - - -	9 55
1	Galway Galway - - - -	43	2		64
1	Kilkenny : Kilkenny - - - -	46	1	Wexford . Enniscorthy - - - -	40

STUDENTS IN SCOTLAND.

No of Schools		No of Students	No of Schools		No of Students
3	Aberdeen : Aberdeen - - - - Aberdeen* - - - - Newhills - - - -	61 317 17	1	Inverness : Inverness - - - -	27
1	Ayr : Beith - - - -	395 7	1	Kilmarnock : Kilmarnock - - - -	76
1	Dumbarton : Dumbarton - - - -	12	1	Kincardineshire . Banchory - - - -	13
1	Edinburgh : Leith - - - -	228	1	Kirkcudbright. Corsock - - - -	13
1	Forfarshire : Dundee - - - -	76	3	Lanarkshire : Glasgow (three schools) † - - - -	1,760
			1	Orkney : Kirkwall - - - -	10

* Navigation School, not examined in May.

† Only 176 of these wish to be examined.

Appendix, No. 2.

App. No. 2.

PAPERS handed in by Mr. Cole, 30 April 1868.

No. 1.

ROYAL SCHOOL OF MINES

1. How many years has the Jermyn-street School been established?
It is now (1867-8) the 17th Session, the school having been established in 1851.
 2. How many students have passed through the school?
 1. As students for one to three years (associate or matriculated students) - - - - - 233
 2. As occasional students - - - - - 1,113
- TOTAL - - - 1,346

3. The amount of Fees received each year from Students since the Commencement:

Session	£.	s.	d.
1851-52	686	10	-
" 1852-53	636	3	4
" 1853-54	721	10	-
" 1854-55	675	8	4
" 1855-56	726	3	4
" 1856-57	461	7	4
" 1857-58	517	-	-
" 1858-59	582	1	-
" 1859-60	661	10	-
" 1860-61	810	-	-
" 1861-62	1,034	15	-
" 1862-63	764	1	10
" 1863-64	1,029	11	8
" 1864-65	719	7	-
" 1865-66	771	15	-
" 1866-67	972	15	-
TOTAL	£.	11,769	16 10

N.B.—These amounts include the sums received for the "Working Men's" and "Evening Lectures."

4. The number of Students in each subject in 1865 or 1867.

	Session 1865-6.	Session 1866-7.
Chemistry	24	39
Natural History	11	5
Physics	22	28
Geology	15	17
Mining	6	3
Mineralogy	5	5
Metallurgy	5	9
Applied Mechanics	6	2

N.B.—These numbers do not include the associates.

5. The number of Students educated in Jermyn-street under scholarships:
Twenty-one; viz., 14 as Royal Exhibitioners (established 1861-2); one free scholar from Edinburgh, two from Cheltenham, one from Truro, and three from Bristol. Besides these, 22 certificated masters or pupil teachers have been admitted to the lectures on payment of an examination fee of 1*l*, and two gold medallists have been admitted free.

FINANCIAL STATISTICS—SCIENCE and ART.

	Salaries and General Management.	New and Permanent Buildings.	Purchase of Works of Art.	Cost of Management.				Grants in Aid			East London Museum.	Jermyn Street.	Edinburgh Museum.	Royal Dublin Society.	Royal College of Science, Dublin.	
				Science and Art Department.	South Kensington.	National Portrait Exhibition.	Total Cost.	Science Schools.	Art Schools.	School of Naval Architecture.						
	£.	£.	£.	£.	£.	£.	£.	£.	£.	£.	£.	£.	£.	£.	£.	
Estimates 1868-9	8,507	32,500	24,000	11,850	34,240	3,000	49,090	18,900	37,750	3,600	10,000	12,258	8,219	2,185	6,268	
" 1867-8	8,317	32,500	21,250	7,850	34,225	-	42,075	8,600	22,000	2,800	5,000	11,299	5,328	2,185	5,943	
Reports 1866	5,760	18,038	13,887	5,839	25,905	3,742	35,386	5,874	16,728	753	-	7,153	3,185	7,569	-	
" 1865	7,398	19,998	14,846	7,233	40,687	-	47,920	26,605	-	-	-	8,703	4,780	14,059	-	
Estimates 1864	5,760	24,000	500	21,540	24,155	-	45,695	20,000	-	-	-	7,414	2,837	7,472	-	
Report 1863	4,847	25,855	989	25,863	23,461	-	48,824	18,948	-	-	-	6,660	2,113	7,017	-	
" 1862	4,704	3,142	-	24,328	18,480	-	43,808	17,748	-	-	-	6,314	2,392	6,000	-	
" 1861	4,391	-	-	28,876	20,210	-	49,086	17,497	-	-	-	6,706	2,072	6,000	-	
" 1860	3,819	3,394	-	21,578	24,000	-	45,578	16,244	-	-	-	6,684	2,270	6,000	-	
" 1859	3,615	5,691	-	18,906	12,452	-	31,358	15,408	-	-	-	6,187	1,922	6,060	-	
Estimates 1858	3,625	5,570	-	28,400	9,445	-	37,845	15,900	-	-	-	6,241	1,334	6,060	-	
				Department of Science and Art.				Cost of Schools throughout Kingdom.								
Report 1857	3,325	-	-	22,499			-	29,774								
" 1856	4,569	-	-	33,496			-	23,303								
" 1855	5,545	-	-	19,478			-	20,722								
" 1854	TOTAL Cost for Science and Art throughout Kingdom													£. 26,596.		

App. No. 2.

No. 3.

ANSWERS to Mr. Dixon.

Section II.

1. Number of teachers in 1867, 200.
2. Average amount paid to each on 1867 examination, 40 l.
- 3, 4, and 5. (There was not sufficient time to obtain this information).
6. The total cost of the Queen's Prizes issued in 1867 for Science was:—

	£. s. d.
For Books - - - - -	586 14 5
For Medals - - - - -	152 6 9
TOTAL - - - £.	739 1 2

7. The total amount paid as results in 1867, was 8,000 l.

No. 4.

PAYMENTS to SCIENCE TEACHERS in 1862 (before change of System).

Name of Teacher.	School.	—
		£. s. d.
Brazier, James - - - - -	Aberdeen, M. I. - - - - -	20 - -
Beveridge, Robert - - - - -	ditto - - - - -	12 - -
Maver, David - - - - -	ditto - - - - -	20 - -
Beesley, Thomas - - - - -	Banbury - - - - -	31 - -
Beale, John H. - - - - -	ditto - - - - -	41 10 -
Eardley, Fras. - - - - -	Belfast - - - - -	91 10 -
Rambach, David W. - - - - -	Birmingham, Art School - - - - -	29 - -
Williams, W. M. - - - - -	Birmingham, Midland Institution - - - - -	53 - -
Fulton, Hugh - - - - -	Bristol, Trade School - - - - -	8 10 -
Coomber, Thomas - - - - -	ditto - - - - -	116 10 -
Rowden, W. T. - - - - -	ditto - - - - -	124 10 -
Wood, Charles S. - - - - -	Bristol, Mining School - - - - -	90 - -
Clement, Leonard - - - - -	Burnley, &c. - - - - -	91 - -
Bownas, John - - - - -	Calne - - - - -	44 - -
Tate, Ralph - - - - -	Belfast, Lisburn, and Carrickfergus - - - - -	184 - -
Dowling, John - - - - -	Cork, Bandon, and Clonmel - - - - -	145 - -
Clough, James C. - - - - -	Dedham - - - - -	7 10 -
Jones, John - - - - -	Dudley - - - - -	23 - -

Name of Teacher.	School.	£	s.	d.
M'Ivor, Alexander	Edinburgh	6	-	-
Mayer, John	Glasgow	81	-	-
Jeffery, Walter	Gloucester	109	-	-
Noble, John	Halifax	89	10	-
Mellor, James	Oldham and Hollinwood	49	-	-
Tindall, George	Huddersfield	26	-	-
Meaden, Henry P.	Accrington, Burnley, and Haslingden	130	10	-
Bentley, Buzi	Kirkheaton	27	-	-
Ward, George	Leeds	9	10	-
Collingwood, D. C.	Liverpool	50	-	-
Birkenhead, E. H.	Liverpool and Wigan	188	10	-
Pike, Robt. W.	Bethnal Green, Birkbeck School	41	10	-
Taylor, Charles	Charterhouse	16	-	-
Cooke, M. C.	Highbate	41	-	-
Howard, John	Islington	21	-	-
Runtz, James	Kingsland, Birkbeck School	10	-	-
Bithell, Rich.	Kingsland, British School	47	-	-
Stockton, William	Poplar	16	-	-
Strachan, R.	ditto	85	-	-
Douglas, John C.	London, Birkbeck School	27	-	-
Chadwick, John	Macclesfield	50	10	-
Snelus, George J.	ditto	29	10	-
Hudson, Fearnade	Manchester, Corporation-street	54	10	-
Crossley, Wilham	Middlesboro'-on-Tees	26	10	-
Twate, Charles	Redruth	18	-	-
Pearoe, Richard	ditto	25	-	-
Jones, Thomas	St Leonards	22	-	-
O'Neill, Charles	Salford	74	-	-
Jarman, George	Huddersfield and Slathwaite	121	10	-
Dorrell, John	Slough	19	10	-
Hudson, Washington	Stockport and Pendleton	22	-	-
Pullen, Moses	Painwick and Stroud	60	10	-
Davis, Urnah J.	Upton St. Leonards	44	-	-
Hetherington, J. H.	Windsor	5	-	-
TOTAL		£	2,694	-

Average payment, 52 £ each, nearly.

App No. 2.

No. 5.

PAYMENT TO TEACHERS in London and its District Science Schools on the Results of the Examination in May 1867.

SCHOOL.	TEACHERS.	£. s. d.	Total Amount.
London.		£. s. d.	£. s. d.
Bath-street, City-road	Davidson, Ellis A.	14 - -	14 - -
Battersea, Sir Walter St. John's School.	Martin, James Snelus, G J.	48 - - 99 - -	147 - -
Bethnal Green, British School	Pike, R W.	79 2 6	79 2 6
Bethnal Green, National School	Simpson, B.	78 7 6	78 7 6
Chelsea, St. Mark's Training College.	Eastburn, Rev. C. F. Lawson, W. Atkins, G Briggs, Henry	97 10 - 130 - - 28 - - 10 - -	265 10 -
Working Men's College, Great Ormond-street.	Snelus, G J.	17 - -	17 - -
City of London College	Gibson, Rev B W.	10 - -	10 - -
Kingsland and Dalston	Bithell, Dr. R.	15 - -	15 - -
Lower Islington	Howard, John	89 5 -	89 5 -
Lambeth	Duckett, W Griffiths, J. A.	37 - - 20 - -	57 - -
Peckham	Tate, R (Middle and Upper Class School).	- - -	- - -
Royal Polytechnic	Snelus, G. J. Coles, F.	35 10 - 10 - -	45 10 -
Croyden	Sullivan, M.	29 - -	29 - -
Deptford, St John's	Farncomb, C (teacher not qualified to claim payment).	- - -	- - -
Deptford, St. Paul's	Busbridge, W. Dorrell, C. F.	15 - - 27 - -	72 - -
Greenwich	Griffiths, John A. Jones, Thomas	60 5 - 88 - -	148 5 -
Plumstead	Farlie, C J Rowden, W T. Shipman, Charles	60 - - 58 - - 86 5 -	204 5 -
Woolwich, Royal Arsenal Military Institution	Jones, Thomas Duckett, W. Davidson, G Brown, L.	3 - - 45 17 6 72 15 - 17 - -	188 12 6
Woolwich, National School	Swiss, Henry Farlie, C J. Noble, John Rowden, W T.	71 5 - 42 - - 15 - - 42 - -	170 5 -
Woolwich, St. Thomas	Clark, J J. Busbridge, W. Byatt, Horace	9 - - 98 15 - 62 15 -	171 10 -
		£.	1,751 12 6

Average, 87 l. 11 s. per School.

No. 6

LIST OF TEACHERS Employed.

	Subjects.	Schools.	Amount.
			£ s d.
Atkins, George	X	St Mark's, Chelsea	28 - -
Bithell, R.	IV	Kingsland and Dalston	15 - -
Briggs, Henry	VII	St Mark's, Chelsea	10 - -
Browne, Leonard	XXIII.	Woolwich, Royal Arsenal	17 - -
Busbridge, Walter	I, II, III	Deptford and Woolwich	148 15 -
Byatt, Horace	I.	Woolwich, St. Thomas'	68 15 -
Clark, John J	IV	Woolwich, St Thomas'	9 - -
Coles, Ferdinand	X	Royal Polytechnic	10 - -
Davidson, Ellis A.	II, III.	City, Middle Class School.	14 - -
Davidson, George	I, II, III.	Woolwich, Royal Arsenal	72 15 -
Dorrell, Chas F.	I	Deptford, St Paul's	27 - -
Duckett, William	I, II, III	Lambeth and Woolwich	82 17 6
Eastburn, Rev. C. F.	IV	St. Mark's, Chelsea	97 10 -
Farlie, Chas J.	I, III.	Plumstead and Woolwich	102 - -
Gibsons, Rev. B. W.	X.	City of London College.	10 - -
Gniffiths, John A.	I, II	Lambeth and Greenwich	80 5 -
Howard, John	{ IX., X., XIV., XV., XVI., XXIII.	Lower Islington	89 5 -
Jones, Thomas	{ I., II., III., VII., XIV., XXIII.	Woolwich and Greenwich	91 - -
Lawson, William	XXIII.	St. Mark's, Chelsea	130 - -
Martin, James	IV.	Battersea	48 - -
Noble, John	X.	Woolwich	15 - -
Pike, Robert W	{ IX., XIV., XXIII.	Bethnal Green, Birkbeck School.	79 2 6
Rowden, Wm. T.	{ I, II, III, VI, VII	Woolwich and Plumstead	100 - -
Shipman, Chas.	I, II	Plumstead	86 5 -
Simpson, Bentham	{ VIII, IX, XII, XVI., XXIII.	Bethnal Green National School.	78 7 6
Snelus, George J.	IX., X., XIV.	Battersea and Royal Poly- technic	161 10 -
Sullivan, Michael	I, II, III.	Croydon	29 - -
Swiss, Henry	I, II, III.	Woolwich National School	71 5 -

Average, 62 L 10 s 6 d.

App. No 2.

No. 7.

ROUGH STATEMENT OF EXPENDITURE for SCIENCE TEACHING under each of the following Heads, in the Year 1867-8.

1867-8.		£. s. d.
1. General Management - - - Estimate, 8,317 l.	Proportion of Salaries of Secretary, Assistant Secretary, Chief Clerk, Clerks, Accountant, &c. } say 1-10th	880 - -
2. New Buildings - - - Estimate, 32,500 l.	Proportion of expenditure on Science Schools cannot be stated at present.	- - -
3. Purchase of Works of Art, &c. &c. Estimate, 21,250 l.	The direct vote for Science Purchases is - - - - - but many objects are indirectly for Science, and the amount can scarcely be stated	1,250 - -
4. Science and Art Department - Estimate, 7,850 l. Expenditure, 9,720 l.	Viz --Examination Papers } Inspection - - - } say 3-5ths Travelling - - - } of 9,720 l. Incidental - - - }	6,885 - -
5. South Kensington Museum - Estimate, 34,225 l.	Proportion for Education, good Naval Architecture, Animal Products, &c , cannot well be distinguished.	- - -
6. National Portrait Gallery - - -	Nil for Science - - - - -	- - -
7. Science Schools - - - Estimate, 8,600 l. Expenditure, 10,200 l.	- - - - -	10,200 - -
8. Art Schools - - - Estimate, 22,000 l.	Proportion for Mechanical Drawing cannot be given.	- - -
9. Naval Architecture - - - Estimate, 2,800 l. Expenditure, 2,108 l.	- - - - -	2,108 - -
10. East London Museum - - - 5,000 l. to account	Will be chiefly devoted to Science -	- - -
	£.	20,218 - -

Appendix, No. 3

PAPER handed in by Mr. *Whitworth*, 7 May 1868.Science Form, No. 298
South Kensington, May 1868.

App. No. :

Science and Art Department of the Committee of Council on Education, South
Kensington

MR WHITWORTH'S SCHOLARSHIPS FOR MECHANICAL SCIENCE

At Whitehall the 5th day of May 1868.

By the Right Honourable the Lords of the Committee of Her Majesty's Most Honourable
Privy Council on Education

MY Lords read Mr Whitworth's letter of 4th May 1868 transmitting a memorandum on his scholarships and on the establishment of 60 exhibitions of 25 l for the present year preparatory to the competition for his scholarships, and requesting that the Science and Art Department may conduct the necessary examinations and correspondence.

Their Lordships have great pleasure in acceding to Mr. Whitworth's request and giving every assistance in their power in carrying out his patriotic munificence.

Sir,

Manchester, 4 May 1868

REFERRING to your letter of March 28th by which you transmit to me a copy of the Minute which the Lords of the Committee of Council on Education had passed in acknowledgment of my endowment of scholarships for promoting mechanical science, and to the concluding sentence of the Minute which invites further suggestions and offers to render assistance in carrying out the intentions of the endowment

1 I beg leave to enclose for the information of the Lords of the Committee of Council on Education a memorandum on the subject of the endowment, which I trust will meet with the approval of their Lordships, and that they will cause it to be circulated and the necessary correspondence arising out of it to be conducted by the Science and Art Department.

2 I would beg leave to ask the Lords of the Committee of Council on Education to undertake the examinations for these scholarships

3 As respects the preparation of the necessary details for the examinations in the use of tools, I am willing to be responsible myself with the aid of friends, and I propose to obtain the consent of a few gentlemen to advise with me from time to time in whatever may arise in the future for my consideration

4 In reply to the invitation of their Lordships to submit any suggestions, I venture to submit for consideration whether honours in the nature of degrees might not be conferred by some competent authority on successful students each year, thus creating a faculty of industry analogous to the existing faculties of divinity, law, and medicine I am of opinion that such honours would be a great incentive to exertion, and would tend greatly to promote the object in view.

5 I venture further to express a hope that the Government will provide the necessary funds for endowing a sufficient number of professors of mechanics throughout the United Kingdom

6 In conclusion, I inform you that the necessary arrangements for securing the endowment have been made, and I have given instructions for the preparation of the draft of a deed of trust which will be sent for the approval of the Lord President.

I am, &c
(signed) *Joseph Whitworth.*To Henry Cole, Esq.,
Secretary of the Science and Art Department.

MEMORANDUM ON SCHOLARSHIPS FOR MECHANICAL SCIENCE.

To be competed for in May 1869.

I. HAVING offered to the Lords of the Committee of Council on Education to "found 30 scholarships of the annual value of 100 l each, to be applied for the further instruction of young men, natives of the United Kingdom, selected by open competition for their intelligence and proficiency in the theory and practice of mechanics and its cognate sciences, with a view to the promotion of engineering and mechanical industry in this country," I propose that the following should be the general arrangements in the first instance, which may be modified after the first competition has taken place in May 1869.

II That the 30 scholarships of 100 l each should be open to all of Her Majesty's subjects whether of the United Kingdom, India, or the Colonies, who do not exceed the age of 26 years, and be held either for two or three years, as experience may prove to be desirable, that 10 scholarships should be competed for and awarded in May 1869, at the annual national examinations in science, provided that a sufficient number of candidates prove themselves to be competent, that the successful candidates should be required to spend the period of holding the scholarships in the further satisfactory prosecution of the studies and practice of mechanical engineering, and pursue their studies according to the spirit of the endowment, making periodical reports of them, that the student should state where he proposes to pursue his studies, the Lord President of the Council deciding if the proposal can be allowed, also if the student's progress be satisfactory, and the manner in which it shall be tested from year to year. In deciding if the plan of study proposed by the student be satisfactory, as much latitude as possible may be allowed. If the student wish to complete his general education instead of continuing his special scientific study, he may be permitted to do so. He may go to the universities or colleges affording scientific or technical instruction, or he may travel abroad. The successful artisan should be encouraged to study theory, and the successful competitor in theory aided in getting admission to machine shops and other practical establishments. All further details would be hereafter prepared and issued by the Science and Art Department.

III The candidates must be of sound bodily constitution.

IV. The first competition should be in the following theoretical subjects —

- | | |
|---|-------------------------------------|
| 1. Mathematics (elementary and higher) | 4. Physics |
| 2. Mechanics (theoretical and applied) | 5. Chemistry, including metallurgy. |
| 3. Practical plane and descriptive geometry,
' and mechanical and freehand drawing | |

And in the following handicrafts:—

- | | |
|-----------------|---------------------------------|
| 1. Smith's-work | 3. Filing and Fitting |
| 2. Turning | 4. Pattern making and moulding. |

V No candidate should obtain a scholarship who has not shown a satisfactory knowledge of all the following theoretical subjects —

- | | |
|----------------------------|---|
| 1. Elementary mathematics. | 3. Practical plane and descriptive geometry
and freehand drawing |
| 2. Elementary mechanics. | |

with the power to use one or more of the following classes of tools —

- | | |
|----------------------------|---------------|
| a. The axe | d. The file |
| b. The saw and plane. | e. The forge. |
| c. The hammer, and chisel. | |

I propose that the maximum number of marks obtainable in the theoretical subjects and those obtainable by the most skilled workman should be about equal.

VI My object in devising the foregoing scheme has been, while requiring a practical acquaintance with a few simple tools as a *sine qua non*, to render the competition accessible on fairly equal terms to the student who combines some practice with his theory, and to the artisan who combines some theoretical knowledge with perfection of workmanship.

Preparatory Exhibitions of 25 l. for the Year 1868.

VII. As the scholarships scheme can only come into full operation by degrees, I propose from the fund ultimately available for the scheme at once to create 60 exhibitions or premiums, of the value of 25 l. each, tenable until April 1869, and to place them at the absolute disposal of the governing bodies of the following educational institutions and towns, in order that they may award them to youths under 22 years of age, who may thus be aided to qualify themselves, and must undertake to compete for the scholarships of 100 l in May 1869

VIII.—

- | | |
|--|---|
| 3 Exhibitions to Owens College, and 2 to the
Grammar School, Manchester, the seat of my
Workshops. | 3 University of Oxford
3 University of Cambridge.
3 University of London. |
|--|---|

And

And one to each of the following universities, colleges, and public schools —

App No.

University of Durham	Westminster
University of Dublin	Winchester
University of Edinburgh.	St Paul's, London.
Watt Institution, Edinburgh	Mechants Tailors
University of Glasgow	Christ's Hospital
Andersonian University, Glasgow	City of London
University of St Andrew's	Shrewsbury
University of Aberdeen	Marlborough.
To each of the Queen's Colleges at Belfast, Cork,	Cheltenham.
Galway, Ireland.	Chester
King's College, London	Clifton
University College, London,	Brighton,
Eton	Liverpool
Harrow,	
Rugby.	2 to the College of Preceptors
Charter House.	8 to the Science and Art Department

I propose that the following exhibitions shall be given to artisans only —

2 to the Society of Arts

Also one for artisans to each of the following towns —

Birmingham	Leeds
Bristol.	Northampton.
Swansea and Cardiff	Sheffield
Hull or Huddersfield.	

And if there be any of the above unapplied, they may be given by the Science and Art Department to any other scholastic institution which makes satisfactory arrangements for affording instruction in mathematics and mechanics, freehand and mechanical drawing.

IX. I would point out that the exhibitions to artisans may perhaps be increased to 50 £ for the year, by connecting them with the Science and Art Department, under the Minute of the 21st December 1867.

(signed) *Joseph Whitworth*

Manchester, 4 May, 1868:

MINUTE ON MR WHITWORTH'S OFFER TO ENDOW SCHOLARSHIPS.

At Whitehall, the 27th day of March 1868.

By the Right Honourable the Lords of the Committee of Her Majesty's Most Honourable Privy Council on Education

MR LORDS consider Mr Whitworth's letter to the First Lord of the Treasury, dated 18th March 1868. In this letter Mr. Whitworth offers to found 30 scholarships of the annual value of 100 £ each, to be applied for the further instruction of young men, natives of the United Kingdom, selected by open competition for their intelligence and proficiency in the theory and practice of mechanics and its cognate sciences, with a view to the promotion of engineering and mechanical industry in this country, and he expresses hopes that means may be found for bringing science and industry into closer relation with each other than at present obtains here

It is unnecessary now to repeat the thanks which the First Lord of Her Majesty's Treasury and the Lord President of the Council have already conveyed to Mr. Whitworth for his generous offer, which they are convinced the country will fully appreciate

Mr Whitworth proposes that these scholarships should be tenable on conditions to be defined by a deed of trust regulating the administration of the endowment fund during his life, and that thereafter the management of this fund, subject to the conditions specified therein, should rest in the Lord President of the Council or other Minister of Public Instruction for the time being.

It is the wish of my Lords to see provision made in several large centres of manufacturing industry in the United Kingdom for affording to all classes of Her Majesty's subjects ample opportunities for acquiring instruction in the sciences which are applicable to productive industry. My Lords are of opinion that by the union of local and private efforts, supplemented as far as is proper by State assistance, this provision will be best made.

This will be rendered easy if the munificent example set by Mr. Whitworth shall be extensively followed by others.

My Lords will be happy to receive any further suggestions from Mr Whitworth should he desire to make them, and to be informed if the Department can render him any assistance in carrying out his liberal intentions.

Appendix, No 4.

PAPER handed in by Captain Donnelly.—(See Evidence, No. 143.)

RETURN OF SCHOOLS HAVING DAY CLASSES IN SCIENCE.

TOWN.	SCHOOL.	Number of Individual Students.	Practical, Plane, and Solid Geometry	Mechanic Construction and Drawing	Building Construction	Elementary Mathematics	Higher Mathematics	Theoretical Mechanics	Applied Mechanics	Acoustics, Light, and Heat.	Magnetism and Electricity	Inorganic Chemistry	Organic Chemistry	Geology	Mineralogy.	Animal Physiology	Zoology	Vegetable Physiology and Economic Botany	Systematic Botany	Mining	Metallogy	Navigation.	Nautical Astronomy	Steam	Physical Geography	
ENGLAND.																										
Andover	British School - - - - (Day Class) - - -	38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30
	Ditto - - - - - (Evening Class)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	-	-	-
Birmingham	St Barnabas - - - - (Day Class) - - -	47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12
	Ditto - - - - - (Evening Class)		-	-	-	-	-	-	-	-	-	-	-	-	-	-	36	80	-	-	-	-	-	-	-	-
Bristol	(Day Classes)	143	57	57	57	57	-	57	57	-	57	57	57	-	-	-	-	-	-	-	-	-	-	-	-	-
	(Evening Class)		16	26	11	21	-	16	-	-	-	17	36	36	-	-	-	-	-	-	-	-	-	-	-	-
Bromsgrove	{ Literary and Mechanics Institute (Day Class) - - -	23	-	-	-	-	-	-	-	-	-	-	-	-	-	23	-	-	-	-	-	-	-	-	-	-
Burnley	Carlton Road School - (Day Class) - - -	63	-	-	-	-	-	-	-	-	-	47	-	-	-	24	-	-	-	-	-	-	-	-	-	-
	Ditto - - - - - (Evening Class)		-	-	-	-	-	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	-	-	-	-
Cheltenham	Grammar School - - - (Day Class) - - -	45	-	-	-	-	-	45	-	-	-	45	-	20	-	-	-	-	-	-	-	-	-	-	-	-
	Science School - - - (Day Class) - - -	132	-	-	-	-	-	-	-	-	-	-	-	-	-	20	-	-	7	-	-	-	-	-	-	-
Ditto - - - - - (Evening Class)	-		-	-	-	-	-	54	54	33	34	11	18	-	-	8	7	-	7	-	18	-	-	-	-	18
Cold Norton	National School - - - - -	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Culham	Training College - - - - -	22	-	-	-	-	-	2	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-	-	-
Derby	Grammar School - - - - -	13	-	-	-	-	-	-	-	-	-	13	-	-	-	13	-	-	-	-	-	-	-	-	-	-
Hull	Navigation School - - - - -	73	-	-	-	69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	65	63	70	73	
Kettering	Boys' National School (Day Class) - - -	16	-	-	-	-	-	-	-	-	-	-	-	-	-	16	-	-	-	-	-	-	-	-	-	-
Liverpool	Liverpool Institute - (Day Class) - - -	83	-	-	-	83	-	-	-	-	-	63	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Llanely	Copper Works School - (Day Class) - - -	43	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-
	Ditto - - - - - (Evening Classes)		-	-	22	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Macclesfield	Modern Free School - - - - -	41	-	-	-	-	-	-	-	-	-	41	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manchester	Mechanics' Institution (Day Class) - - -	200	-	-	-	-	-	-	-	30	30	60	-	-	-	60	-	-	-	-	30	-	-	-	-	55
	Ditto - - - - - (Evening Class)		127	127	127	-	12	12	-	-	-	-	25	-	-	27	-	-	-	-	-	-	-	-	-	-
Oldbury	National School - - - - -	35	-	-	-	-	-	-	-	-	-	-	-	-	-	35	-	-	-	-	-	-	-	-	-	-
Olham	Parish Church School - - - - -	25	25	25	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

APPENDIX TO REPORT FROM THE

RETURN OF SCHOOLS HAVING DAY CLASSES IN SCIENCE—continued.

TOWN.	SCHOOL.	Number of Individual Students.	Practical Plane, and Solid Geometry	Machine Construction and Drawing	Building Construction	Elementary Mathematics	Higher Mathematics	Theoretical Mechanics	Applied Mechanics	Astronomy, Light and Heat	Magnetism and Electricity.	Inorganic Chemistry.	Organic Chemistry.	Geology.	Mineralogy.	Animal Physiology	Zoology	Vegetable Physiology and Economic Botany	Systematic Botany.	Mining	Metallurgy.	Navigation.	Nautical Astronomy.	Steam.	Physical Geography		
<i>IRELAND—continued</i>																											
Carlow	Christian Schools	19	19																								
Carrockfergus	Model School	26																									
Coleraine	Model National School	57				24																				26	
Cooralare	National School	83				88																				57	
Cork	Model School	55								12	10																
Dublin	Central Model School	107	65								97						54										
	King's Hospital School	45				41																					
	Incorporated Society's Day School	19				12		12																		46	
Dundalk	Free Library, &c.	49				36		15		16	14											18				13	
Eglisli (County Armagh)	National School	50									50															28	
Fintona	National School	8				8																				8	
Galway	Model School	42				22		9			36																
Gilford	National School	38									28																
Holywood	Sullivan's Schools	70								72																	
Kilkenny	Model School	52				15				50																57	
Loughlinland	National School	20															28									18	
Markethill	Coolmalish National School	20																								20	
Newtonbreds	National School	25																								25	
Newtonwards	Model School	98				40																				80	
Oldcastle	Endowed Schools	165									80																88
Raphoe	National School	9				9																					
Santry	Incorporated Society's Training School	64	23			64	24	64	64	64	64																
Strabane	(Class of National School Teachers)	21				21												64	64			24	24	64		64	
Tandragee	The Common School	35				7		2		35	2																
Trim	Model School	30												30													
Waterford	Model School	50										50															
	TOTAL for IRELAND	1,656	107			487	24	131	64	409	506	50		46		83	72	64	64			121	86	64		702	
	TOTAL for the UNITED KINGDOM	4,894	289	253	253	986	25	307	132	458	774	544	57	395		578	292	196	71		60	1,017	252	165		1,352	

Appendix, No. 6.

PAPER handed in by Mr. *Mundella*, 11th June 1868.

App. No 6.

LETTER from Mr *Thurlow* to Mr. *A J Mundella*.

Dear Sir, Trinity School, Nottingham, 6 February 1868.
 THE subject of technical scientific education has been in my mind very much of late. As I have now been for a considerable period local secretary to the science classes in this town, and know, too, the deep interest you take in the advancement of education of all kinds in general, and of this branch in particular, I venture to intrude a few remarks and suggestions upon your notice.

The instruction given in the science classes is sound, and imparted by duly certified teachers; but yet it is a fact that the classes are not large, nor attended by those whom the department had specially in view in encouraging their establishment. That something more must be aimed at than the present classes are likely to achieve seems now to be the opinion of those in authority. A Minute has been passed by the Science and Art Department for the establishment of scholarships, to be held by scholars of elementary schools, who are between the age of 12 and 16 years, and who shall pass at the examination of science classes in the month of May in each year, so as to gain a third Queen's prize in some subject sanctioned by the department. If, previously, the scholar has passed in the three first grade subjects for drawing, and succeeds in the science examination, the department will grant 10/ towards his maintenance at school, but if he succeed in his science examination, and has not passed in drawing, then the managers are required to find 5/ to meet a Government grant of 5/ for the aforementioned purpose. This is the point where I imagine the Minute will be found to break down in practice. Moreover its effect will be almost *nil*, for the scholarships are only in the proportion of one per cent. of the scholars in attendance.

If there really is a desire, on the part of the Government, to encourage scientific instruction in schools, a more liberal and practical scheme must be devised than that set forth in the recent Minute. There seems to me no reason why the same plan should not be adopted as exists in the case of instruction in first grade drawing.

The first necessity seems to me to be, the provision of suitable elementary text-books on the scientific subjects in which instruction is to be imparted, and then a system of examination precisely answering to the method adopted in the case of drawing. Elementary text-books for class instruction would soon be produced if there was known to be a want, or, if such were not procurable, they would soon be forthcoming if only the department adopted a similar course to that pursued when the first grade drawing copies were needed, *viz.*, of offering prizes for the best.

Then, again, the examination could be conducted by means of questions supplied from the department of a sufficiently elementary character to be classed as first grade questions. To the successful competitors there might be awarded a pass certificate, and to the more meritorious a certificate and a prize, exactly answering to the course pursued by the department in the case of the drawing.

For the encouragement of the introduction of this kind of teaching in schools, the same scale of payment on results might be made to the managers, to go to the teacher in way of augmentation of his income.

For the supply of necessary apparatus, diagrams, and specimens, the department would only need to return to the plan which was in force some years since, *viz.*, of making grants to school managers to enable them to purchase such, where the master had satisfied the department, by examination, of his competency to use the same. I say nothing of the subjects of instruction, as these would vary with the locality.

It seems to me that by some such plan as I have sketched, our present primary schools might be utilized as a means of laying a solid foundation in the principles of science, and thus a taste created and students provided for our advanced science classes. Failing this, there would still be the broad principles taught, which the individual might perfect by his own reading, if so inclined.

A. J. Mundella, Esq

I am, &c.
(signed) R. Thurlow.

Appendix, No. 7.

PAPER handed in by Mr *George Gibb*, 8 June 1868.

WORKING MEN'S COLLEGE, HALIFAX.

App

TECHNICAL EDUCATION

Technical Instruction:

IN and around Halifax, dyeing and machine-making are the staple industries, therefore it has been determined by the founder and supporter of the Working Men's College to make provision for the teaching of subjects bearing on such occupations. Besides the general classes for instruction in reading, writing, arithmetic, algebra, geometry, book-keeping, English literature, geography, &c, and those in chemistry and French already in operation, it is proposed at once to open classes in

The Chemistry of Dyeing,

under Mr. Jarman, of Huddersfield, who possesses an excellent theoretical and practical knowledge of the subject, and others in

Practical Geometry, Machine Drawing, and Freehand,

under Mr. Stopford, head master of the School of Art, Halifax, whose accurate professional knowledge of the subjects above named will ensure the success of the students who enter the classes. A large well-ventilated room, with a good supply of the drawing boards, instruments, models, and copies required will be supplied, free of expense, to the students

Both in the science classes, and those under the charge of Mr. Stopford, pupils are eligible to compete for prizes offered by the Science and Art Department of the Committee of Council on Education. These prizes consist of books, mathematical instruments, boxes of colours, &c., and the examinations are of such a nature that any moderately intelligent student who has attended during the session can carry off one or more prizes. They are unlimited in number, every pupil reaching the very moderate standard required, receives a prize in any subject.

As it is wished to make these classes available to all, the fees are very low, viz. —

Chemistry Classes:

Five shillings per session for one class, 2 s 6 d for each of the others, chemicals and all requisite apparatus being supplied free at the laboratory. The session is from October to April.

Drawing Classes:

Freehand, machine drawing, practical geometry, any one or all; to students attending the general classes of the Working Men's College, 2 s. 6 d. per half-session from September to Christmas, or from Christmas to April; to others 3 s. 9 d. per half-session.

App No 7.

General Classes

Reading, mathematics, geography, English literature, &c 2 s per term (about 2 d per week)

A class in Latin is about to be begun, ~~the charge~~ for which is included in the above
Book-keeping, by agreement, French, ~~by agreement~~.

The chemistry classes will meet three times per week on Wednesday, Thursday, and Friday, from half-past seven to half-past nine

The drawing class (at present) on Thursday from half-past seven to half-past nine

The general classes meet on Monday, Tuesday, Wednesday, and Thursday, from a quarter-past seven to a quarter-past nine

It is earnestly hoped that employers of labour will bring this matter under the notice of their workpeople, and the intelligent workmen of Halifax are strongly recommended to avail themselves of the unusual advantages here offered to assist them in keeping their country in the van of the world's progress

The general classes and the drawing class commence in the first week of September
The chemistry classes early in October

August 1867

Appendix, No. 8.

PAPER handed in by Mr. *Flatt*, 18 June 1868.

SYLLABUS of STUDIES at the OLDHAM SCHOOL of SCIENCE and ART.

App.

SCIENCE.

Instruction is given in the following subjects by *Thomas Mitchell*, F.R.G.S., &c., Civil Engineer, and Certified Teacher at South Kensington by the Science and Art Department in Practical, Plane, and Descriptive Geometry, Mechanical and Machine Drawing, Building Construction, Theoretical and Applied Mechanics.

1. *Practical Geometry, Plane and Solid*.—Classes meet on Wednesdays and Fridays, from 7.30 to 9.30 p.m. Books recommended: 'Tate's Practical Geometry and Binns' Orthographic Projection (Gleig's series); or, for more advanced pupils, Burchett's Practical Geometry and Binns' Geometrical Drawing.

2. *Mechanical and Machine Drawing*.—Classes meet on Mondays and Tuesdays, from 7.30 to 9.30 p.m.

3. *Building Construction*.—Classes meet on Mondays and Tuesdays, from 7.30 to 9.30 p.m.

4. *Theoretical Mechanics*.—Text Book: Buckmaster's Elements of Mechanical Physics. Class meets on Thursdays, from 7.30 to 9.30 p.m.

5. *Applied Mechanics*.—Books recommended: Baker's Elements of Mechanism (Weale's series), and Tate's Elements of Mechanism and Exercises in Mechanics. Class meets on Tuesdays, from 8.30 to 9.30 p.m.

The school is well supplied with models, diagrams, and experimental apparatus, provided in accordance with the recommendation of the Science Department at South Kensington.

Fees for Full Course.

Artizans, 5 s. per session; one half to be paid at the commencement, and the other half at the end of the first three months.

Non-Artizans and those who do not intend to sit at the Government examination, 10 s. 6 d. per session; to be paid in advance.

Day Classes

Day classes are in operation for the study of practical machine and architectural drawing, and meet on Mondays and Fridays, at 3 p.m. Terms: 10 s. 6 d. per quarter of ten weeks.

Students are also trained for the professions of civil, mining, or mechanical engineering draughtsmen and surveyors, or for the competitive examinations of the Indian civil service engineers' department.

For further particulars apply to Mr. Mitchell, Highfield, Greenhill, Oldham.

Classes for the study of the following subjects are conducted by *J. Philip*, M.A., to whom the Science and Art Department at South Kensington has granted an Honorary Diploma without examination.

1. *Geometry*.—Original exercises, based on Euclid's Elements, are proposed one Friday and solved on the following Friday.

2. *Algebra*.—Regular progressive instruction is given, and the shortest method of operation exemplified on the black-board.

0.72.

3 x 2

3. *Trigonometry*.

App No. 8.

3. *Trigonometry*.—A course of lessons in this subject will be commenced early in the session.

Students in book-keeping, mensuration, or other mathematical subjects are also admissible to these classes

Books: Euclid, Algebra, and Trigonometry, by Todhunter or Colenso. Classes meet on Mondays and Fridays, at 7 30 p m.

C. P. Bahr, PH D., of the University of Giessen, will give instruction in

1. *Chemistry*.—The course of instruction is calculated to prepare students for the examinations which are held yearly by the Science and Art Department

It comprises—1 the elements of inorganic and organic chemistry; 2. Qualitative analysis

A suitable apparatus has been procured for performing the necessary experiments.

Terms: 5 s. per quarter for non-artizans, and 2s. 6d per quarter for artizans. Entrance fee 5s per session, for renewing materials Ten lectures constitute one quarter. The class meets every Monday at 7,30, in the laboratory of the Lyceum

Text book. Buckmaster's Elements of Chemistry.

2. *Magnetism, Electricity, and Galvanism*.—Terms: 5s. per quarter for non-artizans, and 2s 6d. per quarter to artizans Entrance fee 2s. 6d., for renewal of materials. Ten lectures constitute one quarter. The class will meet on Thursdays, at 7 30, p m.

Text Book. Electricity, Galvanism, Magnetism, &c. of the Irish National Schoolbook series.

Vegetable Physiology and Economic Botany.

Teacher, Mr. C Walters

Fees for the Session: Artizans, one lesson per week, 2s. 6d., non-artizans, 5s. The class will meet on Saturdays, from 6 30 to 7 30 p.m.

ART.

Teacher, Mr. T. Heywood.

Classes for Drawing

The course of study comprises the following subjects.—Freehand, landscape, perspective, and model drawing—flower painting, shading in chalk from the cast, &c.

Day Classes.

Elementary Tuesdays and Fridays, from 3 to 5 p.m., 10s. 6d per quarter. From 4 to 5 p.m., 5s. per quarter

Advanced Tuesdays and Fridays, from 3 to 5 p.m., 12s. 6d. per quarter. From 4 to 5 p.m., 7s. 6d per quarter

Evening Classes.

Elementary Tuesdays and Fridays, from 7 30 to 9.30, 2s 6d. per quarter

Advanced Tuesdays and Fridays, from 7 30 to 9 30, 4s. per quarter.

Non-artizans or others who wish to join the evening class, and be exempt from the Government examinations, elementary, 6s. per quarter; advanced, 10s 6d. per quarter. All fees payable in advance

The quarters of the public classes commence about January 15th, April 1st, July 25th, and October 1st.

Ten consecutive weeks constitute a quarter of the special classes, commencing at any time.

Appendix, No. 9.

PAPER handed in by Captain *Donnelly*, R.E., 25 June 1868.

Science Form, No. 299
South Kensington, April 1868.

C. 1
App. No 9

Science and Art Department of the Committee of Council on Education,
South Kensington

At Whitehall the 24th day of April 1868

By the Right Honourable the Lords of the Committee of Her Majesty's Most Honourable
Privy Council on Education

BUILDING GRANTS FOR SCIENCE SCHOOLS.

My Lords read applications and consider the subject of building grants for Science Schools

My Lords will be prepared to make grants towards the building of Schools of Science at the rate of 2s 6d per square foot of internal area, up to a maximum of 500l for any one school, on condition that the school—

a. Be built under the Public Libraries Acts (13 & 14 Vict. c. 65, 18 & 19 Vict. c. 70, 29 & 30 Vict. c. 114).

Or—

b. Be established in connection with a School of Art aided by a department building grant.

And that the terms of the Minute of the 18th December 1866 (No. 603), relating to building grants for Schools of Art, so far as applicable to Schools of Science, be complied with.

Appendix, No. 10.

PAPER handed in by Mr. Thomas Coomber, F.C.S.

App. No. 10.

BRISTOL MINING SCHOOL.

THE scheme of practical instruction has been drawn up by Mr. George Greenwell, the eminent mining engineer. The course lasts two years.

The first year's course is—

- 1 The different modes of working coal.
- 2 The different modes of ventilation; viz., natural, furnace, and mechanical ventilation.
- 3 The drainage of mines by pumping engines, and other contrivances.
- 4 Coal-drawing and the engines, and various mechanical expedients employed for that purpose.
- 5 The character of different coals.
- 6 Drawing and planning, with operations.

The books which the students read and are examined in are.—Dunn on the winning and working of collieries. The same author on the prevention of accidents in mines. Fenwick on subterranean surveying, and Ralph Moore on ventilation.

The second-year's course of study is—

- 1 Hedley's ventilation.
- 2 Atkinson's papers on ventilation in the proceedings of the North of England Institute of Mining Engineers
- 3 Atkinson and Goulson's papers on tubing, in the same volumes.
- 4 Nicholas Wood on underground tunnelage.
- 5 Hull's Coal Fields of Great Britain.
- 6 Elementary geology and chemistry, with the examination by analysis of coals, and the assay of the useful metals.
- 7 On boring, with the tools employed in sinking.
- 8 The pupils are each to produce a plan of a colliery establishment, with details; say depth 100 fathoms. Thickness of seam 5 feet. Inclination, 1 in 18. Water 250 gallons per minute. Coal required, 500 tons per day. The seam supposed to be fiery. The royalty a tract of 500 acres. The pit supposed to have been at coal work three years. There must be a surface plan showing the situation of the engines and machinery, and also the railway and branches, narrow gauge, a section of the strata and details of the engines, pumps, cages, tubs, &c. An estimate of cost of establishment, and of working charge of coals; also a plan of the underground workings, shewing the ventilation.

For the best of the above, with a satisfactory examination thereon, a prize of 5*l.* is given.

To those pupils who do themselves credit at the school a certificate is given, a copy of which I enclose. This is highly prized, and has been proved of value to several to whom it has been awarded.

Appendix, No 11.

PAPEK handed in by Captain *Donnelly*.

MEMORANDUM of SUGGESTIONS for Enlarging the System of STATE AID to SCIENTIFIC INSTRUCTION, drawn up in accordance with the Instructions of the Lords of the Committee of Council on Education. App.No 11.

THE system and rules of the Science and Art Department for administering the grant for scientific instruction appear fairly to meet the requirements of one large class of persons. Sufficient aid is afforded and encouragement thereby given to the elementary instruction in science of the adult artizan class.*

The development that this system has at present taken has been almost entirely in creating evening classes. Being a pure system of payment on results, however, it is quite possible under it for schools for boys of 10 to 15 years of age to flourish, and to earn large payments, as for instance the Bristol Diocesan Trade School, the Bethnal Green Birkbeck School, and the Glasgow Secular School do, but as yet few such schools have sought this aid. The reason is obvious. Schools cannot combine State aid to elementary and science instruction. It is only in large towns and under peculiar circumstances that day schools wholly devoted to secondary instruction can exist. Their establishment must be a work of time. The action of the department has therefore been principally confined to promoting evening instruction in mechanics' institutions and such places. Though payments are not made for the instruction of middle class students, their instruction has incidentally been aided and encouraged by the establishment and existence of these classes, affording them opportunities of instruction which did not exist before. Between 12 and 13 per cent. of the students in science classes at present are middle class students.

There remain two; as far as the machinery of education is concerned, broad classes but slightly affected by the present system of State aid to instruction in science. These are the younger artizan class; broadly the children of the weekly wage class, before they leave school, say of from

10 to 14 years of age, and the younger middle classes, the sons of the employers of labour and so forth, who are eventually to have the management and direction of works, before they leave school.

There can be no doubt that to meet the requirements of the day, it is essential that there should be a more or less general diffusion among all classes engaged in productive industry of scientific, or as it is sometimes loosely called, technical instruction, — scientific instruction that is taken up from the point of view of its future application to industry, and not as a purely educational system.

To meet the wants of the younger artizan class it appears to be only necessary to remove some existing restrictions † which prevent payments being earned for instruction in science given during the three attendances of an elementary school receiving aid. This restriction was imposed when the schools were aided under the whole system, which it was considered justified and required some check of this kind. If teachers of elementary schools were permitted to earn payments for the instruction in science, — as in drawing, of the more advanced students in these schools, the results of the present science system show conclusively that they would very soon form such classes, and would induce a considerable percentage of the parents to allow their children to remain longer at school.

Probably it would be advisable that the payments should be made through the Education Department, who would then have full control of the matter. The Science and Art Department acting according to its present system would simply have to make a return of the results of the examinations to the Education Office.

To meet the requirements of these schools it would be advisable to have a sixth standard of examination below the present fifth class, and make a payment of 10s. on passing it. Whether it would be advisable to make any restriction as to the subjects of instruction or not, is doubtful. It is generally better to leave this to work itself out.

It has not been the policy of the State in this country to aid or interfere with the education of the middle classes except to some slight extent, and that indirectly, by State endowments in colleges. The

* The progress of the Science Schools since the passing of the general Science Minute, June 1859, is shown in the following Table —

Year	Number of Schools	Number under Instruction
1860	9	500
1863	70	1,350
1864	91	4,660
1866	153	6,835
1867	313	10,230

The 313 schools had 560 classes in different subjects. Of the 10,230 persons under instruction 4,590 came up for examination, besides 400 persons not taught in classes aided by the department. 6,437 papers were worked, 6,120 were passed.

† Sections XXIII and XXIV of the Science Directory
‡ Payments to Professors and Examiners, Exhibitions, Scholarships, Medals, and Prizes in the University of London, the Universities of Scotland, and the Queen's University and Colleges in Ireland.

App. No. 11. The general opinion of the country, working through the Schools Inquiry Commission and such agencies, can alone be looked to make any important change in the way of introducing the study of science. Nothing however can have much effect on the grammar schools and middle class schools of the country generally until the universities, which give the key of education in the country, allocate a fair proportion of their endowments to the reward of scientific studies. Till such knowledge pays at the universities the middle class schools, which look more or less to them, cannot be expected to change their courses of instruction.

Should it however be considered good policy for the State to intervene more than it does at present in furthering scientific instruction among the middle classes, it would appear far more judicious to use existing machinery than to establish new. Money granted as endowments among the universities and colleges of the country would be more economically and effectively expended than in the creation of special State institutions.

The instruction in the primary schools can of course only be of an elementary character. That in the adult night classes, though in some cases carried a little further, for want of time, means, and apparatus, cannot go to any depth. Such instruction generally diffused is of the greatest use. But it only goes far enough to warn people of the mistakes they may fall into from sheer ignorance; to teach them not to be satisfied with mere empiricism; to show them how science may be applied to their work, and to induce them to follow it up.

The question then arises of providing instruction of a far more advanced character. The application of science to the arts can only be by those who have a thorough knowledge of special branches. The masters, foremen, and others, who will take it up in this way are necessarily but a small per-centage of those engaged in industry. Any of the poorer classes who show a special ability and aptitude for science can only follow it out if supported while pursuing their study. The richer classes can pay for their instruction. It is only necessary to provide the opportunity. Whatever the universities and higher educational establishments of the country may do to afford instruction in science, the science will only form one portion of a general course of education. It would be foreign to their objects to afford advanced instruction in one special branch of science, and grant diplomas to men who had not time or did not wish to pursue other studies, and possibly were very slightly generally educated.

It is not in the least necessary that the institutions for giving this instruction should be spread about in country towns. The schools and classes attended by artisans at work and boys living at home can only be effective according as they are widely spread. But when it comes to the student devoting his whole time and being supported, it may as well be done in London as in Manchester or Birmingham, and besides the advantages of accessibility, etc., the best instruction can only be obtained in the capitals.

A college of science has lately been created in Ireland. The course of instruction, which lasts three years, is general during the first two years for all the students. During the third year it is specialised under the heads of agriculture, mining, engineering, and manufactures. In England the only public institution besides the Royal School

of Naval Architecture for advanced scientific instruction is the Royal School of Mines, Jermyn-street. It has not quite as large a staff of professors as the college of Science in Dublin.

There are now 17 royal exhibitions to the institutions competed for at the May examinations of the department. They are of the value of 50*l.* per annum, and are tenable for three years. Six, therefore, become vacant every year except every third year, when five only become vacant. The fees are remitted, and the 50 goes to support the student. They are more eagerly competed for. The number might with advantage be increased, at all events in a few years.

A very simple and probably effective extension of this action would be to allow that, wherever a locality raised funds to establish exhibitions to support deserving students in London or Dublin, the fees for instruction should be remitted for those students, and perhaps the local funds supplemented. Any place, Leeds for instance, organising its system of elementary science classes in any way that suited its requirements, could then for a few hundreds a year support several of the most promising students here in London, where they would receive the best scientific instruction to be had anywhere.

The present constitution* and the name "School of Mines" prevents that institution filling the position of an advanced school of general science effectually. At the same time, far the larger portion of the scientific instruction given in it is general, and would form a course applicable to any industry. This is not known and a proposition to send students there would unless they were intended for mining, not be understood. The Royal School of Naval Architecture and Marine Engineering has as yet not got any staff for instruction in experimental science. This instruction is given by lecturers appointed from year to year, and in a small temporary chemical laboratory. It is therefore most advisable that a college of general science should be organised or constituted in London on the plan of the Irish College of Science to meet the requirements here indicated.

A change is most desirable in every way. It is greatly to be regretted that the admirable courses of lectures of the professors at the Royal School of Mines are attended by so few students. Though the separate courses are in some cases fairly attended, there are only some five or six students entered, besides the Royal exhibitioners, for the full course of the school, that is for the Associateship. This must always be so. The field that a school of mines applies to is but limited. It does not get known in the country, and even the separate courses are not taken that advantage of which one would suppose.

In time it may be found desirable to establish a third college of science in Edinburgh, and perhaps a fourth in the north of England. There is no call for these however at present.

Much is said about the necessity for technical instruction, and efforts will no doubt be made to induce the State to supply it. It becomes therefore necessary to consider how far, if at all, the

* A Commission consisting of Lord Granville, Sir C. E. Trevelyan, and Mr. Lowe, decided in 1862 that the instruction in the Royal School of Mines should embrace only those branches of general science which are applicable to mining, and that it should be a special mining school similar to those on the Continent.

the State can take thus up advantageously as distinct from the general scientific instruction previously considered.

This action is proposed from two rather different points of view. The one proposal is to have a technical school adapted to the staple industry of a place, the other apparently to teach trades which do not exist there, with the idea of their introduction.

Real technical education—the teaching of a trade or art itself on scientific principles—necessarily entails workshops for practice. It would be scarcely possible to devise a more effectual blow to the manufacturers of a place than for the State to establish a real technical school for their trade, with its workshop, under no constraint to pay its expenses, underselling them and interfering with their market. A State pottery school and Messrs Minton could not exist side by side. On the other hand, for the State to teach trades, where they don't exist, with the view of introducing them, and thereby most probably tempting them away from where they have established themselves, could at the most only be innocuous so long as it was ineffectual.

If then it were possible to keep pace with trade, the more efficient the schools were, the more injuriously would they affect private enterprise. It is, therefore, not necessary to dwell on the constant shiftings of trade according to the labour market, the difficulty of determining what was, and what should be, the staple industry of a place, and many other such points, which would render the administration of a system of technical schools an impossibility in this country.

The only technical schools which the State advantageously deal with are such as the military schools, the school of naval architecture and marine engineering, etc.—that is, where it is said to be instructing apprentices for the purpose of itself employing them partially or wholly.

With regard to general industry, it may be taken that the action of the State cannot safely go further than by aiding and encouraging instruction in general science, or such applied science as mining and metallurgy. The Commission for the College of Science for Ireland laid down that its aim should be to impart a sound and thorough knowledge of those branches

of science which may be applied to industry, leaving it to the student subsequently to specialise his knowledge and turn his attention in the direction he may find most suitable.

The system of payment on results is so well established, permits of such complete freedom of action, is applicable to such a variety of circumstances of schools, and has borne such good fruit that I take for granted it will not be proposed to alter it.

As much pressure may, however, be brought to bear on the Government, it is perhaps right to point out, that the experience of this department has proved nothing more decisively than that, in the conduct of science or art schools, any general joint action between the State and the locality is sure to lead to difficulties. Whatever system of guarantees for salary, etc., may be invented, the fact that the liability is really limited to one of the partners is sure to have its effect. It is impossible for the State to withhold the whole grant and close up the establishment after it has been in operation a few years because the locality does not comply with every tittle of its contract; and so matters go on getting worse from year to year. If pure payment on results cannot be wholly adhered to, care should be taken that the department is only committed to some definite piece of work when the locality has fulfilled its portion, and that no continuous partnership is entered into.

In conclusion, it is only necessary to point out that aiding instruction in science on the plan now being followed with the proposed extension, can and will aid pure technical instruction in the very best way. That is to say, if the masters of works will either separately or in combination establish schools for the instruction of their *employés*, the State, by paying on the results of elementary and scientific instruction, would assist in the instruction of the students just up to the point of their learning the absolute trade. There is nothing to prevent manufacturers with energy and public spirit establishing as good schools as those of M. Schneider, at Creuzot, and obtaining as much Government aid towards them.

(signed) *J. F. D. Donnelly,*
Captain, R. N.

12 November 1867.

App. No. 12.

(See Evidence 888)*

VALUE OF SCIENCE PRIZES.

	£.	s.	d.
Issued in 1860 - - - - -	46	18	4
" 1861 - - - - -	168	1	-
" 1862 - - - - -	319	-	5
" 1863 - - - - -	228	10	1
" 1864 - - - - -	841	14	-
" 1865 - - - - -	829	11	11
" 1866 - - - - -	540	9	10
" 1867 - - - - -	739	1	2

(signed) W. G. Groser, Storekeeper.

(See Evidence 988)

IMPORTS from France into England.—Extracted from the Statistical Returns published by the Board of Trade.

The IMPORTS of the following Articles, the manufacture of which is influenced by Scientific or Artistic Knowledge, have increased since the French Treaty of 1860

	In 1859, the Year before the Treaty	In 1861, the Year after the Treaty	In 1866	
	£	£	£	
Books - - - - -	83,443	86,537	88,615	
China, porcelain, and earthenware - -	40,091	79,088	101,784	
Clocks - - - - -	90,226	161,466	190,821	
Cotton manufactures - - - - -	371,774	399,210	589,216	
Flowers (artificial) - - - - -	97,273	275,092	291,269	Falling off since 1862.
Furniture (wood) - - - - -	not stated	14,310	47,386	Falling off since 1865
Glass (flint, cut and uncut) - - - - -	9,126	41,141	31,478	
" (plate) - - - - -	19,101	16,174	105,449	
Hats, &c. (straw) - - - - -	69,664	31,184	1,182,700	
" (felt) - - - - -	not stated	not stated	66,967	
Hides, dressed, &c. - - - - -	122,178	89,439	320,512	
Iron and steel manufactures - - - - -	6,916	24,489	91,738	
Lace - - - - -	22,364	37,847	78,012	
Leather manufactures (gloves and boots) -	698,777	785,113	1,182,766	Increases in gloves only, falling off in boots
Linen manufactures - - - - -	22,689	12,121	62,143	
Musical instruments - - - - -	86,869	105,376	164,743	
Opera glasses - - - - -	-	-	77,822	
Paper hangings - - - - -	10,107	14,750	22,864	
" of other sorts, including pasteboard	16,082	19,152	71,784	
Plating of straw, &c - - - - -	125,192	90,178	146,063	
Silk manufactures - - - - -	1,372,065	4,471,169	6,787,629	Decrease in plush.
Skins - - - - -	68,997	18,667	22,491	
Watches - - - - -	210,733	321,400	241,341	Falling off since 1861
Woollen manufactures - - - - -	607,609	1,057,837	1,151,092	Considerable fall- ing off since 1862.

The IMPORTS of the following Articles have Diminished since the French Treaty of 1860.

	In 1859, the Year before the Treaty	In 1861, the Year after the Treaty.	In 1866.	
	£	£	£	
Bronzes - - - - -	28,008	81,508	46,235	
Buttons, &c - - - - -	56,041	42,094	33,996	
Embroidery, &c - - - - -	67,761	46,550	36,018	
Prints and drawings - - - - -	22,973	12,268	12,482	
Silk (thrown) - - - - -	298,427	152,133	100,896	

27 May 1868.

G. F. Duncombe.

Apj

A List of Persons Certificated as Competent to act as TEACHERS of ART SCHOOLS, with their present Occupations, so far as known

Group 1 Elementary Drawing and Colouring. | Group 5 Modelling the Figure.
 Group 2. Painting | Group 6a. Mechanical Drawing.
 Group 3 The Figure drawn and painted | Group 6b Architectural Drawing.
 Group 4 Modelling Ornament

Present Occupation	Names of Masters and Students in Training	School where previously Taught.	Certificates obtained.
School of Art, Coventry - - -	Anderson, John - - -	Stoke - - -	1, 2, 3, 6a.
Private Teacher - - -	Anderson, H. T. - - -	Metropolitan Dis- trict.	1.
Private Teacher - - -	Andrew, F. W. - - -	Metropolitan Dis- trict	1.
Occupation not known - - -	Arthur, T. - - -	Metropolitan Dis- trict	1.
School of Art, Edinburgh - - -	Ashworth, Susan - - -	Metropolitan Dis- trict.	1, 2
Occupation not known - - -	Atkins, Catherine - - -	Training Class - - -	1.
Private Teacher - - -	Atkinson, G. M. - - -	Cork - - -	1, 6a.
Occupation not known - - -	Atkinson, Mary - - -	Training Class - - -	1
Schools of Art, Newcastle-under Lyme, and Stoke-on-Trent.	Bacon, J. P. - - -	Manchester - - -	1, 6a.
School of Art, Inverness - - -	Bain, R. L. - - -	Dundee - - -	1.
Private Teacher - - -	Baines, Catherine - - -	Metropolitan Dis- trict.	1, 2.
School of Art, Stirling - - -	Baker, L. - - -	Metropolitan Dis- trict	1
School of Art, Southampton - - -	Baker, W. J. - - -	Unconnected with the Department	1.
School of Art, Lambeth - - -	Bale, Edwin - - -	Metropolitan Dis- trict	1, 4, 5, 6a.
School of Art, Glasgow - - -	Banner, A. - - -	Dundee - - -	1, 6a, 6b
Occupation not known - - -	Barrett, Mary - - -	Metropolitan Dis- trict	1.
Occupation not known - - -	Beal, Emma - - -	Training Class - - -	1.
School of Art, Bloomsbury - - -	Bélinsaye, Laura de la	Metropolitan Dis- trict.	1
Occupation not known - - -	Benny, James - - -	- - -	1.
School of Art, Birkenhead - - -	Bentley, John - - -	Macclesfield - - -	1, 4, 6a, 6b.
School of Art, Exeter - - -	Birkmyer, James - - -	Liverpool - - -	1, 2, 6a, 6b
Training Class Student - - -	Black, Amy E. - - -	Metropolitan Dis- trict	1, 2.
School of Art, Kilmarnock - - -	Black, Francis M. - - -	Dundee - - -	1.
School of Art, Birmingham - - -	Blizard, Edward - - -	Spitalfields - - -	1, 6a, 6b.
Private Teacher - - -	Boon, William - - -	Hanley - - -	1, 2, 4, 6a.
School of Art, Bromsgrove - - -	Bowen, W. P. - - -	Worcester - - -	1, 2.
School of Art, Stourbridge - - -	Bradley, Eleanor - - -	Metropolitan Dis- trict.	1.
Training Class Student - - -	Bradbury, Alfred A. - - -	Leeds - - -	1, 6b
School of Art, Cork - - -	Brenan, James - - -	Dublin - - -	1, 2, 3, 4a.
Private Teacher - - -	Brown, John - - -	Metropolitan Dis- trict.	1, 4, 6a.

App. No. 12.

Present Occupation	Names of Masters and Students in Training	School where previously Taught.	Certificates obtained.
School of Art, Limerick - - -	Brophy, N. A. - - -	Limerick - - -	1, 6a, 6b
School of Art, Cheltenham College -	Brooke, Alfred N. - -	Manchester - - -	1, 6a.
School of Art, Liverpool, North District.	Burkinshaw, S. - - -	Birmingham - -	1, 2, 6a.
School of Art, Cardiff - - -	Bush, James - - -	Cermerthen - - -	1.
Private Teacher - - -	Bustin, R. B. - - -	Metropolitan District.	1.
School of Art, Westminster - - -	Burchett, E. S. - - -	Metropolitan District.	1, 6a, 6b.
Occupation not known - - -	Butler, Mary E. - - -	Training Class - -	1.
Occupation not known - - -	Cahill, R. S. - - -	Unconnected with the Department	1.
School of Art, Bridport - - -	Campbell, J. A. D. - -	Metropolitan District	1, 2, 6a, 6b.
School of Art, Dorchester - - -	Carter, David - - -	Coventry - - -	2.
School of Art, Hanley - - -	Carter, James - - -	Unconnected with the Department.	1, 2, 3, 6a.
Training School, South Kensington -	Casabianca, Florence -	Metropolitan District.	1, 2.
School of Art, St. Martin's, London -	Casey, W. L. - - -	Cork - - -	1, 2, 3.
Training Class Student - - -	Cutley, William - - -	Boston - - -	1.
School of Art, South Kensington -	Channon, Mary E. - - -	Metropolitan District.	1, 2.
School of Art, Hull - - -	Chandler, Edwin - - -	Plymouth - - -	1, 2, 3, 6b.
Private Teacher - - -	Charles, Rebekah C. -	Training Class - -	1.
Training Class Student - - -	Childe, Eilen E. - - -	Bloomsbury - - -	1.
Private Teacher - - -	Chittenden, Thos. - -	Training Class - -	1.
South Kensington - - -	Clack, Thos. - - -	Coventry - - -	1, 2, 3, 4, 6a.
School of Art, West London - - -	Clarke, C. M. - - -	Manchester - - -	1, 2.
Retired - - -	Cleland, P. - - -	Aberdeen - - -	1.
Private Teacher - - -	Clifton, J. S. - - -	Unconnected with the Department.	1.
Occupation unknown - - -	Cole, Lætitia M. - - -	Metropolitan District.	1.
Occupation not known - - -	Collier, Thomas F. - -	Training Class - -	1.
Private Teacher - - -	Collins, Emma - - -	Liverpool - - -	1.
Occupation not known - - -	Colson, John - - -	Unconnected with the Department.	1.
School of Art, Norwich - - -	Cochrane, Robert - - -	Unconnected with the Department.	1, 2, 6a.
School of Art, Weston-super-Mare -	Cosbie, W. S. - - -	Liverpool - - -	1, 2, 3, 6a, 6b.
Training Class Student - - -	Cox, William - - -	Training Class - -	1.
School of Art, Chester - - -	Cranter, Walter - - -	Training Class - -	1, 6b.
Training Class Student - - -	Croasdale, Elizabeth -	Training Class - -	1.
Private Teacher - - -	Croome, John D. - - -	Unconnected with the Department.	1, 2.
Training Class Student - - -	David, Mary R. - - -	Metropolitan District.	1.
City Middle Class Schools - - -	Davidson, E. A. - - -	Metropolitan District	1, 6a, 6b.
Training Class Student - - -	Davis, Flora - - -	Metropolitan District.	1.
School of Art, Bridgewater - - -	Davis, James - - -	Metropolitan District.	1, 6a.
School of Art, Lambeth - - -	Dennis, Henry J. - - -	Metropolitan District	1, 6a.
Training Class Student - - -	Dickinson, Henry D. -	Training Class - -	1.
Training Class Student - - -	Dixon, Laurina - - -	Metropolitan District	1.
Private Teacher - - -	Dodge, Sarah A. - - -	Metropolitan District.	1, 2.
School of Art, Great Yarmouth - - -	Dominy, I. S. - - -	Devonport - - -	1, 2, 6a, 6b.
Private Teacher - - -	Drummond, J. G. - - -	Cork - - -	1, 2, 6b.
Training Class Student - - -	Duckett, William - - -	Lancaster - - -	1, 6b.

Present Occupation.	Names of Masters and Students in Training.	School where previously Taught.	Certificates obtained.
Private Teacher - - - -	Duncan, W. S. -	Dundee - - - -	1, 6a, 6b.
Greenwich Hospital School - - - -	Dundas, James -	Dundee - - - -	1, 2, 6a, 6b.
Private Teacher - - - -	Earle, Emily -	Training Class -	1
Occupation not known - - - -	Eavestaff, Anna -	Training Class -	1.
Private Teacher - - - -	Edgley, Sarah J. -	Metropolitan District -	1.
Occupation not known - - - -	Edwards, Catherine -	- - - -	1.
Occupation not known - - - -	Edwards, John -	Dunfermline -	1, 6a.
Private Teacher - - - -	Edwards, Maria -	Metropolitan District -	1.
School of Art, Darlington - - - -	Elton, Samuel -	Metropolitan District -	1, 6a.
Private teacher - - - -	Elliott, Rebecca -	Metropolitan District -	1.
Private Teacher - - - -	Ferrier, R. E. -	Metropolitan District -	1.
School of Art, Liverpool (South District) - - - -	Finnie, John -	Newcastle - - -	1, 2, 6a.
School of Art, Lewes - - - -	Fisher, Alexander -	Dudley - - - -	1, 2, 4, 6a, 6b.
Private Teacher - - - -	Fisher, Ellen -	Training Class -	1
Occupation not known - - - -	Foster, William -	Manchester - - -	1, 6a.
School of Art, Macclesfield - - - -	Ford, James -	Penzance - - - -	1, 2, 4, 6a, 6b.
School of Art, Clonmel - - - -	Fraser, Edw. A. -	Dublin - - - -	1, 6b.
Schools of Art, Andover and Salisbury - - - -	Frazer, John P. -	Aberdeen - - - -	1, 2, 3, 6a, 6b.
Private Teacher - - - -	Freed, Mary Ann -	Metropolitan District -	1.
Private Teacher - - - -	Fussell, Fred R. -	Nottingham - - -	1.
Private teacher - - - -	Grammage, Emma -	Liverpool - - - -	1
School of Art, Bloomsbury - - - -	Gann, Louise -	Metropolitan District -	1
Occupation not known - - - -	Gallimore, S. -	Stoke - - - -	1, 6b.
School of Art, Penzance - - - -	Geoffroy, Henry -	Unconnected with the Department -	1.
Training Class Student - - - -	Gibbons, Albert -	Crencester - - -	1.
Training Class Student - - - -	Gibbons, Owen -	Crencester - - -	1.
Designer - - - -	Gibbs, Charlotte -	Metropolitan District -	1.
Schools of Art, Preston and Lancaster - - - -	Gilbert, H. -	Metropolitan District -	1, 6a.
Occupation not known - - - -	Gill, George R. -	Metropolitan District -	1, 6a, 6b.
Occupation not known - - - -	Gillo, Robert -	Bath - - - -	1
King's College, London - - - -	Glenny, W. J. -	Metropolitan District -	1, 2, 6a, 6b.
Occupation not known - - - -	Godwin, Mary -	Metropolitan District -	1
School of Art, Frome - - - -	Goepel, James S. -	Training Class -	1, 6b.
Enamel Painter - - - -	Gray, George -	Potteries - - - -	1.
Occupation not known - - - -	Gray, Thomas -	Aberdeen - - - -	1, 6a.
Occupation not known - - - -	Green, Charlotte -	- - - -	1.
Occupation not known - - - -	Greenhill, Mary E. -	Training Class -	1.
School of Art, Ipswich - - - -	Griffiths, W. T. -	Unconnected with the Department -	1, 6a, 6b.
In India - - - -	Griffiths, John -	Metropolitan District -	1, 2, 4, 5, 6b.
School of Art, Truro - - - -	Griffiths, Richard -	Carnarvon - - - -	1, 6a.
Training Class Student - - - -	Grubb, Wm. M. -	Dundee - - - -	1.
Schools of Art, Dudley and Wolverhampton - - - -	Gunn, Archibald -	Unconnected with the Department -	1, 6a, 6b.
Training School, South Kensington - - - -	Hagreen, H. B. -	Unconnected with the Department -	1, 6a.
Hampstead Night Class - - - -	Hale, Robert -	Manchester - - - -	1, 6a.
Training Class Student - - - -	Hall, Fanny -	Training Class -	1.

App. No. 12, 1

Present Occupation.	Names of Masters and Students in Training.	School where previously Taught.	Certificates obtained.
Sandhurst College - - - -	Harley, R. - - -	Unconnected with the Department.	1, 2, 3.
Private teacher - - - -	Hardess, Maria - -	Metropolitan District.	1, 2.
Occupation not known - - -	Harrison, J. C. - -	Leeds - - -	1.
Schools of Art, Henley-on-Thames and Reading	Havell, C R - - -	Unconnected with the Department.	1.
Occupation not known - - -	Hayden, E - - -	Warrington - - -	6a.
Occupation not known - - -	Healy, James - - -	Dublin - - -	1.
Occupation not known - - -	Heazle, William - -	Cork - - -	1.
Private Teacher - - - -	Hill, John - - -	Warrington - - -	1, 6a, 6b.
Smethwick Night Class - - -	Hill, Henry - - -	Birmingham - -	1
Private Teacher - - - -	Hipwood, Sarah - -	Metropolitan District	1, 2.
School of Art, Edinburgh - - -	Hodder, Charles D. -	Metropolitan District.	1, 2.
School of Art, Torquay - - -	Holmes, Thomas - -	Dublin - - -	1, 2, 6a.
Occupation not known - - -	Holt, Mary Ann - - -	Metropolitan District.	1.
Occupation not known - - -	Home, Emily G. - - -	Training Class - -	1.
Occupation not known - - -	Hone, Alfred - - -	Unconnected with the Department.	1, 4.
Training Class Student - - -	Horneastle, Jane - -	Training Class - -	1, 2.
Schools of Art, Carmarthen and Llanelly.	Hosford, F F - - -	Cork - - -	1, 2.
School of Art, Boston - - - -	Howard, Vernon - - -	Metropolitan District.	1, 2, 6a.
Occupation not known - - -	Huckvale, Elizabeth	Leeds - - -	1.
Private Teacher - - - -	Hull, Clementina - -	Training Class - -	1.
Private Teacher - - - -	Hull, Susanna, E. - -	Metropolitan District.	1.
Private Teacher - - - -	Hulme, Fred E. - - -	Metropolitan District.	1, 6a, 6b.
Occupation not known - - -	Hulme, Robert C. - -	Metropolitan District.	1, 6a.
Occupation not known - - -	Humphreys, Jane - - -	Metropolitan District	1.
Occupation not known - - -	Hunter, Jessy - - -	Carmarthen - - -	1.
School of Art, Perth - - - -	Hutton, David C. - -	Dundee - - -	1.
Occupation not known - - -	Inskipp, Janet - - -	Unconnected with the Department	1.
Occupation not known - - -	Johnson, Annie - - -	Metropolitan District.	1.
Training Class Student - - -	Jones, David - - -	Carmarthen - - -	1, 2, 6a, 6b.
Occupation not known - - -	Judd, Florence - - -	Training Class - -	1.
School of Art, Dublin - - - -	Julyan, Mary - - -	Metropolitan District.	1, 2, 3.
Occupation not known - - -	Kelly, Edwin J. - - -	Macclesfield - - -	1, 6a, 6b.
Schools of Art, Gloucester and Stroud	Kemp, John - - -	Cork - - -	1, 2, 6a.
Training Class Student - - -	Kemp, Minna - - -	- - -	1.
Training Class Student - - -	Kemp, Mrs. A. - - -	Training Class - -	1.
Private teaching - - - -	Kennedy, James - - -	Dublin - - -	1, 4, 6a, 6b.
School of Art, Dundee - - - -	Kennedy, John - - -	Dublin - - -	1, 2, 6a.
School of Art, Kidderminster	Kennedy, Joseph - -	Dublin - - -	1, 6a, 6b.
Occupation not known - - -	Keyworth, Annie R - -	Reading - - -	1.
School of Art, Cheltenham	Knight, J. F. - - -	Metropolitan District.	1.
Training Class Student - - -	Lang, Isabella - - -	Training Class - -	1.
Private Teacher - - - -	Lanchenick, J. C. - -	Metropolitan District.	1.
Training Class Student - - -	Larking, Mary - - -	Metropolitan District.	1.
School of Art, Carlisle - - - -	Lees, Herbert - - -	Metropolitan District.	1, 2, 6a.
Occupation unknown - - - -	Legge, Lionel - - -	Metropolitan District	1, 4.
Training Class Student - - -	Lindsay, Thomas M. -	Training Class - -	1.
School of Art, Calcutta - - -	Lock, Henry H. - - -	Metropolitan District.	1, 4, 6b.

Present Occupation	Names of Masters and Students in Training	School where previously Taught	Certificates obtained.
Private Teacher	Lord, John	Dublin	1, 6a.
	Lushington, Alice	Training Class	1
School of Art, Dublin	Lyne, Robert E.	Unconnected with the Department	1, 2, 3, 6a.
Flower Painting	Manly, Alice E.	Bloomsbury	1.
School of Art, Queen-square	Mateaux, Clara	Metropolitan District.	1.
School of Art, Oxford	Macdonald, Alex	Dundee	1, 2, 3, 6a, 6b.
Training Class Student	M'Carty, Wm M.	Training Class	1.
School of Art, Waterford	M'Cloy, Samuel	Belfast	1
School of Art, Cape of Good Hope	M'Gill, W M	Dudley	1, 2, 6a, 6b.
Training Class Student	M'Minn, Jane K	Training Class	1
School of Art, Dublin	Mayne, Arthur J.	Dublin	1.
School of Art, Aberdeen	Menzies, John	Aberdeen	1, 2, 6a, 6b.
Private Teaching	Mills, Eliza	Metropolitan District.	1, 2.
School of Art, Spitalfields	Mills, Samuel F	Metropolitan District	1, 2, 6a, 6b.
School of Art, Cirencester	Miller, James	Aberdeen	1, 6a, 6b.
Works, South Kensington	Moody, Francis W		1, 4, 6b
School of Art, Edinburgh	Morley, William A.	Metropolitan District.	1, 4, 5, 6a.
School of Art, Manchester	Muckley, William J	Birmingham	1, 2, 3, 6a.
Private Teacher	Mulligan, James A	Unconnected with the Department	1, 6a
Training Class Student	Nesbitt, Sidney	Boston	1
School of Art, Exeter, Student	Nevett, John C.	Exeter	1.
School of Art, Durham	Newton, George	Unconnected with the Department.	1, 2, 3.
School of Art, Bristol	Nichols, Alfred	Metropolitan District.	1, 2, 4, 5, 6a
Architectural Draughtsman	Notley, Robert		1.
School of Art, Shrewsbury	Noyes, H J.	Unconnected with the Department	1.
Private Teacher	Oxford, John	Unconnected with the Department.	1.
School of Art, St. Thomas, Charter house, London	Parker, John	Birmingham	1, 2, 3, 6a.
Occupation unknown	Peal, Samuel E	Metropolitan District	1, 4, 5, 6a.
School of Art, West London	Pilsbury, Wilmot	Birmingham	1, 2, 3, 6a, 6b.
Occupation unknown	Pozzi, William E.	Metropolitan District.	1, 2, 4, 6a.
Training Class Student	Priest, Mary A.	Training Class	1.
Training Class Student	Pritchard, Zachariah	Macclesfield	1, 2, 6a, 6b.
Designer	Protat, Mons. H.	Unconnected with the Department.	6a
Schools of Art, Bath and Chippenham	Puckett, Robert C.	Metropolitan District	1, 2, 3, 4, 5, 6a.
Training Class Student	Pullin, Elizabeth	Training Class	1
Private Teacher	Pyne, C. C.	Unconnected with the Department.	1
Occupation unknown	Rafter, Henry	Unconnected with the Department	1.
School of Art, Birmingham	Rambach, D. W.	Unconnected with the Department	1
Ornamental Draughtsman	Randall, John	Metropolitan District	1, 2, 3, 6a.
School of Art, Nottingham	Rawle, John S.	Unconnected with the Department.	1, 2, 3, 6a, 6b.
Training Class Student	Rawson, William	Leeds	1.
Private Teacher	Rees, Mary	Metropolitan District.	1, 2.
Private Teacher	Richardson, J. V.	Unconnected with the Department.	1.

App. No. 22.

Present Occupation	Names of Masters and Students in Training	School where previously Taught.	Certificates obtained.
Occupation unknown - - -	Ridley, Charlotte - - -	- - - - -	1.
Occupation unknown - - -	Riley, Benjamin - - -	Manchester - - -	1.
Training Class Student - - -	Roberts, William - - -	Southampton - - -	1.
Training Class Student - - -	Robinson, Thos W H - - -	Leeds - - -	1.
Schools of Art, Devonport and Tavistock.	Robyjohns, F R. - - -	Tavistock - - -	1, 2, 6a.
Occupation unknown - - -	Robson, George - - -	- - - - -	1.
Private Teacher - - -	Routledge, Robert - - -	Manchester - - -	1, 6a.
School of Art, Carnarvon - - -	Rowland, J. C. - - -	Unconnected with the Department.	1.
School of Art, Taunton - - -	Rowe, John - - -	Penzance - - -	1, 6a.
Leamington Night Class - - -	Ryan, Charles - - -	Dublin - - -	2, 2.
Architectural Draughtsman - - -	Ryan, James - - -	Dublin - - -	1, 6a.
Training Class Student - - -	Ryder, Emily S. - - -	Training Class - - -	1.
Schools of Art, Devizes, Trowbridge, and Warminster	Ryles, George - - -	Poteries - - -	1, 6a.
Works, South Kensington - - -	Sadler, Alfred - - -	Metropolitan District	1.
Training Class Student - - -	Sawkins, Isabella - - -	Metropolitan District	1, 2.
Training Class Student - - -	Schutze, E. Eliz. - - -	Training Class - - -	1.
Lambeth School of Art Student	Shepherd, Emily J. - - -	Lambeth - - -	1.
Occupation unknown - - -	Shiel, Edward - - -	Unconnected with the Department	1, 6a.
Training Class Student - - -	Slack, Mary E. - - -	- - - - -	1.
Training Class Student - - -	Slocombe, Fred. - - -	Training Class - - -	1, 6a.
Dublin Night Class - - -	Smeeth, Joseph F. - - -	Dublin - - -	1.
Belfast Night Class - - -	Smeeth, Rowland - - -	Belfast - - -	1.
School of Art, Leeds - - -	Smith, Daniel - - -	Leeds - - -	2.
Training Class Student - - -	Smith, Isabella F. - - -	Bloomsbury - - -	1.
School of Art, Bristol - - -	Smith, John N. - - -	Dundee - - -	1, 2, 6a, 6b.
Schools of Art, Leeds and Bradford - - -	Smith, Walter - - -	Metropolitan District	1, 2, 4, 5, 6a.
Training Class Student - - -	Soden, Susannah - - -	Metropolitan District	1.
School of Art, Sheffield - - -	Sounes, W. H. - - -	Metropolitan District	1, 4, 5, 6a.
School of Art, Lambeth - - -	Sparkes, John - - -	Unconnected with the Department.	1, 2, 6a, 6b.
Training Class Student - - -	Spragge, Catherine - - -	Training Class - - -	1.
Artist - - -	Stannus, Anthony - - -	Belfast - - -	1, 2.
School of Art, Leeds - - -	Stevenson, A. - - -	Dundee - - -	1, 6a.
School of Art, Ipswich - - -	Stevenson, Rea L. - - -	Halifax - - -	1, 2, 6a, 6b.
School of Art, Halifax - - -	Stopford, Wm - - -	Cork - - -	1, 6a, 6b.
School of Art, Leeds - - -	Sturgeon, W. - - -	Leeds - - -	1, 2, 6a, 6b.
Training Class Student - - -	Sullivan, Michael - - -	Training Class - - -	1, 6b.
School of Art, York - - -	Swallow, John Charles - - -	Metropolitan District	1, 2, 4, 6a.
Private Teacher - - -	Swallow, J. Florence - - -	Metropolitan District	1, 2.
North London School of Art, Kingsland	Swinstead, C. - - -	Metropolitan District	1, 6a.
Occupation unknown - - -	Sylvester, H. - - -	Metropolitan District	1, 6a.
School of Art, Lincoln - - -	Taylor, Edward R. - - -	Burslem - - -	1, 2, 3, 6a.
Training Class Student - - -	Theaker, George - - -	Sheffield - - -	1.
Training Class Student - - -	Thomas, Stephen - - -	Penzance - - -	1, 2, 6a, 6b.
School of Art, Warrington - - -	Thompson, J. C. - - -	Unconnected with the Department.	1, 2.
Wellington College - - -	Tucker, Raymond - - -	Unconnected with the Department.	1, 6a.

Present Occupation.	Names of Masters and Students in Training.	School where previously Taught.	Certificates obtained.
Training Class Student - - -	Tucker, Wilham -	Worcester -	1.
Training Class Student - - -	Wade, George A -	Preston -	1.
Occupation unknown - - -	Waite, James -	Newcastle -	1
Occupation unknown - - -	Waite, Robert -	Cheltenham -	1, 6a.
Private Teacher - - -	Walker, J. W. -	Norwich -	1, 2, 6a.
Training Class - - -	Walker, Susie -	Training Class -	1.
Private Teacher - - -	Wardle, George -	Macclesfield -	1, 6a, 6b.
	Warry, Jessie -	Training Class -	1.
Teacher in Canada - - -	Way, Charles J. -	Metropolitan District.	1, 6a.
School of Art, Newcastle-on-Tyne -	Way, W C. -	Metropolitan District.	1, 2, 6a, 6b.
Occupation unknown - - -	Weale, Frances -	- - -	1
Training Class Student - - -	Webb, Anna Day -	Metropolitan District.	1.
School of Art, Bloomsbury, Student -	Webb, Mary White-man	Metropolitan District.	1
Occupation unknown - - -	Weston, Sophia -	Training Class -	1
Private Teacher - - -	Wheeler, Sarah A. -	Metropolitan District.	1, 2.
Modeller, in America - - -	Whitaker, C. H. -	Training Class -	1, 4, 5.
School of Art, Brighton - - -	White, J. -	Unconnected with the Department.	1, 6a.
School of Art, Croydon - - -	Wigzell, M. -	Metropolitan District.	1.
Private Teacher - - -	Wilkinson, Ellen -	Training Class -	1.
Maidstone Night Class - - -	Williamson, J. B -	Belfast -	1, 2.
Occupation unknown - - -	Wilson, Catherine -	Metropolitan District.	1.
Occupation unknown - - -	Williams, W. O -	Unconnected with the Department.	1.
School of Art, Bloomsbury - - -	Wilson, Helena -	Metropolitan District.	1, 2, 3
School of Art, Cambridge - - -	Wood, Daniel -	Metropolitan District.	1, 2, 4, 6a.
School of Art, Coalbrookdale - - -	Woolner, Henry -	Unconnected with the Department.	1, 2, 5, 6a.
Occupation unknown - - -	Wrigley, Wilham -	Aberdeen -	1, 6a.
Private Teacher - - -	Wright, Henry W. -	Unconnected with the Department.	1
South Kensington - - -	Wylde, Robert G -	Metropolitan District.	1.
School of Art, Worcester - - -	Yeates, George P. -	Unconnected with the Department.	1, 2, 3

App No. 12.

(Confidential)

NOTES ON PUBLIC EDUCATION,

Prepared at the desire of the Right Hon. Lord Robert Montagu, M.P., Vice President of the Committee of Council on Education.

South Kensington Museum,
28 November 1867

My Lord,

In obedience to your Lordship's desire I have prepared a few notes on public education, which I hope you will regard only as brief suggestions for maintaining and improving the existing arrangements rather than as proposing any new or comprehensive plan.

PRIMARY OR ELEMENTARY EDUCATION

1. Since the system of payments on results, which in the first instance had been tried successfully in schools of science and art, was introduced into primary schools, I have always considered that State aid to elementary education should be so afforded as to encourage in every kind of school, and without conditions, the teaching of reading, writing, and cyphering, and to pay for those subjects by results. The condition of limiting the aid to schools employing a certificated teacher always seemed to me illogical, impolitic, and indefensible.

Payments on results
for reading, writing,
and cyphering.

2. If this condition were removed, State aid could be easily extended to all schools throughout the country, and a partial, if not perfect, system of national education, so far, 072.

- App. No. 12. would be possible, without disturbance to the existing voluntary system. I have never believed in the prophetic fears, that the quality of general education would be lowered by encouraging the universal teaching of reading, writing, and cyphering alone; but granting that such an apprehension has some force in respect of the supply of teachers, it appears to me that it might be met by simply putting a sufficient premium on the employment of certificated teachers.
- Status of the certificated teachers. 3. I think the principle of an augmentation grant to a school employing a certificated teacher should be revived; and just as the State keeps soldiers and sailors on half-pay, and has a militia and a naval reserve, it might be good public policy to maintain a force of certificated teachers who might always be in the market to be engaged. I would pay annually to a certificated teacher, I° a low registration fee whether employed or not, II° an augmentation grant when employed, and III° a capitation grant for the attendance and the good order of the school where he is employed.
- Half time system 4. Measures should be taken to encourage the "half time" system for children above a certain age, as advocated by Mr Chadwick, which I believe is generally as efficacious as full attendance at school.
- Vagrants. 5. All idle vagrants in the streets under 12 years of age should be sent to union schools, and the parents who are thus offenders against society and their offspring should be compelled to pay towards their teaching. The educational systems in Switzerland and Prussia offer suggestions.
- Inspection. 6. The system of inspection and examination might be improved and largely increased with great advantage and without a proportionate increase of cost.*
- Drilling, gymnastics, and music universal. 7. I think that drilling, gymnastics, and music, should be made a part of elementary education in all schools as far as possible, and that the State should make payments in aid of those subjects which are commonly taught abroad. In respect of teaching elementary science, I call attention to the advice given by Adam Smith, a century ago, who said—"There is scarce a common trade which does not afford some opportunities of applying to it the principles of geometry and mechanics, and which would not therefore gradually exercise and improve the common people in those principles, the necessary introduction to the most sublime as well as to the most useful sciences. The public can encourage the acquisition of those most essential parts of education by giving small premiums and little badges of distinction to the children of the common people who excel in them."
- Permissive rating 8. I think a permissive local rating Bill is very desirable, as proposed by Mr. Bruce. It exists already for libraries, art schools, and museums,—why not for primary instruction? As its adoption would be voluntary it should be accepted by the State on the same terms as the present voluntary system.
- Graduated fees for different classes. 9. Measures might be usefully taken to induce the children of all classes of society to attend elementary schools, especially in small places, as they do the schools of art and the science schools. Gradations in the payment of fees should be encouraged. The Birkbeck Schools directed by Mr. Ellis offer valuable suggestions in this respect.

II. SECONDARY OR TECHNICAL INSTRUCTION.

10. I concur generally in the paper of 12th November 1867 which Captain Donnelly has prepared on this subject.
- Elementary schools and science 11. I recommend that the managers of elementary schools be free to establish classes for teaching science through certificated teachers, and that payments on results be made to them, and that all fears of competition with elementary education be ignored. (See Education Minute of 20th February 1867)
- Free and grammar schools. 12. If effective measures can be taken to deal with the funds and management of the old free and common grammar schools, the teaching of art and science might be largely introduced into them without increased charge on Parliamentary funds.
- Upper grammar schools. 13. I consider that the State might usefully establish professorships, with prizes and perhaps scholarships for science at Eton, Harrow, Rugby, &c., as well as at the Universities. A very few thousand pounds expended annually in this direction would, I conceive, be the most efficient means of aiding technical instruction. Such an expenditure would act in increasing the public revenue in a few years. Until increased honours are awarded at the Universities for acquiring experimental science, and the knowledge is felt to be remunerative, experimental science will stand no chance with the study of classical learning, and the industrial position of this country in comparison with other countries generally will get from bad to worse. (Some Parliamentary Votes are already made to universities for science, see Estimates, Class IV)† The address of Mr. J S Mill, Rector of St. Andrew's, whilst fully estimating the great value of classical knowledge, shows the necessity for scientific teaching, in the most eloquent terms. It is a text book on the subject. (See also Mr Lowe's Address to the Philosophical Institution at Edinburgh.)

14. Four

* That is for systematically making reports on the deficiency of schools, with the view of adopting some such measures as Mr. Lowe suggests.

† See pp 6 and 7.

14. Four establishments should be formed in the nature of training colleges for teaching practical science. There is already one at Dublin. The School of Navigation and Science, now building at South Kensington, might be readily enlarged into such a college. Arrangements, I believe, might be made for a third, either in connection with the University at Edinburgh or at Glasgow, and a fourth might be created in the Midland Counties. The latter college, as well as that for Scotland, might be located in that place which offered to endow the greatest number of scholarships in it.

Training colleges for science.

15. Captain Donnelly's paper fully states the objections to State "trade" schools, so I do not repeat them.

III PUBLIC LIBRARIES AND MUSEUMS

16. Public libraries, galleries, and museums should be viewed as the highest instruments of public instruction, and be rendered as effective as possible to that end. Full titles, inventories, and catalogues should be prepared as well for the learned as the unlearned visitor. The superior manners and general culture of the mass of the people, especially in art and science, in many parts of Europe, are to be attributed to the influence of the greater number of public libraries and museums than with us, and to the facilities offered to all classes to study them*. The British Museum, which possesses treasures of the greatest instructional value, is still somewhat treated in its management and purpose only as a collection of things "rare and curious," as they were defined by Sir Hans Sloane a century ago, and not as a great public educational institution which it might be made

Public libraries and museums necessary to public instruction.

17. I strongly recommend, both on religious and moral grounds, that arrangements be made as at Kew Gardens and Museum, Hampton Court, and Greenwich Picture Galleries, &c. to admit the public to national institutions on Sunday afternoons. A more elevating measure could not be devised.

Sunday opening.

18. To render public libraries and museums, which are supported in the main by public funds, proper instruments of public instruction, and to manage them effectively and economically, it seems to me indispensable that they be placed under the sole responsibility of a Minister of the Crown. Numerous boards render executive management impotent, and are quite incompetent to deal with the proper expenditure of public funds. Boards are useful for counsel, but obstructive for action. On this subject, as well as on better administration of public museums, public opinion has been maturing for more than 30 years. See especially "Quarterly Review," No. 175, December 1850, "Edinburgh Review," January 1866.

Minister of Public Instruction.

19. The greater number of such public institutions of science and art are already under a Ministerial authority. It would be of great public benefit in every way to subject the remainder to the same authority* (See Estimates, Class IV, Learned Societies). But I allude especially to the British Museum, the National Gallery, National Portrait Gallery, and Patent Museum in London, also to the National Gallery, and Royal Irish Academy in Dublin, and the National Gallery, Edinburgh.

Public museums under Minister of Public Instruction.

IV. GENERAL PRINCIPLES OF ADMINISTRATION.

20. I consider it necessary that elementary education, secondary, or technical instruction, the management of public libraries, galleries, and museums, and all the votes given for education, science, and art, should be concentrated in their administration of them, so far as the expenditure of public funds at least is concerned, under the sole authority of the same Minister of the Crown.

General principles of administration.

21. This Minister of Public Instruction ought not, I venture to think, to be the Lord President of the Council. The work appears to me ample enough to engage the sole attention of a minister who, I also venture to think, ought to rank as a Secretary of State. He would sit in either House, according to the circumstances of the Cabinet. There should be an Under Secretary also in Parliament.

22. In my opinion, the present work at the Privy Council Office, with all the calls for charters, health, cattle plague, quarantine, &c., made upon the attention of the Lord President, make it impossible for that high functionary to devote sufficient time to numerous questions involved in public instruction viewed comprehensively.

23. To enlarge elementary education, making it truly national; to reform the educational charities; to increase technical instruction throughout the United Kingdom, to reorganise the British Museum,† the National Portrait Gallery, &c., so as to make them work efficiently and harmoniously together, are functions which ought not, I conceive, to be treated as of secondary importance to any others.

To the Vice President of the
Committee of Council on Education.

I have, &c.
(signed) *Henry Cole.*

* See list of such institutions in France, &c., printed by the Department.
† In doing this the family Trustees should be kept of course, but they should revert to their original functions there should be no further elections of "Elected Trustees," and the "Official Trustees" would at once give way to a single responsible minister.

PARLIAMENTARY VOTES for Science for the Middle and Upper Classes in 1887-8, exclusive of the Cost of the Queen's Colleges, Ireland.

<i>University of London.</i>		£.	s.	d.	The Amounts to each Class of Subjects were as follows—				
Two Examiners in Mathematics and Natural Philosophy - 200 l. each	400	--	--		<i>Mathematics</i>		£.	s.	d.
Two Assistant Examiners in Mathematics - - - 50 l. each	100	--	--		University of London - - -	500	--	--	
Two Examiners in Chemistry - - - 175 l. each	350	--	--		" St. Andrew - - -	100	--	--	
Two Assistant Examiners in Chemistry - - - 25 l. each	50	--	--		" Glasgow - - -	100	--	--	
Two Examiners in Experimental Philosophy - - -	200	--	--		" Edinburgh - - -	180	--	--	961 -- --
Two Examiners in Botany, 75 l. each	150	--	--		<i>Chemistry</i>				
Two Examiners in Geology, 75 l. each	150	--	--		University of London - - -	400	--	--	
Two Examiners in Physiology and Zoology - - - 150 l. each	300	--	--	1,700	" St. Andrew - - -	125	--	--	
					" Aberdeen - - -	100	8	8	
<i>University of St. Andrew's.</i>					" Glasgow - - -	400	--	--	
Professor of Natural Philosophy -	150	--	--		" Edinburgh - - -	200	--	--	1,815 8 8
" Mathematics - - -	100	--	--	384	<i>Natural and Experimental Philosophy.</i>				
" Chemistry - - -	125	--	--		University of London - - -	200	--	--	
<i>University of Aberdeen.</i>					" St. Andrew - - -	150	--	--	
Professor of Chemistry - - -	40	8	8		" Glasgow - - -	121	--	--	
Assistants - - -	150	--	--	490 8 8	" Edinburgh - - -	280	--	--	761 -- --
Professor of Botany - - -	300	--	--		<i>Botany.</i>				
<i>University of Glasgow</i>					University of London - - -	150	--	--	
Professor of Mathematics - - -	60	--	--		" Aberdeen - - -	300	--	--	
Assistant - - -	100	--	--		" Glasgow - - -	100	--	--	
Professor of Natural Philosophy -	21	--	--		" Edinburgh - - -	160	--	--	710 -- --
Assistant - - -	100	--	--		<i>Geology</i>				
Professor of Natural History - - -	200	--	--		University of London - - -	-	--	--	150 -- --
" Chemistry - - -	200	--	--	1,258	<i>Physiology, Zoology, and Natural History.</i>				
Two Assistants - - -	200	--	--		University of London - - -	300	--	--	
Professor of Botany - - -	100	--	--		" Glasgow - - -	200	--	--	
" Civil Engineering and Mechanics - - -	275	--	--		" Edinburgh - - -	160	--	--	650 -- --
					<i>Mechanics and Civil Engineering.</i>				
<i>University of Edinburgh.</i>					University of Glasgow - - -	-	--	--	275 -- --
Professor of Mathematics - - -	80	--	--						
Assistant - - -	100	--	--						
Professor of Natural Philosophy -	180	--	--						
Assistant - - -	100	--	--						
Professor of Natural History - - -	160	--	--						
" Botany - - -	160	--	--						
" Chemistry - - -	200	--	--	980					
TOTAL	£	4,812	8	8	TOTAL	£	4,812	8	8

No annual reports are made to Parliament of the results of this expenditure.

Mathematics, Natural Philosophy, Natural History, Chemistry, Mineralogy, and Geology, Engineering, Agriculture, Anatomy, and Physiology, and Political Economy, are taught in the Queen's Colleges of Belfast, Cork, and Galway.

LIST of Royal Exhibitors to the Museum of Irish Industry and Royal College of Science, *Dublin*.

YEAR.	Name.	Science School where Taught.
1865 - - - -	Frank Clowes - - - -	Middle class student
	James Craik - - - -	Middle class student
	John Connelly - - - -	Bandon.
	Wm. B. Leonard - - - -	Drogheda.
1866 - - - -	Charles G Stewart - - - -	Camden Town.
	John M'Allan - - - -	Self-taught
	Stewart Williamson - - - -	Middle class student.
1867 - - - -	Phineas S Abraham - - - -	Self-taught
	James R Kilroe - - - -	Santry
	William Hunt - - - -	Santry.
	Edward T Hardman - - - -	Dublin Central Model School.
	Richard J. Cruise - - - -	Middle class student

(See Evidence, 930)

LIST of Royal Exhibitors to the Royal School of Mines, *Jermyn-street*.

YEAR.	Name.	Science School where Taught.
1863 - - - -	Charles Berrell - - - -	Middle class student.
	William T Rowden - - - -	Trade School, Bristol
1864 - - - -	Geo J. Snelus - - - -	Science teacher.
	William Thorpe - - - -	Middle class student.
	Edward Richards - - - -	Poplar Navigation School.
1865 - - - -	Thomas Jones - - - -	Science teacher.
	Edward Collens - - - -	Trade School, Bristol.
	John A. Griffiths - - - -	Mechanics' Institution, Manchester.
1866 - - - -	German Green - - - -	Lower Islington, Public School
	Fred. J M. Page - - - -	Middle class student (City of London School).
1867 - - - -	William Garnett - - - -	Middle class student (City of London School).
	Archibald Liveridge - - - -	City of London College and Royal Polytechnic Institution.
	Alex. W. Bickerton - - - -	Painswick.
	Wm. J. Solla - - - -	Royal Polytechnic Institution.

Appendix, No. 13.

App. No. 13.

UNIVERSITY OF EDINBURGH.

GRADUATION IN SCIENCE.

The degrees of bachelor of science (Sc. B) and of doctor of science (Sc. D.) are given in the following departments of science:—

Division I.—PURE SCIENCE.

- Section A —Physical and natural science.
 „ B.—Mental science.
 „ C.—Philology.

Division II.—APPLIED SCIENCE.

This comprises—

- Section A.—Agriculture
 „ B.—Engineering (civil and mechanical).
 „ C.—Veterinary surgery.

Full details of the curriculum and examinations in each division are given in the “University Calendar” for 1868-69, published by Messrs. Edmonston & Douglas; price 2 s. 6 d.

GRADUATION IN SCIENCE.

Division II.—APPLIED SCIENCE.

ALL candidates for the degree in Applied Science must give proof of having received a liberal education by being either—

- 1.—B A or M.A.
- 2.—M B or M.D.
- 3.—Sc. B or Sc D.
- 4.—Holders of two departmental certificates in the Faculty of Arts of Edinburgh.
- 5.—Matriculated students of the University of London.

Or failing any of these qualifications, the candidate must pass a preliminary examination in English, Latin, logic, arithmetic, the elements of mathematics and mechanics, and either Greek or two modern languages (of which French must be one), as an alternative for Greek. The examination will be the same as that required of medical students.

The department of “Applied Science” is divided into—

- A.—Agriculture.
 B.—Engineering and mechanical science
 C.—Veterinary surgery.

A.—There will be two examinations for the degree of bachelor of agriculture (Agr. B.), and one for that of master of agriculture (Agr. M.) The examinations will be both written and oral.

The first examination is the same as that required for the first examination in the case of Sc. B, and relates to the knowledge of the candidate of the following subjects—

- | | |
|-----------------|--------------------------|
| 1. Mathematics. | 4. Geology. |
| 2. Chemistry. | 5. Zoology. |
| 3. Botany | 6. Experimental physics. |

This examination is compulsory on all candidates who do not possess the following qualifications—

A.—Masters

A.—Masters of arts who have taken honours in the natural sciences.
Masters of arts who have not taken honours in the natural sciences are exempted from mathematics and experimental physics only

B.—Bachelors and doctors of medicine who have taken honours in the natural sciences at their professional examinations, and who have passed in higher mathematics, natural philosophy, and logic, in their extra professional or preliminary examinations.

C.—Holders of certificates from the classes in science devoted to the foregoing subjects in the University of Edinburgh, showing that the candidate obtained 80 per cent of the available marks during the session. Any of the subjects cleared by such a certificate will be omitted from the written examination

The candidate who has passed successfully this examination may present himself at the next examination for his degree of bachelor of agriculture (Agr. B.)

For this examination the candidate must produce certificates of acquaintance with practical agriculture, and is required, with the view of specialising his studies, to profess one, and not more than one, of the following groups of subjects, with their practical relations to agriculture:

A.— <i>Natural Sciences</i>	- - -	}	Botany, Geology, Zoology.
B.— <i>Experimental Science</i>	- - -	{	Chemistry, Physics
C.— <i>Mechanical Science</i>	- - -	{	Mechanics, Engineering.

The certificates of the Royal Agricultural Society, the Highland Society, and the Royal Agricultural College, will be accepted for practical agriculture

Successful candidates who have thus acquired the degree of Agr. B. may at the next period of examination, provided they have attained the age of 21, proceed to the examination for the degree of master of agriculture (Agr. M.)

For this degree the candidate will be required to submit to a searching examination on one of the following subjects, in its special relation to agriculture.

- A.—Agricultural chemistry—organic and inorganic
- B.—Agricultural mechanics
- C.—Engineering (civil)—surveying, drawing, &c
- D.—Natural history—botany, geology, &c.
- E.—Animal physiology—breeding, rearing, &c, of animals.

Should the candidate pass successfully this examination, he will receive the degree of master of agriculture (Agr. M.)

The examinations for degrees will be conducted by university examiners, and an examiner appointed by the Highland Society

B.—Engineering—Civil and Mechanical.

1st. All candidates for a degree in engineering must have the qualifications required for matriculation before passing a science degree.

There will be two examinations in engineering for the degree of *bachelor of engineering* (Sc. Mach. B.), and a third for the degree of *master of engineering* (Sc. Mach. M.)* The examinations will be both written and oral. The first examination is as to the general knowledge of the candidate on the following subjects:—

1. Mathematics.
2. Natural Philosophy
3. Chemistry.

This examination is called the first bachelor of engineering examination, and is compulsory on all who do not possess the following qualifications:—

- A.—Masters of arts who have taken honours in the departments of mathematics or natural science
- B.—Bachelors in science in the University of Edinburgh or London.
- C.—Graduates in science who have passed the first bachelor of science examination in the University of Edinburgh.

The candidate who has successfully passed the first bachelor of engineering examination may proceed to the second examination, which is to be entitled the second bachelor of engineering examination.

The candidate will be examined in the following subjects:—

- (A) Mathematics applied to mechanics.
- (B) Engineering—Civil engineering, mechanical engineering, surveying and levelling.
- (C.) Drawing—Geometrical projection, mechanical drawing, plans and surveys.

The candidate having passed successfully the first bachelor of engineering examination (or having the qualifications necessary to escape this examination), after passing with approval

* *Scientiæ Machinabilis [Magister] (Pliny, lib. cap.).*

App. No. 13.

approval the second examination, shall be recommended to the Senatus for the degree of bachelor of engineering.

This degree will indicate that the student has received such a preparation as will qualify him to enter with advantage the office of a civil engineer or the workshop of a mechanical engineer as a pupil.

Should the candidate desire to become a master of engineering, he may present himself for a third examination. All candidates for this degree must prove that they have passed at least two years as a pupil under a civil engineer in practice, or in a mechanical workshop. He must then profess one, and not more than one, of the subdivisions in each of the two following groups of subjects.—

- | | | |
|------------------------------------|---|--|
| 1st. <i>Practical Engineering.</i> | { | (a) The design of machinery, with complete drawings, specifications, and estimates |
| | { | (b) The preparation of designs, specifications, and estimates for some civil engineering work. |
| 2nd. <i>Applied Science -</i> | { | a. Applied mathematics. |
| | { | b. Chemistry |
| | { | c. Geology. |
| | { | d. One branch of experimental physics. |
| | { | e. Telegraphy. |

The class of machinery, or the nature of the engineering work in which the student is examined, will be chosen with reference to the special work in which he has been engaged during his pupilage

This degree will indicate that the student is qualified to practise the profession of an engineer.

The examination for degrees will be conducted by University examiners, and an examiner appointed by the Institute of Civil Engineers

For the degrees in sections A. and B. (agriculture and engineering), the same rates will be charged as for the degrees in science.

C.—*Veterinary Surgery.*

The University of Edinburgh propose to institute a degree in veterinary surgery, open to qualified students of all the veterinary schools in Great Britain who comply with the regulations laid down for such degree

All candidates for examination for such degree must be 21 years of age, and have obtained by examination a veterinary diploma or license from some recognised teaching or licensing body in Great Britain

This diploma or license will be accepted as satisfactory evidence of the candidate's general education, and of his acquaintance with the groundwork of his profession, and will exempt him from the preliminary and the "bachelors" examinations, required in the other sections of the department of applied science.

Candidates will be also required to produce certificates of attendance upon at least three out of the following list of classes in the University of Edinburgh:—

- | | | |
|---|--|---------------------|
| 1. Anatomy. | | 4. Natural history. |
| 2. Institutes of medicine (physiology). | | 5. Botany. |
| 3. Surgery. | | 6. Agriculture. |

Candidates thus qualified will be admitted to examination for the degree of master of veterinary surgery (C.V.M.)

The examinations in all the above subjects, in their applications to veterinary surgery, will be both oral and written, and be held at the close of the winter session. They will be conducted by the University examiners on the respective subjects of examination, assisted by an examiner appointed by the Council of the Veterinary College of Edinburgh, and an examiner appointed by the Royal College of Veterinary Surgeons.

For the degree of veterinary surgery, the fee will be 10 l. 10 s.

Appendix, No. 14.

SYLLABUS of the Course of INSTRUCTION in the SCIENTIFIC DIVISION of the
GRAMMAR SCHOOL, LEEDS.App. No

1. ELEMENTARY COURSE of about one year.

Elementary Principles of two or more
of the following subjects. { Mechanics.
Natural Philosophy.
Chemistry.
Botany.

2. ADVANCED COURSE of one or more years.

A. PURE SCIENCE.

B PROFESSIONAL COURSES, MEDICAL, ENGINEERING, &c.

Science is taught not only as an efficient instrument for mental culture, but attention will, when required, be more confined to particular subjects connected with a profession.

A. PURE SCIENCE { Mechanics.
Natural Philosophy.
Chemistry.
Biology, *i.e.*, Zoology, Botany, &c.

B. PROFESSIONAL COURSES.

1. *Medical* - Chemistry, Chemical Analysis, Botany.
2. *Engineering, &c.* Mechanics and Mechanism, Metallurgy, &c.

PRINCIPAL TEXT BOOKS

Chemistry, Williamson's.
Chemical Analysis, Conington's.
Botany, Oliver's.
——— Henfrey's.

Zoology, Dallas'.
Mechanism, Baker's.
Geology, Page's.
Physics, Gaynot's.

It is desirable that parents should give notice of a wish to enter their sons in the scientific division before the conclusion of the previous half-year

Appendix, No 15

PAPERS handed in by Mr. Roscoe, 18 June 1868

OWENS' COLLEGE, MANCHESTER.

App No. 15

FUND for the Endowment of a PROFESSORSHIP of ENGINEERING and Adjuncts.

At a meeting of engineers, held nearly twelve months ago, it was decided to make efforts to raise a sum of at least 10,000 *l* for the above purpose

The amount already promised is about 8,750 *l*, contributed by the firms and gentlemen whose names will be found annexed to this statement

The contributors were called together a few days ago, and they decided that as the necessity for the establishment of such a professorship in Manchester was urgent, the funds already collected should be at once handed over to the trustees of the College, with a view to their securing the services of a suitable professor, able to commence his course after the Christmas Vacation

The meeting expressed a strong opinion, that if the subject were fairly brought before the engineers of Manchester, and the manufacturing districts, a large amount of support could not fail to be received, and they desire it to be known that the duties of the professor and his assistants would ultimately comprise such a course as the following

The stability of structures, the strength of materials, metals and metallurgy, the principles of the action of machines, prime movers, the principles of hydraulics, the mathematical principles of surveying and levelling, the engineering of earthwork, masonry, carpentry, structures in iron, roads, railways, bridges and viaducts, tunnels, canals, works of drainage and water supply

Evening lectures and classes would be held in addition to the day lectures, so as to make a considerable portion of the instruction accessible to those whose time might be occupied during the day in other ways

It is to be considered that pupils who embrace this opportunity of acquiring the theoretical portion of a "technical education" would also be enabled to avail themselves of any or all of the following courses of study, already provided by the college, under the direction of the respective professors, viz

PROFESSORS.

Languages and literature of Greece and Rome	{ J G Greenwood, B.A., Fellow of University College, London.
English language and literature, and ancient and modern history	{ A.W. Ward, M.A., Fellow of Saint Peter's College, Cambridge
Logic, mental and moral philosophy, and political economy	{ W Stanley Jevons, M.A., Fellow of University College, London.
Mathematics	{ Thomas Barker, M.A., Fellow of Trinity College, Cambridge
Natural Philosophy	{ William Jack, M.A., Fellow of Saint Peter's College, Cambridge.
Jurisprudence	- Richard C. Christie, M.A.
Chemistry	- Henry E. Roscoe, B.A., F.R.S.
Natural history	- Wm C. Williamson, F.R.S.
Oriental languages and literature	- } T. Theodoros.
Modern languages and literature	- }
Drawing (teacher of)	- Mr. Wm. Walker.

These courses of study are followed in whole or in part by 152 day students and 310 evening students, so that engineering students would have the advantage of contact with a large number of others, under proper restraints of discipline. The erection of new and enlarged college buildings is in contemplation; and it is hoped that in them additional facilities for study and training would be afforded to all who might avail themselves of the opportunities of instruction furnished by this college.

SUBSCRIPTIONS TO THIS DATE.

App No. 1

Messrs. Beyer, Peacock & Co.	- £. 3,000	John Ramsbottom, Esq.	- - £. 200
Joseph Whitworth, Esq.	- - 1,000	Messrs. Mather & Platt	- - 200
Charles P. Stewart, Esq.	- - 1,000	John Hawkshaw, Esq.	- - 100
John Robinson, Esq.	- - 1,000	Matthew Curtis, Esq.	- - 100
William Fairbairn, Esq.	- - 500	Henry Wren, Esq.	- - 100
Messrs. Platt Bros., & Co.	- 500	Messrs. John Hetherington & Sons	100
Messrs P. R. Jackson & Co.	- 500	George Peel, Esq.	- - 100
Messrs W. & J. Galloway & Sons	250	John Carlisle, Esq.	- - 100

The names of additional subscribers will be received by Joseph Whitworth, Esq., Chorlton-street, or by the Honorary Secretary, John Robinson, Esq., Atlas Works, and payments may be made to the credit of Joseph Whitworth, Esq., Treasurer of the Owens' College Engineering Professorship Fund, with the Manchester and Liverpool District Bank, King-street, Manchester

Atlas Works, Manchester,
December 1867.

OWENS' COLLEGE EXTENSION.

OWENS' COLLEGE was founded by the munificent bequest of Mr John Owens, merchant, of Manchester, who bequeathed the bulk of his property to trustees, to found "an institution for providing or aiding the means of instructing and improving young persons of the male sex (and being of an age not less than 14 years) in such branches of learning and science as were then and might be thereafter usually taught in the English Universities."

The college was opened on the 12th of March 1851. The number of students in the ordinary day classes in the first session was 62, in the present session it is 110,* and the average number for the last five years has been 115. In 1852-53 evening classes were started, in which instruction is given in almost all the subjects taught in the day classes. The number of evening students has increased from 28 in 1852-53 to 279 in 1866-67,† and the average number for the last five years has been 295. It thus appears that the total number of persons taught in the college has averaged 400 during the last five sessions. The number of day classes held has increased from 15 in 1852 to 32 in the present year, and the number of evening classes from 2 to 25.

From its foundation Owens' College has been affiliated to the University of London. More than 130 of its students have matriculated in the University, and about one-half of these have proceeded to the higher examinations for degrees.

It would probably be found that in no institution of the kind in the kingdom are so many persons under instruction in so confined a space. The class-rooms are too few in number, some of them are unduly crowded, and others are quite unfit for the use to which they are put.

It is, then, not too much to affirm that the utmost measure of success attainable in the present buildings has been reached. The trustees have no power to spend any portion of the original endowment in the purchase of land or the erection of buildings. Unless ampler and more appropriate accommodation is provided for the college, future sessions may witness a decline as steady as its growth has been, for in the early years of such institutions not to go forward is to go back.

The erection of new buildings is not, however, all that is needed to enable Owens' College to fulfil the object of its foundation. The proper function of the college may be defined as being to furnish the highest general education, leading to degrees in arts and science, and the special training required for professional and mercantile life. To accomplish this, a very considerable extension of the scheme of studies pursued is called for. Nor can there be a doubt what the prevailing character of this extension should be. Due provision being made for the pursuit of classics and mathematics, and of the other branches of what may be called the older University studies, it is obvious that the special characteristic of a college for the manufacturing districts should be the study of experimental and applied science.

The college already possesses professorships of Greek and Latin (including the Greek Testament), Hebrew and Arabic, English Language and Literature, French and German, History, Mathematics, Natural Philosophy, Logic, &c., Political Economy, Jurisprudence, Chemistry, and Natural History. To these it is proposed to add.

1. A separate professorship of Latin and Comparative Grammar.
2. At least one professorship of Engineering; and if possible, of Surveying and Architecture.
3. A professorship of applied Geology and Mining.
4. A professorship of Astronomy and Meteorology.

It would be necessary, further, to provide most of these chairs with all the apparatus for complete and successful study; to set aside considerable sums for the extension and regular maintenance of the library, and of the Physical and Natural History Departments; and, above all, to place the Chemical Department in a position of efficiency worthy of the present state of the science, and of its importance in relation to the interests of this district.

App No. 15.

With these additions and extensions, the college would begin to assume the proportions and to possess the substantial advantages of a university for the manufacturing districts. The experience of Glasgow proves that academical institutions may flourish in the heart of a mercantile and manufacturing society; and the munificence with which a subscription for erecting new university buildings has been recently commenced shows not more the liberality of the people of Glasgow than their sense of the benefits which the University has conferred upon their city.

The substance of the above statement was laid before a meeting held in the Town Hall, Manchester, on the 1st February 1867, his Worship the Mayor in the chair; when the following resolutions were passed:

Proposed by the very Rev. the Dean of Manchester, and seconded by Mr. Oliver Heywood,

"That this meeting, having heard with satisfaction the statements of the trustees and professors of Owens' College, as to its constitution, operations, and present success, and the suggestions offered for supplying the requirements of the college, and for rendering it on an extended basis, in effect, the local University of Lancashire and the neighbouring counties, is of opinion that the time has come for the public of the district to unite for the purpose of developing the college on a more comprehensive scale, and in appropriate and convenient buildings."

Proposed by Mr. Thomas Bazley, M.P., seconded by Mr. Thomas Ashton, and supported by Sir Elkannah Armitage, Knt.,

"That the trustees and professors of Owens' College, and the following gentlemen (the list contains the names of 69 gentlemen), with power to add to their number, constitute a Committee for raising a fund which it is desirable should be not less than 100,000 £, or, if possible, 150,000 £, for the purpose of carrying into effect the proposed system of extension."

Proposed by Mr. W. R. Callender, sen., and seconded by Mr. John Platt, M.P.,

"That an Executive Committee be appointed, consisting of the following gentlemen (with power to add to their number) —

Thomas Ashton, Esq., *Chairman.*

Oliver Heywood, Esq., *Treasurer*

Benjamin Armitage, Esq.,

Charles F. Beyer, Esq.,

W. R. Callender, jun., Esq.,

Richard Johnson, Esq.,

John L. Kennedy, Esq.,

Sigismund J. Stern, Esq.,

with Principal Greenwood,

Professor Christie,

Professor Roscoe,

And six trustees of the college

[The following gentlemen were accordingly elected by the trustees out of their body].

Robert D. Darbishire, Esq.,

Murray Gladstone, Esq.,

W. H. Houldsworth, Esq.,

Alfred Neild, Esq.,

John Robinson, Esq.,

John Edward Taylor, Esq.,

and that such committee have power to determine on and carry out measures for raising the required fund, and that they be requested to prepare a scheme of such extent as may be deemed desirable and warranted by the funds subscribed, such scheme to include the recommendation of a site and of plans of buildings, the endowment of professorships, and other means of imparting instruction and encouraging study in the various departments of learning and liberal arts, and of science and its applications. The committee to report from time to time to the subscribers."

The Executive Committee confidently appeal to the public of Manchester and of the manufacturing districts for funds to enable them to purchase a suitable site, and to erect commodious and appropriate buildings, in which the actual work of the college may be more efficiently carried on, and such additions made as have been indicated above.

Thomas Ashton, Chairman of the Executive Committee.

Oliver Heywood, Treasurer.

J. G. Greenwood,

W. H. Houldsworth, } Hon. Secretaries

Owens' College, 1 March 1867.

Appendix, No. 16.

PAPER handed in by Dr. *Stevenson Macadam*, 2 July 1868.

Apj

WATT INSTITUTION, EDINBURGH.

CLASS OF MATHEMATICS.—SYLLABUS FOR 1866-67.

Junior Class.

Arithmetic.—Different Scales of Notation,—Theory and Practice of Vulgar and Decimal Fractions,—Logarithmic Arithmetic,—Square and Cube Roots

Algebra.—Algebraic Notation,—Addition, Subtraction, Multiplication, and Division;—Algebraic Fractions,—Simple Equation with one, two, and three unknown quantities,—Quadratic Equations,—Involution and Evolution,—Ratios and Proportion,—Arithmetical and Geometrical Progression

Geometry and Mensuration of Surfaces, along with the Course on Algebra.

Exercises will be given for solution by the Students on all the divisions of the Course. Text Books—"Pryde's Edition of Gray's Arithmetic," and "Practical Mathematics," by the Scottish School Book Association.

Senior Class.

Revision of the higher parts of the Junior Course Quadratic and Higher Equations, and the application of Algebra to Geometry. Trigonometry and its applications to Surveying, Mensuration of Heights and Distances, and Navigation,—Mensuration of Surfaces and Solids. Geometry. Construction and use of Logarithms, and Logarithmic Arithmetic—Exercises throughout the Course.

ABSTRACT of the TREASURER'S ACCOUNTS of the WATT INSTITUTION and SCHOOL of ARTS, from 31st October 1866 to 31st October 1867.

RECEIPTS	£. s. d.	DISBURSEMENTS	£. s. d.
I. Interest received on Bank Account with British Linen Company - -	8 4 7	I Lecturers' Salaries, etc. -	246 6 3
II Students' Fees - -	194 10 -	II Taxes, Insurance, Fire, Light, etc - - -	38 8 10
III. Annual Subscriptions -	60 11 6	III Attendants' Wages, Expense of Collecting Subscriptions, etc - -	27 13 -
IV. Rents of Property to 15th May 1867 - - -	89 16 -	IV. Printing, Advertising, Books, and Stationery - -	36 9 6
V. Balance, being deficiency on Receipts for year -	42 14 -	V. Miscellaneous Charges -	10 11 8
		VI. Repairs on Buildings, etc.	31 6 10
TOTAL - - - £.	890 16 1	TOTAL - - £	890 16 1

Examined, compared with vouchers, and found correct.

George Crochton.
W. T. McCulloch

Edinburgh, 16 March 1868.

Appendix, No. 17.

App. No. 17.

PAPER handed in by Captain *Donnelly*, 3 July 1868.

THE NATIONAL SCHOOL, MIDDLETON, NEAR MANCHESTER.

Sir,

June 30 1868.

WITH regard to the inspection of the science classes and the examinations of the candidates at the May examinations, I think the present system most excellent, provided due care be taken in the formation of the local committee.

Referring to payments to teachers, I am of opinion that a teacher who conducts a class of a specified minimum number of pupils should be guaranteed a certain sum independent of the result of the examination, and this payment might be made in the form of certificate money, say 20 *l* for the holder of a first-class, and 15 *l* and 10 *l* for the holder of a second and third respectively. In other respects I would leave the payments on results as at present, but teachers who devote themselves entirely to science teaching should have no reduction made on the gross sum due to them as is the present custom on amounts over 60 *l*.

I think until the system is more widely spread and better known and appreciated it would be impolitic to reduce the number or value of the Queen's Prizes.

As teaching, accompanied by experiment or illustrated by examples, is not only more attractive but likely to be much more effective, I would recommend liberal assistance to schools and classes in the purchase of apparatus, maps, diagrams, &c. Scientific instrument dealers should be prevailed upon to modify the present enormous prices in favour of science classes recommended and aided by the Science and Art Department.

I am of opinion that much of the success of the present system depends on the influence of the teacher, but if the present method of granting certificates to any one who gains a first or second-class Queen's Prize be continued we shall have many teachers admitted who are deficient in the very elements of general education, and whose character and attainments will fail to command the respect and confidence of either local committee or pupils. I am further of opinion that candidates for science certificates should either present some evidence of the possession of a good general education or pass a preliminary examination in the following subjects at least, viz, the English language, with the option of a further examination in Latin or a modern language, or elementary mathematics.

Thomas Bazley, Esq., M.P.

I have, &c.,
(signed) *George H. Wheeler.*

Appendix, No. 18.

PAPER handed in by Dr. Frankland, 3 July 1868.

App. No

LIST of STUDENTS working in the CHEMICAL LABORATORY of the ROYAL SCHOOL of MINES, the ROYAL COLLEGE of CHEMISTRY, during the present Summer Session, their Ages and Destinations, as far as could be ascertained.

—	Names of Students	Age	Time of Entrance.	Destination.
London - - -	1. W. G Whiffin - -	17	1 Jan 1867 -	Quinine Manufacturer.
London * - - -	2 Archbald Liversidge	21	1 Oct. 1867 -	Royal Exhibitor (undetermined).
London * - - -	3. Wm. Garrett - -	17	1 Oct. 1867 -	Royal Exhibitor (Engineering)
Birmingham * - -	4 Alex Bickerton - -	25	1 Oct. 1867 -	Royal Exhibitor Science Teacher
London * - - -	5. Wm. Johnson Sollas -	19	1 Jan. 1867 -	Royal Exhibitor (undetermined).
Tunbridge Wells * -	6. R. Aldridge - -	18	1 Oct 1867 -	Scientific Chemistry.
Wareham * - - -	7. W. L Pike - -	20	1 Oct 1867 -	Clay Merchant.
York - - - -	8 F. W Bayley - -	22	1 Oct. 1867 -	Mining Engineer.
Lancashire * - - -	9 R. Kay Shuttleworth	20	1 Oct 1867 -	Mining Engineer.
Edinburgh - - -	10 James E. Stoddart -	17	1 Oct. 1867 -	Manufacturing Chemist.
Greenock - - -	11 J D Scott - -	26	1 Jan 1867 -	Sugar Refiner.
Cornwall * - - -	12 J Clemes - -	19	1 Oct. 1867 -	Mining Engineer.
London - - - -	13 Fr Storks - -	18	1 Oct 1866 -	Analytical Chemist.
Burton-on-Trent -	14. J. Bell - -	19	1 April 1868 -	Brewer
Burton-on-Trent -	15 E L. Baylis - -	22	1 April 1868 -	Brewer
Burton-on-Trent -	16 Adrian Brown - -	16	1 April 1868 -	Undetermined.
London - - - -	17 Matthew Jackson -	18	1 Oct 1867 -	Manufacturing Chemist.
Flint - - - -	18 Sydney K Muspratt	18	1 Oct 1867 -	Manufacturing Chemist.
Bristol * - - -	19. Hy Wm. Ll. Tanner	17	Jan 1868 -	Professional Chemist
London - - - -	20. B. Lyell - -	17	1 April 1868 -	Science.
Burton-on-Trent -	21 C J Goer - -	24	1 April 1868 -	Brewer (at Bass & Cos.)
London - - - -	22 Alf. Netley - -	17	1 April 1868 -	Undetermined.
Plymouth - - -	23. Rt Burnard - -	19	1 Oct 1867 -	Artificial Manure Manu- facturer
London - - - -	24. Ed. Midwinter - -	17	1 Oct 1867 -	Manufacturing Chemist.
London - - - -	25 — Nelson - -	30(?)	19 Feb 1867 -	Gelatine Manufacturer
London - - - -	26 J Wilson Bell - -	15	1 Oct. 1867 -	Artificial Manure Manu- facturer
Burton-on-Trent -	27 Hy Daniel - -	24	1 April 1868 -	Brewer (Salt & Co.)
Maidstone - - -	28 F Fremhn - -	18	1 April 1868 -	Brewer
Dudley - - - -	29 Ed Terry - -	22	1 Oct. 1867 -	Mining Engineer.
Ornel, Oxford - -	30 H S. Stephenson -	23	1 April 1868 -	Church.
Stonehurst College -	31. G E L Shadwell -	25	1 April 1868 -	Law
Glasgow - - - -	32 Rev Mr. Williams -	(?)	1 April -	Church (Cath)
London - - - -	33 — Cochrane - -	20	1 Feb. 1868 -	— (?)
London - - - -	34. — Osborne - -	20	1 April 1868 -	Medicine
London - - - -	35. — Duffield - -	45(?)	1 June 1868 -	— (?)
Burton-on-Trent -	36 Horace Brown - -	20	1 June 1868 -	Brewer.

DESTINATION OF STUDENTS.

Chemical Manufactures	- - - - -	9
Brewing	- - - - -	6
Undetermined	- - - - -	7
Mining	- - - - -	4
Professional Chemistry	- - - - -	3
Engineering	- - - - -	1
Science Teaching	- - - - -	1
Sugar Refining	- - - - -	1
Church	- - - - -	2
Law	- - - - -	1
Medicine	- - - - -	1

Appendix, No. 19.

App. No. 19.

PAPER handed in by Mr. Buckmaster, 3 July 1868.

MEMORIAL.

To the Right Honourable Earl Granville, K.G., the President of the Council on Education, and the Right Honourable W. F. Cowper, M.P., the Vice-President of the Council on Education, the Memorial of Working Men belonging to the Royal Polytechnic, the London Mechanics, and other Institutions in London,

Humbly Showeth,

THAT during the years 1828, 1829, and 1830, 400 mechanics' institutions were established, and since the latter period they have increased to nearly 4,000. The primary object contemplated by these institutions was to secure to the operative classes the means of acquiring a sound and useful education, which should not only remedy in some degree the neglect of early instruction, but also improve their general culture and extend their knowledge in that direction which would make them more skilful and more successful in their industrial occupations.

That for some years these institutions laboured to accomplish the objects for which they were established, but from the want of some systematic starting point and a definite object to attain, they have gradually degenerated into places of mere amusement and recreation, and the lectures are usually of such a general and desultory character that they can scarcely be regarded of any educational value.

Your memorialists do not contemplate any interference with the rational amusements of the people, nor any great change in the general character of existing institutions. There will always be a large class of persons satisfied with the reading of a newspaper, a popular lecture, or a game of chess, and were these not provided by the institutions they would probably be sought for at the public-house.

Your memorialists are of opinion that a large number of young men, apprentices and others, would gladly avail themselves of systematic instruction if it were imparted by competent teachers on terms within their means.

That mechanics' institutions are the best centres for this instruction, regard being had to the industrial wants of the locality in which these classes may be established.

Your memorialists would respectfully suggest that the elements of the natural sciences, political economy, physics, chemistry, and drawing, should be taught, in our elementary schools. From the want of such instruction men fall into serious social errors, and labour, instead of being an enlightened and intelligent application of principles, is but too often a dull round of monotonous drudgery. A closer relationship should be encouraged between the elementary schools and mechanics' institutes, so that the instruction

given at the one should always be regarded as preparatory to that to be continued at the other.

We are of opinion that the industrial progress of the Continent and America must, in a great degree, be attributed to the better education of the artisans of those countries. Without an intelligent appreciation of those laws upon which our industrial prosperity depends, and which we are daily called upon to apply, it is impossible to sustain for any great length of time that supremacy in production which is every day becoming more mental and less physical.

Your memorialists are of opinion that voluntary effort is not sufficient to sustain with efficiency the class instruction of mechanics' institutions, nor can the working classes as a general rule pay fees sufficient to secure the services of competent teachers; and to be dependent on charitable aid for that which ought in some degree to be regarded as our right, is a humiliation to which the industrial classes ought not to be subjected.

Your memorialists therefore pray that the Government Board of Education be invested with power to organise, systematise, and direct, in connection with local authority, those institutions desirous of obtaining assistance.

That in consideration of this power the Board of Education be authorised to assist classes in connection with mechanics' institutes, with grants of books, apparatus, and such pecuniary aid as may be essential to their efficiency and permanency. It is desirable that such aid should not interfere with the free action of the classes beyond what is absolutely necessary to secure the correct expenditure of the public money.

With a view of giving encouragement to class instruction in mechanics' institutions, exhibitions or scholarships should be attached to the Government School of Mines, as a reward to those who had distinguished themselves by examination. Artizans employed on our public works might be selected, other things being equal, from those holding a certificate in some speciality relating to their occupation.

And your memorialists, as in duty bound, will ever pray.

Appendix, No. 20

LETTER handed in by Mr. Powell, M.P.

App. No. 20.

My dear Powell,

Cambridge, 11 July 1868

YOU ask me what this University is doing in the way of promoting scientific education; a great advance has been made in the last few years, but it still falls far short of what I wish, and of what I think ought to be done, the University has strained its resources to supply museums of natural science, chemical laboratories, and so on, and the facilities now given here for the study of natural sciences are at least very tolerable, they may be studied practically as well as theoretically. The appliances for this purpose might be made much more complete if the colleges would aid the University, but at present, as you know, while the colleges have ample means, the University is poor, and there is too much collegiate, too little public, spirit for the colleges to combine for common objects and sacrifice their collegiate interests to those of the University; however, the appliances for learning are a small part of the question, they are useless unless there be good teachers and students willing to learn. The number of students in natural science is gradually increasing, the University recognises such studies as a pathway to a degree or to honours, and the colleges have in several instances held out the offer of rewards in the way of scholarships, and so on, for proficiency in such studies. This is the case at Trinity, St John's, Caius, Peterhouse, Sidney, and Downing, and will probably extend to the others. But after all that may be done in this way, I do not think this alone will meet the real want of the country in respect of scientific education. It will do something in the way of supplying teachers in schools and elsewhere and in diffusing sound scientific principles in place of some of the quackery which is now current, but will be a very long while in reaching the lower stratum of those connected with manufactures. We want a different class of students here besides those who now come, it is not likely, or desirable, that the actual artizan class should assemble here in numbers, but the master manufacturers might well be educated here. At present the traditions and habits of the place are such, that few who are engaged in trade think of sending here those sons whom they intend for like pursuits. I want to see these traditions broken through, and many of that class coming here, and I regret very much that our Senate have rejected the proposal for non-collegiate students, because it might have opened a door for a new class of students. I think also that the University might do something to assist the class I have been writing of, if they would open their examinations in science to students who had resided a less time than is now required for a B.A. degree, so that those who came with a view to a speciality, might obtain what they wanted in the most direct way. I lay stress on some residence here, and study here, because I do not think that anywhere else science is so philosophically treated. I should be the last to say that philosophy without practice was the needful thing, but neither is practice without principles, indeed I believe that the need now felt is for instruction in the principles of science. Practice is learnt empirically, but the principles, the laws of nature and their relations to each other, are not taught in the workshop or laboratory, and are not understood. This need is disguised when people talk of "technical education": it is not education in *technicalities* which is wanted, this is learnt during apprenticeship, but education in the principles which are practically applied, but not understood, and, therefore, not made the most of.

The question of expense in relation to education here is only a bugbear, it depends entirely on the student himself. Any one who likes to attend my lectures on chemistry can do so on payment of a small fee, without being a member of the University at all. I usually have some such students, and the laboratory is open to them as well as lectures, so that they can learn practical as well as theoretic chemistry, at, I believe, a less expense than anywhere else. The most promising students, those who may with advantage make study and the advancement of science the business of their lives, are sufficiently provided for by the college endowments; others must treat scientific education as they do other parts of education—be willing to pay a little for it for the sake of future advantage to be gained from it.

There is one great advantage to be met with here, and that is that different branches of science are taught side by side; their bearings one on another can, therefore, be more easily apprehended; and the prevalence of mathematical study has no inconsiderable influence in promoting exactness and logical consistency in the treatment of scientific questions.

As to bringing here the class of students that I wish to see here, I do not know what more can well be done than to open the door as wide as possible; if this cannot be done from within, you may help us to do it from without.

I am, &c.
(signed) G. D. Living.

Appendix, No. 21.

App. No. 21.

LETTER from Dr. Barry to the Chairman of the Committee.

Sir,

Cheltenham College,
14 July 1868.

I GREATLY regret that unexpected circumstances, increasing the usual occupations of this period of our school year, have hitherto prevented me from furnishing that statement which you did me the honour to request.

You are doubtless aware that Cheltenham College has attempted (to an extent hitherto unknown in our "Public Schools") a scheme of instruction in which the teaching of languages, though not neglected, holds a secondary place, and mathematics and experimental science assume the leading positions; the former determining a boy's place in the school, and the latter forming a regular system of instruction for the first eight or ten classes, including about 120 boys.

I beg to subjoin a table, containing a list of the upper classes of this department, with (1) the average ages, and the highest and lowest ages of the boys in each class during the last half year, (2) the subjects in experimental and physical science studied in each; and (3) the mathematical subjects for each class presented for examination in June last. I also beg to send herewith a school list, which may possibly supply some information, which I have accidentally omitted. All these mathematical subjects, I should remark, are studied on what I may call the "Woolwich" as distinguished from the "Cambridge" system, *i. e.* with constant reference to practice, and with great care to promote practical accuracy and facility.

Throughout the whole of this department geometrical and free-hand drawing form a regular part of the work, and in the highest classes plain drawing is brought to a considerable degree of excellence.

It will, therefore, not surprise the Committee, when I add that, except for the actual manual training required, we do not purpose, in our competition for the Whitworth scholarships, to depart in any important point from the regular course of our instruction for the candidates whom the College will send in*.

The boys of the first (or highest) class usually leave at the age of 18, but I have subjoined the average of age (somewhat roughly, but I think accurately estimated) of the various classes, in order that the Committee may judge of the degree of knowledge which a boy should carry with him, if he leaves at an earlier age. Those who do so leave, are usually boys intended for commercial life, whose parents care little for the scientific training, or boys who are exceptionally backward, and who, if intended for scientific professions, require to be brought on by some special and individual tuition.

In this part of our school, modern languages (French and German) are studied throughout; English has always been "classically" studied in the highest classes, and we have just introduced a

regular system of such study through the school; and the rudiments of Latin are taught in the lower classes, and (exceptionally) to certain boys in the higher (generally in lieu of German) who show special aptitude for it, or have special need of it. Our experience here is, that as a rule the success attained in these linguistic studies is considerably less than that which is reached on the classical side of the school, although in the latter the boys devote far less time to the systematic study, either of English or of modern languages. But, if we can only get teachers of French and German, who are competent to teach them, as Latin and Greek are taught by our classical masters, I am sure that we may obtain far greater linguistic results than have been obtained hitherto in our Military and Civil Department. I may remark that, in order to do this, I think we must endeavour to have both Englishmen and foreigners in our modern language staff; the former, if well versed in the language they teach, have incomparable advantage in the systematic and grammatical training, while we look to the latter for skill and vigour in composition, and extensive acquaintance with foreign literature.

It is (I conceive) no part of my duty to institute a comparison between the results of the classical and the "modern" teaching, although the fact, that our two departments are co-ordinate in numbers (about 300 in each) and in age, gives the opportunity of some very interesting comparisons and contrasts.

But it may be to the purpose to remark, that there is no difference whatever in the classes from which the boys of our two divisions are drawn, and that, except in friendly rivalry, there is no division whatever between them.

The Committee may be aware that in Cheltenham College, there is a power vested in the council to accept or refuse any boy nominated, of the working of this rule I have had (for the last six years) little or no experience, but the practical effect has been to exclude the sons of retail tradesmen from the school and to confine it chiefly to the sons of professional men, or those of independent fortune. This rule (of which, personally, I entirely disapprove) may possibly affect the result above noted, but I am inclined to think that it does not affect it materially, for the range of boys, as to class, is still sufficiently extensive to give scope for any variation in respect of class between the two systems, if any variation existed.

The college is also expressly a Church school; *i. e.*, its boys are instructed in the doctrines of the Church of England, and, if boarders, regularly attend its services on Sundays. But we have a considerable number of Dissenters in the school, and also of members of the Church of Scotland; in fact, I believe, of all denominations except Roman Catholics; we ask no questions upon the subject, and I should not now refuse any "conscience clause," if it were asked for by any parent.

* It is my intention to recommend to the Council the establishment of a "Workshop," where boys might be taught the use of carpenters' tools, lathes, and easy iron work. I have long wished for such a shop for its educational influence on the mind, and should like to make all young boys enter it; but the Whitworth competition will naturally give it a more visible and immediate value.

parent. But, again, I do not find that any variation in religious matters affects the destination of a boy to one or other of the departments. I infer that, if all restrictions were removed, the result on this subject would remain unchanged.

I may also add that I find no material difficulty in working the two departments (the classical and military and civil departments) together, on the contrary, I think that their co-existence is most useful. Not only does it enable us to divide boys, after they emerge from the lower or junior school according as their minds or their destinations demand a culture, predominantly "literary" or "scientific"; but the effect is (I think) that the studies of the two departments interpenetrate each other. There is certainly more time given to mathematics and modern languages by the boys of the classical department than in almost any other public school; and the boys of the military and civil department have greater value for and progress in literary culture than would be the case if their connexion with the other part of the school were severed.

I come, therefore, to the conclusion, that there should be no difficulty (although the Public School Commissioners appear to hold the contrary opinion) in affiliating to our ordinary public schools a scientific department, in order to prepare for the schools of technical education, which are the main subjects of the Committee's investigation.

I prefer to look at the question with a view to a liberal education, as such, rather than a technical one, considering (that is) the development of the mind rather than the training for any special profession; and, as it appears that no man is thoroughly educated who has not studied language, mathematical reasoning, inductive science, and some form of (fine) art, as it is clear that these great subjects cannot be all studied to exactly the same extent, without an inevitable danger of smat-

tering and superficiality, as it is equally clear that for different minds different subjects must predominate, especially if the consideration of ultimate destination in life here comes in; I think that, even in the interests of a liberal education, such "bifurcations" are valuable, and I prefer them on the whole to the separate establishment of purely classical and purely scientific schools.

Our own military department, contains about 300 boys, each paying for tuition about 20 £. or 25 £. per year. The salaries of masters (one class master to about 30 boys, besides the superintending masters, and the masters in special subjects) amount to about 4,500 £. per year. Our whole staff numbers 18, and the salaries are not higher than they should be, in fact some are lower than I could desire, for a school of this class. It would be easy to reduce the scale of expense, either by lowering the class of master, or by decreasing their number in comparison with the number of boys, but either of these plans would impair efficiency, and I do not see any other which could greatly diminish cost.

I do not know whether I need trouble the Committee with any further remarks, I have thought it right to confine myself to that aspect of the subject which regards liberal education, and especially the class of boys who go to our "Public Schools," because on this aspect alone have I any knowledge which gives me a claim to speak.

But I beg to add that I shall be most glad to answer any definite questions, or to supply any other information, which may be useful to the Committee in their important investigation.

I have, &c
(signed) *Alfred Barry, D.D.*,
Principal of Cheltenham College,
late Fellow of Trinity College, Cambridge.

B. Samuelson, Esq., M.P.

TABLE referred to on preceding page.

	Age of Boys.	Experimental Science Subjects.	Mathematical Subjects.
CLASS I. - - - - (About 16 boys.)	Average, 17. Highest, 18. Lowest, 16.	Geology. Chemistry. Heat. Magnetism. Galvanism. Electricity.	Euclid Arithmetic. Algebra Trigonometry. Elementary Statistics Dynamics. Differential and Integral Calculus
CLASS II. - - - - (About 21 boys.)	Average, 16½. Highest, 19. Lowest, 14.	Electricity. Heat.	Euclid. Arithmetic. Algebra. Trigonometry. Mensuration. Theory of Equations.
CLASS III. (A. & B.) - - (About 30 boys.)	Average, 16. Highest, 18. Lowest, 14.	Voltic Electricity. Geology. Technology.	Euclid. Arithmetic. Algebra. Plain Trigonometry. Mensuration
CLASS III. (C. & D) - - (About 30 boys.)	Average, 16. Highest, 18. Lowest, 13½.	Electricity. Pneumatics.	Euclid, I IV. VI. Arithmetic. Algebra.
Sandhuist and "Direct" Classes* (About 26 boys.)	Average, 17. Highest, 19. Lowest, 14.	Electricity.	Various, according to the necessities of the case.

* These classes are not included in the regular graduation of school-work, but contain boys who need special tuition, and who work more individually than in other classes.

Note.—It will be observed that subjects are often repeated in various classes, from the necessity of revision.

App. No. 21-

LETTER from Mr. *Thomas Bloxam*, Science Master of Cheltenham College, to Dr. *Barry*.

Dear Dr. Barry,

THE following is a brief outline of the method of study which I have found, from now some seven years' experience, to succeed the best in the Science Department of Cheltenham College

We commence in the lowest division, 3 D, with the introductory matter of science, such as the general properties of matter, the difference between studying a body chemically and physically. Then we proceed to elementary pneumatics, which includes a chemical consideration of the air.

We next pass in 3 C division to an elementary consideration of statical electricity; in 3 B, the subject of geology, and its bearings upon other branches of knowledge is considered. In 3 A division, voltaic electricity forms the subject.

We now pass to 2 B, in which the subject of heat is minutely treated, and in 2 A, frictional and voltaic electricity similarly considered.

In 1 B, our attention is devoted to the study of the non-metallic elements and their chief compounds. 1 A, practical chemistry, where each pupil is taught to detect the more common metals and acids, working for himself at 1st practical table, a written paper (of two hours) upon various parts of chemistry, chemical physics, has to be answered by each pupil of this division every

week; these answers are corrected in red ink, and the whole made matter of discussion once in each week, when the papers are returned, so that every pupil has his errors pointed out to him.

From the above sketch it will be seen that our aim is to impart the elementary consideration of the various branches of science from div. 3 C to 3 A; in 2 A and B, to give the advanced work of chemical physics, and in 1 A and B, to complete the course of study in chemistry.

A pupil having passed through these various divisions will be in a fit state to go up to the several competitive examinations.

We have found a short course of elementary technology of great use; such as manufacture of paper, iron, &c., illustrated by specimens and experiments, where possible. In conclusion, all lectures are experimental; *visa voce* examinations are held upon the subject of the previous lecture always; notes carefully taken, and all pupils invited to attend after hours, should they wish any special explanation.

I shall be happy to furnish any information not contained in the above.

I am, &c.
(signed) *Thomas Bloxam.*

Appendix, No. 22.

PAPER handed in by Mr. Field.

LIST of some ARTICLES made in¹ Birmingham and the Hardware District which are largely Replaced in Common Markets of the World by the Productions of other Countries.

App N:

This List might be immensely extended by further investigation, which the shortness of time has not permitted

Articles, or Class of Articles.	Country whose Products are believed to have Replaced those of this District, in whole or in part.
Carpenters' Tools :	
As Hammers - - - - - Pliers - - - - - Files - - - - - Compasses - - - - - Hand and bench vices - - - - -	} Germany chiefly.
Chains :	
Of light description, where the cost is more in labour than in material - - - - - As halter chains and bow ties, and such like - - - - -	} Germany.
Frying-pans, of fine finish. + + + -	} France.
Wood-handled spades and shovels, an article of very large consumption - - - - -	} United States export them to all our colonies.
Hoes :	
For cotton and other purposes, an article of large consumption - - - - -	} United States compete with us for their own use, and to some extent for export.
Axes :	
For felling trees, &c., an article of large consumption - - - - - Carpenters' broad axes - - - - - Carpenters' and coopers' adzes - - - - - Coopers' tools, various sorts - - - - - Shoemakers' hammers and tools - - - - -	} United States supply our colonies and the world with the best articles } Germany and the United States.
Matchets .	
For cutting sugar canes, an important article - - - - -	} Believed to be now Germany.
Nails :	
Cut - - - - - Wrought - - - - - Point de Paris (wire nails) - - - - - Horse nails - - - - -	} United States export to South America and our colonies. } Belgium } French and Belgian largely supersede English } Beautifully made by machinery in the United } States.
Pumps.	
Of various sorts - - - - -	} Largely exported by United States. } [Note.—An American pump, finding water } for the Abyssinian expedition.]
Agricultural Implements :	
Ploughs, cotton gins, cultivators, kibbling machines, corn crushers, churns, rice hullers, mowing-machines, hay rakes - - - - -	} Many articles similar to these are exported by } United States to common markets.

App. No 22.

Articles, or Class of Articles.	Country whose Products are believed to have Replaced those of this District, in whole or in part.
Sewing machines - - - - -	United States.
Lamps:	
For use with petroleum, now an article of very large consumption - - - -	The United States Petroleum lamps supplant the English in India and China.
Lamps for the table - - - - -	French even imported to England.
Tin Ware.	
Tin'd spoons, cooks' ladles, and various culinary articles, of fine manufacture and finish - - - - -	France.
Locks:	
Door locks, chest locks - - - - -	United States, France, and Germany.
Draw locks, cupboard locks - - - - in great variety.	
Door latches, in great variety - - - -	United States export to Canada.
Curry combs - - - - -	United States and France.
Traps:	
Rat, beaver, and fox - - - - -	United States export to Canada.
Gimlets and augurs (twisted). - - - -	United States export to Canada, and probably elsewhere.
Brassfoundry (cast):	
As hinges, brass hooks, and castors (in great variety) - - - - -	These articles, in great variety, are now extensively exported from France and Germany.
Door buttons - - - - -	
Sash fasteners, and a great variety of other articles - - - - -	
Brassfoundry (stamped)	
As curtain pins, and bands, cornices, gilt heading, and a great variety of other brassfoundry - - - - -	These articles, in great variety, are now extensively exported from Germany and France.
Needles:	
An article of large consumption - - - -	Mostly Germany (Rhenish Prussia), even imported to England.
Fish hooks - - - - -	Believed Germany.
Guns.	
A great variety of sporting guns, articles of large consumption, formerly entirely from Birmingham. - - - - -	Now exported largely from Liege, Belgium, and Etienne, France.
Breechloading muskets and revolver pistols	United States.
Watches and clocks - - - - -	Switzerland and France import into England, United States, and France.
	Note.—Watches made in United States unchangeable, by machinery.
Iron - - - - -	Belgium.
Glass:	
For windows, an article of large consumption, spectacles and all other glass - -	Belgium supplants ours in our own colonies.
Table glass - - - - -	Believed to be Belgium and France.
Swords - - - - -	Prussia and Belgium.
Jewellery:	
Gold, gilt, and fancy steel, in very great variety - - - - -	France and Germany. These articles are even imported into England.
Small Steel Trinkets:	
As bag and purse clasps - - - - -	
Steel buttons, chains, key rings, and other fastenings, and many others in great variety - - - - -	France and Germany. Many of these even imported into England.

Articles, or Class of Articles.	Country whose Products are believed to have Replaced those of this District, in whole or in part.
Leather bags, with clasps, purses, and courier bags, &c	Austria, France, and Russia We believe about all these articles sold in England are imported.
Buttons .	
Mother o' Pearl	Vienna, imported to England
Horn	France
Porcelain (formerly Minton's, of Stoke)	France entirely superseded " " English, and imported to England largely.
Steel buttons (formerly Bolton & Watts)	France.
Florentine or lasting boat buttons	Germany.
Steel pens	
Penholders	} France.
Brass scales and weights	
Cutlery	
In great variety; scissors, light edge tools, such as chisels, &c	} Germany.
Pins for piano strings and other small fittings for pianos	
Silver wire for binding the bars, strings of pianos, &c.	} France.
Iron gas tubing	Germany.
Elastic belts, with metal fastenings	Germany
Brass chandeliers and gas fittings	
Harness buckles, and furniture	} France and Prussia.
German silver spoons, forks, &c	France, Austria, and Prussia.
Locks; best trunk, door, and cabinet locks	Prussia and France.
Umbrella furniture	France and Prussia.
Horn combs	Prussia.
Pearl and tortoiseshell articles	France and Austria.
Iron wire	Prussia and Belgium.
Iron and brass hooks and eyes	Prussia and France.
Bronzed articles	Prussia and France.
Hollowares, enamelled	France and Prussia.
Optical instruments	
Mathematical instruments	} France, Austria, and Bavaria.
Japanned wares	Germany and France.
Bits and stirrups	Belgium and France.
Coach springs and axletrees	France.
Electro-plated wares (customers preferring French goods)	} France.
Gas fittings	United States.
Weighing machines	" "
Plumbers' brass foundry	" "
Table glass ware	" "
Door locks	" "
Machines for domestic purposes, as sausage machines, coffee mills, and washing machines	} " "
Nuts and bolts	" "
Penknives and scissors	" "
Stamped brass ware (certain kinds)	" "
American "Notions," as buckets, clothes pegs, washing, and agricultural machines	} " "

I N D E X

TO THE

R E P O R T

FROM THE

SELECT COMMITTEE.

ON

SCIENTIFIC INSTRUCTION.

Ordered, by The House of Commons, to be Printed,
15 July 1868.

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1. *Limited Operation of the School of Mines: Suggestions for its Extension and Improvement.*
2. *Administration. Amendment suggested*
3. *Particulars in connection with the Students, and the System of Instruction*
4. *Evening Lectures to Working Men*
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KING'S COLLEGE:

1. *As to the Establishment and Support of the College.*
2. *Management.*
3. *Number of Students in the College and School, and Practice as to Admission.*
4. *Applied Science Department.*
5. *Chemical Department.*
6. *Workshop.*
7. *Generally as to the System of Instruction*

1 *As to the Establishment and Support of the College*

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3 *Number of Students in the College and School, and Practice as to Admission:*

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Statement of Parliamentary votes for science for the middle and upper classes in 1867-68, exclusive of the cost of the Queen's Colleges, Ireland, *App.* 462.

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Middlesborough Chamber of Commerce Witness submits a memorandum received from the Middlesborough Chamber of Commerce as to the importance of Government aid in the formation of a school of science in the Cleveland iron district, *Sir C. Lanyon* 6936, 6937.

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MINING SCHOOLS AND COLLEGES.

1. *State of Education of Working Miners; Suggestions on the Subject.*
2. *Suggestions relative to the Scientific Education of Foremen and Managers.*
3. *Question of Establishing Local Mining Colleges*
4. *Question of Local Mining Schools like the School in Cornwall.*

1. *State of Education of Working Miners, Suggestion on the Subject.*

Increasing desire amongst working miners for scientific instruction, owners, and managers, however, not generally attaching advantage to such instruction in the men, and being frequently prejudiced against it, *Hunt* 1818, 1826 1867, 1882, 1883 1892. 1922. 1925 — Diminished number of colliery accidents if the men were better educated, *ib.* 1873 — Difficulty of any scientific instruction of miners through the want of primary education, advantage on this score of applying the half-time system to mines, *ib.* 1878-1881. 1907. 1909, 1910. 1937-1994 1995-2000 — Want of facilities for the circulation and interchange of information amongst miners in different districts, *ib.* 1927-1932 — Circulation and receipt of mining statistics through means of witness's office, *ib.* 1933-1936.

Suggestions for improving primary education in the mining districts, and for combining with it some elementary knowledge of science, as preparatory to increased scientific instruction after the age of fourteen, *Hunt* 1937-1949 — Proposed attendance at evening classes in science in the case of boys at work in the mines after the age of fourteen; course of instruction suggested, *ib.* 1946-1951.

Steps taken for the promotion of primary education in the colliery districts in Staffordshire and the North of England, so that the children of those engaged in mines are generally sufficiently advanced for receiving scientific instruction, *Cochrane* 7135-7153 — Necessity of science classes in the colliery districts around Newcastle being held in the evening; the same teachers could have day classes in the towns for the iron works *ib.* 7176-7179.

Establishment of several colliery schools by Earl Vane, fees being required from the children attending, and the average attendance being very good, *Daglish* 7302-7312. 7373-7378 — Necessity of itinerant teaching, in order to reach the mining population, *ib.* 7339. 7400 — Considerable difficulty in carrying out evening classes in connection with the day schools at Earl Vane's collieries, *ib.* 7391-7400

2. *Suggestions relative to the Scientific Education of Foremen and Managers :*

Approval of a certain amount of scientific knowledge being insisted upon in the case of those in charge of mining operations, *Roscoe* 5715-5719 — Want of facilities for a scientific education of foremen, managers, &c. of collieries, it being necessary to bring such education home to the collieries by means of travelling teachers, *Cochrane* 7132-7134 7153-7160.

Tendency to increased safety in the working of mines, if the foremen had scientific training, *Daglish* 7325. 7389, 7390 — Sufficiency of the primary education of those selected for foremen as a basis of scientific instruction, *ib.* 7326-7335. 7369-7371. 7379-7385 — Advantage of the managers of mines being educated in collegiate schools of science, *ib.* 7371, 7372 — Doubt as to the expediency of making it compulsory for overmen or foremen of mines to pass an examination, *ib.* 7403, 7404.

3. *Question of Establishing Local Mining Colleges :*

Opinion as to the sufficiency of one mining college in London, with several secondary mining schools in the provinces, *Cole* 894-896. 941, 942. 908-923. 992 — Conclusion as to the working of the Jermyn-street School of Mines being no encouragement to Government to found local mining colleges, *ib.* 908-923 — Opinion that there is not sufficient demand for another college or school of mines in the provinces, *Reeks* 1298-1300. 1308-1310.

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3. Question of Establishing Local Mining Colleges—continued.

Explanation of witness's views as to the scientific studies desirable in reference to mining in the case of young men attending the Jermyn-street Institution, or local schools or colleges of a similar kind, *Hunt* 1952 *et seq*—Difficulty as to local mining students attending the Jermyn-street course, convenience and increased attendance if there were colleges in Newcastle and other mining centres, *ib.* 1977-1981 1986-1991.

Representation as to the want of institutions similar to the Jermyn-street School of Mines in the chief mining districts, *Cochrane* 7197-7203. 7276-7293—Expectation that large fees would readily be paid by students at colleges established by Government in mining centres, *ib.* 7277-7286

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Importance of mining schools similar to that in Cornwall were established in the several colliery districts, benefit thereby to employers as well as employed, *Hunt* 1846-1873—Expediency of Government aiding the localities in establishing and maintaining mining schools, *ib.* 1863-1867. 1886-1888. 1894-1903

With regards to the organisation in Cornwall for the instruction of the miners in science, witness was not aware of it till recently, and considers that some similar plan might be adopted in the North of England; difficulty as to the colliery owners subscribing, except in providing the accommodation required, *Cochrane*, 7174, 7175.

Expediency of the mining districts in the north being better informed as to the aid receivable through the Science and Art Department, it being important that the department should organise local science schools, and should maintain inspection over them, *Daglish* 7336-7351 7401, 7402.

Importance attached by the Committee to the operation of schools similar to the mining school of Cornwall, *Rep.* iv, v

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Montagu, The Right Hon Lord Robert (Member of the Committee) (Analysis of his Evidence.)—Explains the views of the Education Department upon the subject of a central university and local colleges of science, 7918 *et seq*—The amount of Government aid towards each local college was to be a matter of negotiation with the locality, the estimated cost to the State being 25,000 *l* a year for ten years, including the central and local institutions, 7924-7931.

Moseley, The Rev. Canon (Analysis of his Evidence)—Is a member of the Council of Military Education, and was formerly one of the inspectors of schools, 3711, 3712—Was one of the founders of the applied science department at King's College, and was the originator of the Bristol Trade School, 3713, 3714—Explains the circumstances under which a former national school at Bristol was converted into the present trade school, 3715—Supplies particulars as to the constitution, management, and operation of the school, the number and class of pupils, the system of scientific instruction, and its excellent results, 3715-3735. 3757-3759 3782, 3783

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Value attached to a system of provincial scientific lectures, 3774-3777—Indirect educational aid received by the upper classes from the State, through existing endowments under its control, 3789, 3792, 3793—Opinion favourable to some instruction in practical geometry before the use of Euclid, 3794, 3795—Contemplated employment in trade schools and private science schools of the proposed class of trained teachers, 3796.

Mundella, Anthony John (Analysis of his Evidence.)—Is chairman of the Nottingham Chamber of Commerce, was one of the jurors at the Paris Exhibition of 1867, and has had considerable experience of manufactures in the midland counties and on the continent, 4561-4567—Immense progress made of late years by foreign manufacturers, though, as regards the hosiery trade, they are still behind British manufacturers, 4568-4574, 4678-4690, 4787-4790—Grounds for the conclusion that an injurious foreign competition has already arisen, and will still further increase, as regards the hosiery, silk, and other trades of this country, through the great attention paid on the continent to scientific acquirements in foremen and managers, whilst England is dormant in the matter, 4571 *et seq.* 4787-4793.

Decided superiority of English over foreign artisans, save as regards education, 4571, 4581, 4634, 4682, 4792—Statement as to the very uneducated character of the artisan classes and of foremen at Nottingham and in the midland counties generally, 4577-4579, 4601-4603, 4691-4693, 4717, 4718, 4762-4764—Great want of scientific knowledge in manufacturers as well as in their foremen, 4588-4590, 4747, 4748—Superior dyeing process on the continent, owing to better chemical knowledge, 4589-4593, 4674-4677, 4694-4696

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Natural Philosophy. The instruction given by witness in natural philosophy at Jermyn-street is conveyed entirely by lectures, *Tyndall* 2206, 2207—Explanation of the subjects dealt with by witness showing their reference to technical teaching, *ib.* 2208, 2209—Very good examination papers sent in by many of the students though destitute of mathematical knowledge, *ib.* 2210-2215—Very useful information conveyed by witness's lectures, though there is only a single course of from thirty to forty lectures, *ib.* 2216-2218—Statement in explanation, and strong approval of the examination in natural philosophy under the Science and Art Department, *ib.* 2238-2242, 2250.

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Naval Architecture Statement as to naval architecture being the only science directly taught at South Kensington, half the students being sent by the Admiralty, *Cole* 874-879—Belief as to the beneficial operation of the naval school at South Kensington, *ib* 952, 953

Witness was principal of the school of naval construction at Portsmouth, during its existence from 1848 to 1853, *Woolley* 3001, 3002—Sundry particulars relative to the course of instruction in the school and its great usefulness as regards the students who passed through it; want of proper official encouragement of the school which led to its abandonment, *ib* 3003-3017. 3027-3045

Establishment of the present school of naval architecture at South Kensington in 1864, great want previously felt for a supply of scientifically trained men in the dock-yards, *Woolley* 3018-3020—Attendance of eighteen private pupils at the South Kensington School in 1867, of whom six were foreigners, *ib*. 3021-3023—Evidence explanatory of the various branches of scientific instruction at the school, respects in which some improvement is desirable, *ib* 3055-3091—Better prepared state of the Admiralty pupils than of the private pupils who came to the South Kensington School *ib* 3092-3096—Great increase of both Admiralty and private pupils since the school was established, *ib* 3097-3099

Majority of the private pupils who leave the South Kensington School after one or two of the courses, *Woolley* 3100—System of granting diplomas, *ib* 3101—Explanation as to the total expense of the school, and the payment of fees by the pupil, *ib* 3102, 3103 3106-3108—Facility given to the private pupils to visit the dockyards, *ib*. 3104, 3105—Hours of study of the pupils at the school, *ib*. 3114—Badly prepared state of the foreign pupils, *ib*. 3115-3117.

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Impetus to be given to the formation of a school of mines in the Newcastle district by means of visits and explanations by the organising masters of the Science and Art Department, facilities offered by the Department in this respect, *Donnelly* 8180, 8181

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Nottingham. Evidence relative to the want of educational facilities at Nottingham, and more especially of instruction in science, it being highly expedient that Government should give increased aid towards science schools, *Mundella* 4568 *et seq*—Difficulty experienced in obtaining good science teachers, *ib*. 4635-4647. 4784 4785—Large cost of the School of Art to the locality, as regards its erection, *Mundella* 4652. 4653. 4749—Beneficial effect of the instruction of artisans in the School of Arts, *ib*. 4740-4746—Small annual subscriptions to the Art School, *ib* 4743-4745.

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Oldham. Particulars relative to the object and operation of a science and art school established by witness at Oldham; very beneficial results produced, *Platt* 5789-5790. 5810-5815 5834-5843.

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OWENS' COLLEGE (MANCHESTER):

1. *As to the Foundation of the College, and the Income from Endowment and from Fees*
2. *Scholarships and Exhibitions*
3. *Funds required for an Extension of the College, local action in the matter*
4. *Character and Remuneration of the Professors.*
5. *Successful operation of the College*
6. *Connection of the College with London University.*
7. *Other Details generally*

1 *As to the Foundation of the College, and the Income from Endowment and from Fees.*

Foundation of Owens' College by bequest of Mr John Owens, who died in 1846, and left about 100,000*l.* for the purpose, *Roscoe* 5463. 5507—Total income of about 8,000*l.* a year, including about 2,000*l.* from fees, *ib.* 5507—The endowment is about 3,000*l.* a year, *ib.* 5507. 5550.

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Particulars in connection with several scholarships in Owens' College for chemistry, &c., founded by private subscriptions, *Roscoe* 5529-5540—Explanation of the mode in which it is proposed to deal with the seven exhibitions of 25*l.* each, placed at the disposal of the college by Mr Whitworth, *ib.* 5576-5580—Importance of the Whitworth and other scholarships attached to Owens' College, *Rumney* 6032 6039.

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4. *Character and Remuneration of the Professors.*

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6. *Connection of the College with London University* :

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7. *Other Details generally* .

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P

PAYMENT ON RESULTS.

1. *Origin and Operation of the System of Payment of Teachers according to the Results produced.*
2. *Suggestions for a Modification and Extension of the System*

1. *Origin and Operation of the System of Payment of Teachers according to the Results produced*

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2 *Suggestions for a Modification and Extension of the System:*

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