LEABHARLANN CHOLÁISTE NA TRÍONÓIDE, BAILE ÁTHA CLIATH | TRINITY COLLEGE LIBRARY DUBLIN
Ollscoil Átha Cliath | The University of Dublin

Terms and Conditions of Use of Digitised Theses from Trinity College Library Dublin

Copyright statement

All material supplied by Trinity College Library is protected by copyright (under the Copyright and Related Rights Act, 2000 as amended) and other relevant Intellectual Property Rights. By accessing and using a Digitised Thesis from Trinity College Library you acknowledge that all Intellectual Property Rights in any Works supplied are the sole and exclusive property of the copyright and/or other IPR holder. Specific copyright holders may not be explicitly identified. Use of materials from other sources within a thesis should not be construed as a claim over them.

A non-exclusive, non-transferable licence is hereby granted to those using or reproducing, in whole or in part, the material for valid purposes, providing the copyright owners are acknowledged using the normal conventions. Where specific permission to use material is required, this is identified and such permission must be sought from the copyright holder or agency cited.

Liability statement

By using a Digitised Thesis, I accept that Trinity College Dublin bears no legal responsibility for the accuracy, legality or comprehensiveness of materials contained within the thesis, and that Trinity College Dublin accepts no liability for indirect, consequential, or incidental, damages or losses arising from use of the thesis for whatever reason. Information located in a thesis may be subject to specific use constraints, details of which may not be explicitly described. It is the responsibility of potential and actual users to be aware of such constraints and to abide by them. By making use of material from a digitised thesis, you accept these copyright and disclaimer provisions. Where it is brought to the attention of Trinity College Library that there may be a breach of copyright or other restraint, it is the policy to withdraw or take down access to a thesis while the issue is being resolved.

Access Agreement

By using a Digitised Thesis from Trinity College Library you are bound by the following Terms & Conditions. Please read them carefully.

I have read and I understand the following statement: All material supplied via a Digitised Thesis from Trinity College Library is protected by copyright and other intellectual property rights, and duplication or sale of all or part of any of a thesis is not permitted, except that material may be duplicated by you for your research use or for educational purposes in electronic or print form providing the copyright owners are acknowledged using the normal conventions. You must obtain permission for any other use. Electronic or print copies may not be offered, whether for sale or otherwise to anyone. This copy has been supplied on the understanding that it is copyright material and that no quotation from the thesis may be published without proper acknowledgement.

University of Dublin
Trinity College

Heurism in Science Teaching in Irish Schools

1878 – 1924

Michael R. Quane

LIBRARY DUBLIN

A dissertation submitted to the School of Education for the award of the degree of Doctor of Philosophy.

June 2003

TRINITY COLLEGE
13 OCT 2003
LIBRARY DUBLIN
THESIS
7487
7364

I hereby declare that this dissertation is entirely my own work and that it has not been submitted as an exercise for a degree at this or any other university.

I confirm that the University Library may lend or copy this thesis upon request.

Signed: Michael K. Quane.

Date: 9th July 2003

Table of Contents

Acknowledgements (i)

Preface (ii)

Introduction (iv)

Chapter 1 Heurism and Henry Edward Armstrong 1

1.1 Introduction 1
1.2 H.E. Armstrong and the genesis of the heuristic method..... 3
1.3 Armstrong's role model – Edward Frankland..... 5
1.4 Further analysis of the heuristic methodology that Armstrong professed 6
1.5 How Armstrong carried forward his crusade for Heurism..... 10
1.6 What would a 'heuristic classroom' have looked like during this period?..... 15
1.7 Armstrong and the British Association..... 23
1.8 Inherent weaknesses in Armstrong's heurism as applied to the classroom..... 28
1.9 Armstrong's connection with education in Ireland..... 31

Chapter 2 Science Teaching in Irish Education 1878 – 1900..... 34

2.1 Introduction..... 34
2.2 St. Kieran's College and the South Kensington Examinations..... 36
2.3 The organisation of the Intermediate system with respect to Science..... 38
2.4 The progress of science under the system from 1879 – 1900..... 40
2.5 Science as a subject and the way in which it was taught..... 42
2.5.1 The teaching of Science with respect to the textbooks of the time..... 43
2.5.2 The teaching of Science as reflected in the examination papers..... 47
2.5.3 The teaching of Science detailed in the examiners' reports..... 49
2.5.4 The way in which science was taught as revealed by the Samuelson Committee 58
2.6 1898 Commission on Intermediate Education (Palles Commission) 60

Chapter 3 National Schools and the Heuristic Method of Science Instruction ... 66

3.1 William Mayhowe Heller 66
3.2 Armstrong's influence 67
3.3 His philosophy and thoughts on science education 68
3.4 The Belmore Commission – George Francis Fitzgerald and William Mayhowe Heller meet in London 71
3.5 The revised programme and Heller's appointment by the National Board..... 72
3.6 Heller's courses..... 76
3.7 Progress of elementary science instruction 1900 – 1912 81
3.8 The National Board's Heuristic policy 87
3.9 Problems for the technical schools 89
3.10 The demise of the system 91

Chapter 4 The Department of Agriculture and Technical Instruction and Secondary School Science from 1900 – 1924..... 94

4.1 Technical education in Ireland prior to 1900 94
4.2 The Recess Committee 98
4.3 The Establishment of the Department of Agriculture and Technical Instruction (DATI). 100
4.4 The state of science instruction under the new Department..... 103
4.5 How the Department went about its work 108
4.6 Building and equipment grants 110
4.7 Teacher training 112
4.8 Progress 117
4.9 Examination papers set by the Department 130
4.10 The Digby Inquiry of 1907 132
4.11 Development of Intermediate school science from 1922 – 1924 138

Chapter 5 The Department of Agriculture and Technical Instruction and Technical Education from 1900 – 1924..... 143

5.1 Introduction 143
5.2 Historical background 146
5.3 The organisation of the Department 148
5.4 The Department's educational policy and strategy 149
5.5 The allocation of monies 156
5.6 Initial progress 160
5.7 The Cork Exhibition of 1902 161
5.8 The provision of suitable training 165
5.9 Continued progress of technical education 166
5.10 Progress from 1910 – 1920 176
5.11 Progress after 1920 182

Chapter 6 The Department's heuristic policy towards Intermediate and Technical School Science instruction..... 186

6.1 Introduction 186
6.2 Armstrong's writings and the Department's heuristic policy..... 191
6.3 The Departmental officers involved in implementing its education policy... 195
6.4 The educational policy of the new Department towards science – a heuristic trend 198
6.5 The Department's scheme in developing a practical form of instruction..... 202
6.6 The Department and heurism in the Secondary Schools, 1900 – 1920 207
6.7 The summer courses of instruction for teachers and the role of the Royal College of Science 214
6.8 Heurism and the Department, Br. Burke's evidence 220
6.9 The Digby Inquiry, the strongest reference to the Department's heuristic Policy 224
6.10 Sir William Ramsay and the heuristic debate 228

Chapter 7 How some Intermediate schools fared under the scheme 232

7.1 Introduction 232
7.2 The early years 232
7.3 Some of the inherent dangers of the new scheme 237
7.4 The design of school laboratories..... 240
7.5 The Grants provided to the schools 247
7.6 The provision of suitably trained science staff and the progress made 249
7.7 The training of science teachers 253
7.8 Adhering to the Department's scheme 255
7.9 The advent of practical science instruction in the schools 258

Chapter 8 Conclusion 265

8.1 Introduction 265
8.2 Criticism of the Department's heuristic approach 265
8.3 Criticism of the Department's structure and staffing 270
8.4.1 An overview of the scheme..... 274
8.4.2 Heurism in the Irish Department and the British Association..... 277
8.4.3 The National Board's heuristic policy in the National Schools..... 278
8.4.4 'Networking' of staff in the Department and their connection with Armstrong..... 278
8.4.5 The teacher training programme 1900-1922..... 279
8.4.6 Armstrong's heuristic syllabus and that of the Department of Agriculture and Technical Instruction..... 282
8.4.7 The Digby Inquiry of 1907..... 284
8.5 The place of practical science in Irish schools after the demise of the D.A.T.I..... 286

Photographs – sources..... 291

Bibliography..... 292

Acknowledgements

This work is dedicated to my Grandfather Dr. Michael Quane, Department of Agriculture and Technical Instruction, 1906 – 1922.

Special thanks are also due to:

Allen Library
Armstrong Archive, Imperial College of Science
Belvedere College
Department of Agriculture Library
North Monastery School
Royal Dublin Society
The Board of Governors of The King's Hospital
The High School Archive
The Library Staff of The National Library of Ireland
Wesley College Archive
London Metropolitan Library. (Photographic Archive)

A.M.D.G.

PREFACE

New times demand new measures and new men,
The world advances and in time outgrows
The laws that in our father's days were best;
And doubtless after us some purer scheme
Will be shaped out by wiser men than we,
Made wiser by the steady growth of truth.
Our time is one that calls for earnest deeds.[1]

(James Russell Lowell)

This thesis had its genesis in two significant events in my life. The first of these was a chemistry book I received from Father Ronald Burke–Savage S.J. This book entitled *A Second Year Course in Chemistry*, was written by the senior science master of Clongowes Wood College in 1909.[2] What fascinated me was the way in which the book was presented, in that certain of the pages were in an 'uncut' form. This was to allow the pupils to perform the various experiments detailed in the book without 'seeing' the answer. On completion of the practical work, the pages could then be 'opened' in order to gain access to the answers. This was my first exposure to the method which Henry Edward Armstrong campaigned for in England at the turn of the last century, and which is known as the heuristic method of science instruction.

The second 'event' was an opportunity in the autumn of 1980 to begin my career as a science teacher in a small preparatory boarding school in Suffolk. Even though I had a basic science degree, I was unqualified to teach in the formal sense. As a result I found myself instructing boys aged between nine and thirteen in the realms of Nuffield science.

---

[1] James Russell Lowell, Victorian poet. From his book of poetry entitled *Progress*.
[2] Watson, G.A. *A Second Year Course in Chemistry for Intermediate Schools*. Dublin: Browne & Nolan, Ltd., 1909.

Most of the course (which was aimed at Common Entrance level) was very practical, and my exposure to it was as heuristic as it could be, for along with the pupils I was teaching, I was also re-discovering much of the science I had learned many years before. These years proved to be the best in terms of the success rate at which my pupils learned science. The excitement and curiosity amongst the pupils that prevailed within the walls of the converted gym which had been converted into a science laboratory fascinated me. Since those days I have witnessed over many years the eager, curious and excited pupils come into the classroom and laboratory as first years, and watch as they advance through the science course to become disillusioned young science experimenters aged sixteen. What is it that we, as science teachers, do to them to turn them this way? Armstrong asked the very same questions over one hundred years ago, and spent the rest of his life trying to find a scheme which would prevent this response. One of the answers he proposed and established was to abolish the examination system that prevailed at that time and replace it with a system of inspection. This was not the only change he wrought. Armstrong's heuristic approach turned the pupils into discoverers in the sense that they worked away in the laboratory and made important (to them) science discoveries. The teacher was merely a facilitator and guided his pupils along their research path. Armstrong had high ideals with regard to the aims of heurism,

> If boys and girls left school properly aware what an experiment is, what is involved in making one, how very far from easy it is to make a real experiment; if they acquired a true sense of exactness in work and in argument: the teaching given in schools would be of great value in after-life, as life is one never-ending experiment.[3]

Nowhere else in the world at this time did such an innovation occur. In a very short period of time the teaching of science in Ireland changed from bookwork in the classrooms to practical work in the laboratories. Examinations were abolished and replaced with inspection, and for almost twenty years Armstrong's heuristic methods were introduced into the schools of Ireland by the Department of Agriculture and Technical Instruction. The purpose of this thesis is to tell the story of this endeavour.

---

[3] Armstrong, H. E., *The Teaching of Scientific Method and other Papers on Educational.* London: Macmillan and Co., Ltd., 1910. p. v. (From the preface to the second edition).

Introduction

The period 1878 to 1924 encompassed by this thesis was one in which profound educational changes which began with the Intermediate Education (Ireland) Act and ended in 1924 with the establishment of the present Department of Education in the new Republic occurred. During this period the teaching of science changed from 'mere bookwork' to widespread heuristic or practical instruction in the schools of Ireland. The agency responsible for this change was the Department of Agriculture and Technical Instruction, led by two great innovators, Sir Horace Plunkett and Mr. T.P. Gill. The Department was established mainly as a result of the findings of the Recess Committee (1898), in which both Plunkett and Gill played such an important role. This new Department was given the responsibility of taking charge of the grant system, which previously benefited this country through the Department of Science and Art based in South Kensington, and it also received substantial funding directly from the Treasury in London. During the Department of Agriculture and Technical Instruction's existence, from 1900 to 1922, school laboratories were not only built but they were also equipped with the aid of substantial grants. Science teachers were trained over the summer holidays in a particular method of science instruction, which is called the heuristic method.

The heuristic method was proposed by H.E. Armstrong, who from 1884 up to his death in 1937 mounted a crusade to bring heurism into school science. It was essentially a pupil-centred form of science education, which put the onus on the pupil to discover the more important aspects of science by experimenting as the pioneers had, the teacher guided this process. The role of the teacher changed from a provider of facts and information to that of facilitator as the pupils worked their way through various investigative work in the school laboratory. Great emphasis was placed on the pupils not being told anything that they should find out themselves, and so textbooks were not advocated as a means of study in the laboratory. The main aim of the heuristic method, as Armstrong saw it, was to instruct the pupil in the ways of observation, recording, deducing and concluding. Using the concept of faculty development current at that time, it was hoped that these aspects of the pupil's work in the school would transfer to their world outside the school.

Armstrong himself said of the heuristic method that it was,

> ... nothing more than the method of gaining a knowledge by experience – by inquiry, by observation, by trial – reduced to a system and formalised.[1]

Armstrong had his disciples, some were pupils he had taught; whilst others were influenced by his copious writing on this subject. One of these men, William Mayhowe Heller was employed by the Board of National Education and charged with implementing a system of elementary science instruction in the National Schools of Ireland. This he did from 1900 to 1918. The object of this thesis is to chronicle the rise of heurism under Armstrong and Heller and detail the progress of its introduction into the schools of this country after 1900. Prior to this however, the state of science in Ireland between 1878 and 1900 is discussed. There are eight chapters and each one provides detail on the various aspects of the development of science instruction between 1878 and 1924.

In Chapter 1 biographical detail is given on H. E. Armstrong and the origin of his heuristic method of science instruction. The development of his heuristic syllabus from his early days at Finsbury Technical School and the use he made of the British Association for the Advancement of Science for his heuristic crusade is examined. The connection Armstrong had with science education in Ireland between 1900 and thereafter is also chronicled, particularly his meetings with officials of the Department of Agriculture and Technical Instruction for Ireland. The nature of classrooms and laboratories in heuristic science education is discussed and the chapter analyses Armstrong's ideas and their implementation in the school context. Armstrong had a long association with Christ's Hospital School, and his design of this school's science workshops provides an insight into the physical form of a heuristic laboratory. It is shown that the Department introduced into schools a form of science room that was specifically designed so that teachers could implement a scheme of heuristic science instruction. For example, great emphasis was placed on facilities for the pupils working in the laboratories which allowed them to write up their laboratory notebooks even during the course of the experiment. The matter of laboratory design is discussed in more detail in section 7. 4.

Chapter 2 details the development of science education in Ireland between the years 1878 and 1900; that is from the enactment of the Intermediate Education (Ireland) Act in 1878, until the advent of the Department of Agriculture and Technical Instruction of Ireland in 1900.

---

[1] Armstrong, H. E., *The Teaching of Scientific Method and other Papers on Education.* Macmillan & Co., Ltd., London: 1910. p. xix. (From the preface: *Twenty five years later.*)

In this regard the relevance of the Samuelson Committee of 1883 and the 1898 Commission on Intermediate Education (Palles Commission) are discussed.

Information is given about schools, such as St. Kieran's College in Kilkenny, where a strong tradition of science instruction was coupled with a strong association with the South Kensington Department. The progress of science under the Intermediate Board up to 1900 is discussed, and analysis made of the type of instruction carried out during this period. This takes the form of an analysis of the textbooks used, the examination papers produced annually by the Intermediate Board and the examiners' reports which detailed the standard of science instruction in the country. Full sets of Intermediate Examination Papers from 1878 to 1899 were located at the Allen Library, Dublin, and the contents of these papers provide evidence for the existence of a non-heuristic approach towards school science work which was examined.

Chapter 3 discusses the connection between the Belmore Commission and William Mayhowe Heller's appointment as Head Organiser to oversee elementary science instruction in the National schools of Ireland using Armstrong's heuristic methodology. Biographical detail on Heller is provided as well as evidence of his association with Armstrong. Analysis of the historical record is used to establish the strong heuristic nature of the Commissioners' intention in science education, and a discussion of the history of the heuristic scheme implemented will be given up to its demise in 1922. The connection between the science taught in National schools and in the Intermediate and Technical schools is clarified, particularly the problems the graduates of the National schools posed for the Technical schools.

Chapter 4 details the relationship between the Department and the Intermediate schools from 1900-1920. It begins with a brief history of the state of science instruction as it existed prior to the establishment of the Department. The importance of the Recess Committee, which was set up by Plunkett, and whose final report contained much of what was implemented by the new Department is evident. How the Department went about its work is discussed and considerable detail on the early years of the new Department is given and the progress charted. The many-fold problems the Department encountered, such as the dearth of science teachers in the country in 1900 and the lack of adequate facilities in the schools, and the ways in which these were overcome provides insights into the factors relating to its material successes in the twenty-two years it was in existence. The change in the

approach owing to the introduction of the heuristic methodology was evident in the examination papers set by the Department during its later years, and detail is provided on the examination questions.

Chapter 5 discusses the connection of the Department with technical schools, again from 1900 – 1922. The development of technical education from almost nothing to a system of technical instruction in almost every part of the country is chronicled. Detail is provided on the Cork Exhibition of 1902, an event the Department used in order to promote its policy of practical science instruction. The methods used to train teachers, and the progress of technical instruction up to 1924, are described. The Gilbert Library and the Dublin Civic Museum provided information on Dublin Corporation, particularly in regard to the implementation of technical education in the City of Dublin.

Chapter 6 presents the core of the thesis; that the Department adopted a heuristic policy in its early years towards science instruction in the schools. Detail of Armstrong's first meeting with members of the Department in 1902 at the British Association for the Advancement of Science meeting in Belfast is also provided. Another link between heurism and the Department is in the senior members of the Department who were recruited from England, and who had very strong ties to Armstrong. The educational policy of the Department towards the Intermediate schools and its manifestation in the schemes it implemented also provide evidence for its heuristic policy. Mention is made of Br. Burke of the North Monastery School in Cork, who developed his own brand of heuristic teaching and who met Armstrong in 1902. Br. Burke also had very strong connections to the Department, and this is manifest in the 1902 Cork Exhibition. The strongest evidence which confirms the Department's heuristic policy is that of evidence given by high-ranking officials of the Department to the Digby Inquiry in 1907. The chapter closes on a controversial note, with an exchange of opinions between Sir William Ramsay, who was lecturing teachers during the Department's summer courses and one of the teachers' journals with regard to the benefits of the heuristic method as proposed by Armstrong.

Some of the major schools that worked under the Department's rules preserved detail of their progress in the form of headmasters' reports, educational records, minute books and Department reports. Using such material Chapter 7 attempts to provide evidence of how schools fared under the scheme. Most of the laboratories built by schools during this period with the aid of Departmental grants, had to conform to strict Departmental regulations. The design of some of these laboratories bear a striking resemblance to Armstrong's design of heuristic laboratories built at Christ's Hospital School. Detail in the form of photographic evidence and laboratory plans is given. The availability and attainment of grants is

discussed and the financial difficulty some schools were placed in by attempting to implement the Department's heuristic form of science instruction is recorded. One of the major concerns for schools during this period was the low availability of science teachers whom the Department recognised as properly qualified; this added to the almost yearly change in regulations, was a contributory factor in the failure of the heuristic scheme.

Chapter Eight analyses the Department's heuristic innovation in science instruction, taking account of material collected from critics of the Department as well as historical events, such as the Great War, the influenza epidemic of 1918 and the War of Independence, all of which conspired to disrupt its efficient working. The flaws inherent in the Department's heuristic policy are examined. The legacy left by the scheme is analysed and its relevance for current practice in Irish science education.

The evidence presented in this thesis shows that, from its genesis the Department acted so as to implement the heuristic methodology put forward by Armstrong, and that this form of science instruction was part of a plan to bring a more practical approach towards science and technical instruction into the schools of Ireland. Furthermore, I put forward the argument that Plunkett was determined that the new Department would be seen to be distinctly Irish in order to placate the more extreme Nationalist educationists rather than a perpetuation of the old South Kensington system. Perhaps this was why the Department did not want to be seen by the public to be associated with a heuristic policy of science instruction even though this was indeed the policy it advocated in the secondary schools. The 'Irishness' of the Department might not have sat well beside an educational scheme which was seen to be English. There was also the fact that the heuristic methodology which Armstrong was advocating at that time was coming in for public criticism, and so the Department might have wanted to avoid unnecessary association with this controversy. There has been very little published about the Department of Agriculture and Technical Instruction and its heuristic policy towards Irish school science; as a result most of the material presented in this thesis is new. Three major sources provided the necessary information two of which proved extremely difficult to locate. The journals of the Department of Agriculture and Technical Instruction were readily accessible, but the minutes of the Board of Technical Instruction were not. These were eventually located in the library of the present Department of Agriculture in their original form. Apart from these minutes, there is very little other documentation relating to the Board of Technical Instruction in this library. A similar situation existed with the Intermediate Board: the Annual Reports are readily available but initially the

minutes of the Board Meetings of the Commissioners were nowhere to be found. Neither the National Library of Ireland, the National Archives or Trinity College had any information on these minutes. The Department of Education was most disappointing in being unable to provide either material or assistance in this regard; and it was only due to a small piece of information casually dropped by the archivist in the Department of Education that enabled this researcher to contact the National Archives and suggest their possible whereabouts. It took another year before an almost complete set of the original minutes of the Board Meetings of the Intermediate Commissioners were found in a warehouse located in south Dublin; they now reside safely in the National Archives. Other sources were provided by the National Library of Ireland, particularly journals and Government reports. The final reports of the Belmore Commission (1898), the Digby Inquiry (1907) and the various meetings of the British Association for the Advancement of Science were located in the library of Trinity College Dublin. Other information came from further afield, such as articles from 'The Central' and some of Armstrong's own educational articles, which were provided by the Imperial College of Science in London.

A significant amount of research for this thesis also took place in various Irish schools such as the North Monastery CBS in Cork, Mercy Convent in Charleville, King's Hospital, Wesley, The High School, Belvedere, Clongowes Wood College and the Christian Schools, particularly through the Allen Library. Although some very valuable and original material came from these schools, much has been lost. The fact that the period covered by this thesis incorporated some very turbulent times in the history of Ireland did not help either. It is evident that unless the authorities in these establishments had a respect for their historical records and consciously attempted to preserve them, the material was destroyed. Kevin Barry's science laboratory notebook for 1915 - 1916 was discovered in Belvedere, this appears to be the only surviving written record of the type of heuristic science carried out in the school laboratories around this time. Moreover school laboratories that had been in existence since the genesis of the heuristic scheme are slowly disappearing. Brother Burke's science school, which was built in 1910 in Cork is due for a refurbishment which will change its original layout, and the science laboratories built at Blackrock College with grants provided by the Department in the early 1900s are due for demolition this year.

Timeline for the thesis.

1874 Pupils from St.Kieran's College sit the Kensington examinations. First Irish School to work under the Science and Art Department.

1878 Establishment of the Intermediate Education (Ireland) Act.

1883 Royal Commission on Technical Instruction (Samuelson Commission).

1884 Armstrong speaks at the International Health conference, introduces his elementary science syllabus based on his heuristic methodology.

1890 Customs and Excise Act.

1893 Technical Education Association of Ireland established.

1896 Recess Committee meets for the first time which includes Plunkett and Gill.

1898 Final Report of the Belmore Commission. Commission on Intermediate Education (Palles Commission). Final Report of the Recess Committee published. Local Government Act established.

1899 Agriculture and Technical Instruction (Ireland) Act leading to the establishment of the Department of Agriculture and Technical Instruction with Plunkett as the Vice-President and Gill as Secretary. The Local Councils are also founded.

1900 Department take over administration of the Parliamentary Vote for Science and Art. Heller begins his work as head organiser of elementary science in the National schools.

1902 The British Association for the Advancement of Science meet in Belfast; Armstrong is President of Section L (Education) in its inaugural year. Armstrong meets Br. Burke in Cork. Robert Blair joins the Department.
The Department exhibits at the Cork Exhibition.

1904 Robert Blair leaves the Department. George Fletcher succeeds Blair.

1905 Dale & Stephens Report on Intermediate Education.

1905 Plunkett steps down as vice president of the Department.

1907 Digby Inquiry

1908 The British Association meet in Dublin. Armstrong returns to Ireland and sits on committees along with members of the Department.

1910 The new Royal College of Science is opened officially by King George V.
The Department take up residence beside the Royal College of Science.

1920 Government of Ireland Act, end of the Department of Agriculture and Technical Instruction.

1922 Irish Free State (Agreement) Act.

1922 Constitution of the Irish Free State (Saorstat Eireann) Act, 1922.

1922 Board of Technical Education ceases to exist. Control of Technical Education comes under the new Department of Agriculture, which was established in this year.

1923 T.P. Gill retires as secretary of the Department.

1924 Ministers and Secretaries Act. Department of Education established.

Chapter 1

Heurism and Henry Edward Armstrong

Discovery consists of seeing what
Everyone else has seen and thinking
What no one else has thought.
(Albert Szent-Gyorgi)

1.1 Introduction

The heuristic methodology that is the focus for this thesis was advocated by Professor Henry Edward Armstrong (1848-1937). Not only was Armstrong a distinguished research chemist for this period, but he was also an outstanding educationalist. Put simply, his philosophy places the pupil as the discoverer with a strong emphasis on the practical nature of the subject. In 1898 Armstrong wrote:

> Heuristic methods of teaching are methods which involve our placing students as far as possible in the attitude of the discoverer – methods which involve their finding out instead of being merely told about things. [1]

Armstrong was not the first to develop this singular idea of a more child-centred form of education, as others who had gone before him had advocated a similar approach, notably Pestalozzi[2], Huxley[3], Tyndall[4] and Frankland[5], (the latter two being members of the so-called 'X-club', founded in 1854), are but a few of the exponents and practitioners of this philosophy of education. Nor was Tyndall the only Irishman advocating a more practical approach to the teaching of science, as James Dominic Burke, a Christian Brother was developing his own brand of practical science instruction around this time in the school laboratories of the North Monastery in Cork.

---

[1] Armstrong, H.E. *The Heuristic Method of Teaching or the Art of Making Children Discover Things for Themselves – A chapter in the History of English Schools*. Special Reports on Educational subjects, Vol.2, 1898 (Sadler Report). London – printed for HMSO by Wyman & Sons Ltd., p. 60

[2] Pestalozzi (1746-1827). His philosophy was that teaching children involved co-operation between teacher and pupil in such a way that activity by the child was encouraged, and that accurate observation increased the quality of the learning.

[3] Thomas Huxley (1825-1895) campaigned for the introduction of elementary science into elementary schools.

[4] John Tyndall (1820–1893). Tyndall taught at Queenwood College in Hampshire, along with Edward Frankland. This school possessed science laboratories, and science was taught in a very practical way.

[5] Edward Frankland (1825–1899), see footnote number 4.

Armstrong first heard the term 'heuristic' used by Professor John Miller Dow Meiklejohn[6] (1836-1902) in a paper he delivered at a health exhibition conference at the Central College on 5th August 1884, although it is likely that Meiklejohn had used the term as early as 1863. Armstrong, at the time professor of chemistry at Finsbury Technical College, also read a paper at this conference entitled, *On the teaching of natural science as a part of the ordinary school course and on the method of teaching chemistry in the introductory course in science classes, schools and college'.*

This was the first time that Armstrong had spoken publicly about the introduction of a heuristic element into school science instruction, although he had written an "Introductory" in such textbooks as Macmillan's Science Primers and his own *Physiography: an Introduction to the Study of Nature.* He expressed his great objection to the method that was in vogue with respect to school science instruction, '...that it is practically the same whether science is taught as a part of the general school course, or whether it is taught professionally'. In a sentence, there was no difference in the way a boy learned science at school to that at college; only at college he carried it further. The method of school instruction Armstrong envisioned was,

> ...being of as practical a character as possible, and of such a kind as to cultivate the intelligence and develop the faculties of observing, comparing and reasoning from observation; and the more technical the course the better.[7]

The method that Armstrong advocated was a form of mental discipline and rigorous training which could be taught to pupils engaged in the early stages of science instruction. Elementary science was thus seen to be a very important stage.

In examining the role of heurism adopted by the Department of Agriculture and Technical Instruction in the years following its establishment in 1900, I will confine my analysis to Armstrong's heuristic ideas. This is because the aim of this thesis is to show that it was Armstrong's heuristic philosophy that was used specifically by this Department in order to further the development of a more practical form of science instruction. Furthermore, it will become clear that his syllabus, having been adapted by the new Department was implemented in the Intermediate and Technical schools.

---

[6] John Miller Dow Meiklejohn (1836-1902), Prolific Victorian textbook writer. Appointed to the chair of Theory, History and the Practice of Education, St. Andrew's University in 1876.

[7] Armstrong, H. E. *On the Teaching of Natural Science.* Published in Health Exhibition Literature, Vol. XIV August 1884. London, William Clowes & Sons Ltd., 1884, p. 72.

Armstrong's influence over the development of science and technical instruction in Ireland was based on personal and professional contact he had with Intermediate and Technical science educators. He was acquainted with many of the senior officials working within the Department, some of whom he influenced in England. He was influential also in the visits he paid to Ireland at critical periods in the development of the Department's system, particularly in 1902 and 1908 when he sat on committees with members of the Department.

1.2 H.E. Armstrong and the genesis of the heuristic method

Henry Edward Armstrong was born on 6th May 1848 into a middle class family. Neither of his parents were professional people. His father was a foodstuffs importer, and can probably be given credit for being the first merchant to import Normandy butter from France into England. From the considerable amount of written material he has left behind it is possible to piece together a tapestry of the man who would become a crusader for heurism during the latter part of the nineteenth and into the twentieth century. He had begun to write his autobiography shortly before his death in 1937.

His own childhood was steeped in self-discovery, from rambling in the countryside around his home in Lewisham Kent, to discovering the analytical methodology of Trench[8] applied to the English language. This particular work had a profound effect on Armstrong who later stated:

> I still vividly recall to mind how from this book, as a mere lad, I for the first time gained ideas as to the value of method – of what I should now call scientific method.[9]

It is even suggested that his fascination with the application of scientific method began with reading this work. He was very fond of referring to the great value of Trench's *Study of Words*, which he described as the one and only interesting text-book put into his hands as a boy and to which he attributed his heuristic tendencies. [10] Armstrong had a 'minimal formal education'[11] and consequently had limited exposure to

---

[8] Richard Chenevix Trench (1820-1893), Irish poet and scholar. Appointed professor of divinity at King's College, London, and from 1863, Archbishop of Dublin. He published his *Study of Words* in 1851.

[9] Armstrong, H.E. *The Heuristic Method of Teaching or the Art of Making Children Discover Things for Themselves – A Chapter in the History of English Schools.* Special Reports on Educational subjects, Vol. 2, 1898 (Sadler Report). London: printed for HMSO by Wyman & Sons Ltd., p. 391.

[10] Rich, E. M. *The Central*, Vol. XXXV, No.83, June 1938. London: William Brown & Co. Ltd., p. 86.

[11] Nott, M. *Representing and re-presenting science education.* Paper read at the NARST conference, March 2000, p.1.

formal examinations, which may account for his disdain for such means of assessment of pupils engaged in heuristic instruction. Even his Ph.D. thesis was written up and examined in a matter of weeks before his return to London from Leipzig where he worked under the German chemist Adolph Kolbe [12]. Armstrong never taught in a school classroom, the closest he came to school science instruction was his involvement in the planning of science workshops at Christ's Hospital School and through his relationship with one of the head science teachers there, Charles Browne. He also gained some exposure to science teaching in the teacher training courses he helped found in East London and from which so many of his future heuristic adherents emerged. He did lecture to medical students at St. Bartholomew's Hospital in London in 1870, and it was in this regard that he saw a real need for proper science training at an early age. He found that the students he was lecturing to had very little grasp on any form of practical science. This experience awakened in him an interest in education and consequently led him to develop heuristic ideas as a means of rectifying this observed weakness in the pupils he was presented with.[13]

Apart from the influence of Trench's work there were two other major events in Armstrong's life that affected him deeply, and conveyed to him the importance of instruction through heurism. The first of these events was his own personal experience in the chemistry laboratories both at the Royal College of Chemistry in London, and at Leipzig in Germany. The influence of the German system of laboratory discipline contributed greatly to his thinking along heuristic lines. His work was practical based and very analytical. For much of the time he worked on his own and discovered through trial and error the correct procedures that led him to his ultimate goal – his doctorate. This was to be his one and only formal academic qualification.

The second of these events was his experience in a patent law case in 1879, when he represented the defence as an expert witness. Here he learned first hand the importance of rigorous testing in the legal form of cross-examination, and realised the value of authentication with constant testing. These attributes expressed in a science context would emerge later in his heuristic syllabi.

---

[12] Quane, M. *Henry Edward Armstrong – William Mayhowe Heller and the implementation of Elementary Science in the Irish National Schools System from 1900 – 1922.* M.Sc thesis, Trinity College Dublin, 1999, p. 2.

[13] Browne, C.E. *Henry Edward Armstrong – Educational Work.* London: Harrison & Sons Ltd., pp. 1-2.

Armstrong based his heurism on the theory of faculty psychology. This theory supposed that the mind could be analysed in terms of various powers or faculties – a theory that can be traced back to the Greeks. Tyndall and Armstrong were alike in recognising that, since science and literature are complementary, tremendous benefits would accrue if those concerned with education made more use of the imaginative faculty.[14] However Armstrong took it a step further by promoting the idea of 'transfer by training'. Put simply this implied that heuristic methods trained the faculties in observation, accuracy of thought, word and deed. Whilst this training occurred in a classroom setting, it would then be possible for the 'scientifically-trained pupil' to use these learnt skills in their world outside the classroom. This would be used by some educationalists to further a more practical form of technical instruction which would follow the secondary school, and which demanded a more scientifically skilled pupil. This theory would later be attacked by those wishing to discredit heurism and eventually lead to its demise as new psychological theories came into vogue, as the perceived defects in faculty psychology became apparent to educationalists. Even Robert Blair, a great proponent of heurism, speaking at the British Association for the advancement of Science at Cardiff in August 1920 admitted:

> Following in the steps of a series of American investigators, Winch and Sleight in this country have shown very clearly that practice in one kind of activity produces improvements in other kinds of activities, only under very limited and special conditions.[15]

1.3 Armstrong's role model – Edward Frankland

Something must be said of the man who would appear to have influenced Armstrong's way of thinking, and which led him onto the path of heurism with respect to science teaching. Edward Frankland (1825-1899), like Armstrong, spent part of his professional training in chemical laboratories in Germany under Hermann Kolbe. Together with the Irish physicist John Tyndall he developed and practised a form of heuristic instruction at Queenwood College in 1847. This Quaker school in Hampshire, along with purpose built laboratories was the perfect location for such a development. Writing about this period Dr. Norman McMillan says:

---

[14] McMillan, N. D. & Meehan, J. *John Tyndall – 'X'emplar of scientific and technological education.* Dublin: E.T.A. Publications, 1980. p. 81.

[15] Report of the 1920 Cardiff Meeting (88th) of the British Association. London: John Murray, 1920, p.194.

> In this unique facility Tyndall and his friend Edward Frankland, the Superintendent of the Science Laboratory, carried out probably the first experiment in England in practical engineering and science teaching and developed the "heuristical method" made famous later in the century by Frankland's disciple H.E.Armstrong.[16]

Both Frankland and Tyndall went on to found the 'X-club' in 1854. This prestigious group included such illustrious names as the biologist T.H. Huxley and the philosopher Herbert Spencer. It is a prime example of the 'networking' that occurred during this period, and into which Armstrong and his followers immersed themselves in order to champion the heuristic cause. Armstrong read almost everything that both these men published. Another aspect in relation to Frankland and Tyndall is that as lecturers they were much more comfortable in performing practical demonstrations than being engaged in long protracted arguments of a scientific nature: 'Frankland had no art of oratory but every word told. He was the man of deeds'. [17] Interestingly Armstrong himself was a very poor lecturer and was much more at home when demonstrating. What is important is that Frankland did not just imbue in Armstrong a passion for chemistry and a '...love of the practical';[18] he was also responsible for awakening in Armstrong an interest in science education.

The heuristic form of science instruction and the networking it entailed in setting it up would appear to have flourished in the intermediate schools and technical colleges of this country through the Technical Instruction branch of the Department of Agriculture from 1900 onwards, of which more detail will be given in Chapters Four and Five.

1.4 Further analysis of the heuristic methodology that Armstrong professed

In a phrase - learning through doing. Armstrong believed that children learned from practical work, and the consequential thought processes that were sparked as a result of their inherent curiosity. He felt that they should be critical, and develop a sense of accepting what they found to be true by their own experience via experimentation. Armstrong always believed that the heuristic methodology could be employed to teach almost any subject, he did not limit his ideology to just science subjects alone. He insisted that learning had

---

[16] McMillan, N. D. *Tyndall the philosopher, John Tyndall (1820-1893),* p. 25.

[17] H. E. Armstrong. Huxley Memorial Lecture, from W.H.Brock. *H.E. Armstrong and the teaching of science, 1880-1930.* London: Cambridge University Press, 1973, p. 65.

[18] Brock, W. H. *H. E. Armstrong and the teaching of science, 1880-1930.* London: Cambridge University Press, 1973, p. 4.

to be active not passive; the learner must be involved and the learning activities must be a mix of practical and 'literary'. The practical activities had to engage the learner in the 'methods of science' which included, for Armstrong, induction, deduction, being systematic, being accurate and taking measurements.[19]

It was essential that the pupils had to learn by discovery, leading to new information for them, although not necessarily for the teacher. This particular point would be incorrectly interpreted by some, causing unnecessary heated debate, which gave Armstrong some considerable angst.

The teacher was to act in the mode of facilitator on this path of discovery. Discovery would be encouraged by using techniques such as '...practical activities, questions and use of reference books' [20] in order for the pupil to arrive at an answer which they had researched themselves. Furthermore, the teacher was encouraged to allow the pupils to '...go up blind-alleys' if necessary, in order to experience the true path of discovery and that of being discoverer.

Textbooks were not encouraged for the young learners in this scheme. In fact no information was allowed which might disturb the individual thought-processes of the person in 'discovery-mode'.

> Having used the word textbook, let me point out that no textbook must ever be allowed in classes such as are under discussion. Each child should write its own text-book and be taught to regard it as a holy possession.[21]

The method he used to instruct his children in heuristic practices at home, particularly in their written reports is an indication as to what he meant by 'holy possession'. One of Armstrong's seven children, Harold aged 8, had been given a present of a book entitled *The Monkey that would not Kill*. In a part of this story the monkey is thrown into the sea weighed down with a stone tied to him. He survives by carrying the stone underwater and wading out of the sea. To the childrens' questions as to whether this was possible or not, Armstrong told them to find out for themselves by investigation and experimentation, and stipulated that no textbooks were to be used in order to discover the answer to the problem.

The childrens' notebooks still survive to this day[22], and provide a window through which we can capture a glimpse of Armstrong's heuristic methodology in action. Charles Browne, as a young man who witnessed

---

[19] Nott, p.1.
[20] Ibid, p. 1.
[21] Armstrong, H. E. *The Heuristic Method of Teaching,* p. 76.
[22] In the Imperial College of Science Archives, London.

Armstrong's 'siblings experiment' and who would later implement heuristic methods in science at Christ's Hospital School remarked:

> They carried out a series of investigations, guided by their father when necessary, of a very simple problem which they had themselves suggested, understood and wanted to do.... They recorded their work separately in large well-bound books, and their notes and observations were illustrated with photographs, diagrams and sketches, this part being done during the week under the general supervision of a governess...[23]

Their father would return home in the evening and question the children on what they had discovered that day. Armstrong had very little time for the use of science textbooks in order for the pupils to 'discover' answers to their questions, although he did grudgingly admit that they did fulfil a role for the more advanced pupils. There was room for reference books, which could be consulted only when the pupil had discovered something and required more immediate information. This consultation would in turn lead to further inquiry involving more experimentation, and so on. At the British Association meeting in Belfast 1902, Armstrong made reference to this when he said:

> The teaching of the elements of experimental science must therefore accompany the teaching of reading. And great care must be exercised that the palate for experimenting, for results, is not spoilt by reading. The use of text-books must be most carefully avoided at this stage in order that that which should be elicited by experiment is not previously known and merely demonstrated...[24]

He even employed the argument of expense in order to promote the avoidance of the use of textbooks in the heuristic classroom. 'In future we must give the training at less cost and teach the art of going to books for minute details whenever they are wanted.'[25] On the nature of problem solving he had this to say,

> ...the object must ever be to train children to work out problems themselves and to acquire the utmost facility in doing so... but do not let us spoil them by telling them definitely in advance what to look for and how to look for it: such action is simply criminal[26]

---

[23] Browne, C. E. *Henry Edward Armstrong and Charles E. Browne*. Imprint: Christ's Hospital, Harrison & Sons Ltd., London 1968, p. 12.

[24] Address by H. E. Armstrong to the Educational Science Section of the British Association for the Advancement of Science, Belfast 1902, p. 117.

[25] Ibid., p. 118.

[26] H. E. Armstrong. *The Heuristic Method of Teaching*, pp. 68-69.

He likened an experiment, say on rusting, to that of a crime. The pupils were an investigating force. Young children were delighted to be so regarded, to be told that they are to act as a band of young detectives.[27]

Without doubt, Armstrong was in touch with the true nature of children and their common curiosity with regard to the science of everyday objects. This was due to the experiences of his own childhood and first-hand experience with his children and the way in which they worked. Curiosity is common to most children, and he simply sought to tap into this inherent trait in the most practical way he knew.

> In the first place, interest is excited in common objects and common phenomena and these are gradually studied – not merely talked about. Children are thus encouraged to look about them – to be properly inquisitive and inquiring.[28]

He outlined a 'checklist' of features such a scheme of practical work might provide, each facet based around active laboratory work by the pupil.

- Exactitude in measuring both in practical work and in the use of language by the pupil.
- Observational skills are acquired, wastage is minimised and attention to detail learnt.
- Reasoning skills based on observation involving an appreciation for logical thought.
- Judgement based on reason, which in turn comes from the evidence acquired.
- The power of devising and fitting up apparatus, as well as experiments.
- Handiness follows.[29]

Armstrong saw the adequate supply of properly trained teachers as the main problem associated with any major drive on implementing his heuristic methodology in the classrooms and laboratories of schools. He saw the training that was been given at the time as 'anti-heuristic'. The way out of this seemingly problematic area was in 'very special steps' in order to secure a supply of competent teachers.

Writing in 1898, William Mayhowe Heller, both a past pupil and colleague of Armstrong, referred to the crucial role that properly trained teachers played in this scheme. (He had been involved with the training of teachers in the 'Berner Street project' prior to this.)

---

[27] Ibid., p. 69.
[28] Ibid., p. 70.
[29] Ibid., p. 70.



Plate 1. Professor Henry Edward Armstrong in 1885. (Photograph courtesy of the Imperial College of Science archive).

> It must be fully recognised that these heuristic methods are difficult and tax the devotion and conscientiousness of a teacher to the utmost, and it is only the best teachers who will *with their present training* do justice to them.[30] (Italics added).

The amount of time available in a normal school timetable was seen by some to be a mitigating circumstance against implementing this particular teaching method. Under the prevailing system at that time, radical changes had to be made in order to meet this 'time difficulty'.[31] Armstrong understood most of the problems to be overcome, and the questions he asked are still very pertinent to science classrooms to-day.

> Why is it that our children so seldom talk about their schoolwork? Why is so much trivial conversation indulged in on all hands? Why is so much trivial literature read? Is it not because so little encouragement is given to rational conversation and reading at schools? [32]

Under his scheme, pupils would engage together '...in the work of discovery', which in turn would lead to them exchanging views, asking advice from one another and other aspects which would be so divorced from the enforced silence in the classroom of a didactic teacher.

1.5 How Armstrong carried forward his crusade for Heurism

Armstrong pushed his heuristic ideas forward on three fronts. The first of these was in his involvement with the British Association for the Advancement of Science. This had been in existence since 1831, and had been formed primarily as '...a valuable annual public platform for the announcement of new ideas or experimental work, or for the discussion and report of scientific enterprises'.[33] It was his involvement with this Association, which would bring him to Ireland on several occasions. Addressing delegates in 1885 as President of Section B (Chemistry) at Aberdeen, more than half of his speech involved education, proof that he considered this as an important sounding board for the advancement of his ideas. In the following year Armstrong began to consider bringing school science to the attention of the Association. Following constant campaigning, he managed to create a committee in 1887 that was to investigate '...the present

---

[30] Heller, W. M. *Impressions of three years' experience of science teaching in East London Schools.* Appendix D. Sadler Report, 1898, p. 431.
[31] H. E. Armstrong. *The Heuristic Method of Teaching*, p. 70.
[32] Ibid., p. 71.
[33] Brock, p. 22.

methods adopted for teaching chemistry'.[34] The result of this committee's report was the identifying of six main problem areas. These were (in no order of importance and included): expense, low esteem of the science subjects against other subjects on the curriculum, the examination syllabus, absence of good textbooks, lack of qualified teachers and finally, lack of good laboratories. The committee suggested that the method of teaching science should be on an experimental basis, and it was felt that the system that existed was far too focussed on '...qualitative analysis and manipulation'.[35] From this dialogue emerged Armstrong's *Suggestions for a Course of Elementary Instruction in Elementary Science*, which he presented at Newcastle-upon-Tyne using the Association as a platform for his developing ideas in 1889. The Headmasters of schools in which elementary chemistry was taught were asked to express their views on '...chemical teaching and also for a statement as to the methods which had been found to render the teaching most effective as a mental training'.[36] The evidence that had been collected was conclusive and showed that '...much of the teaching of elementary chemistry is far from satisfactory, and needs to be considerably modified if it is to affect that valuable mental discipline which science teaching can afford.' [37] The committee that reported this consisted of Armstrong, among others. It went on to define the aims it would like to see applied to science instruction. These consisted of employing the scientific method by means of '...observation, experiment, and reasoning with the aid of hypothesis, the learners should be put in the attitude of discoverers and should themselves be made to perform many of the experiments.'[38] Furthermore, the subject matter had to be familiar to the pupils and should be associated with everyday pupil experience. In closing, the committee concluded that: 'Without pledging themselves to accept all its details, the Committee consider that the schemes which Professor Armstrong has prepared is in general accordance with their views as to what should constitute a course of elementary instruction in physical science.' [39] The schemes referred to by the committee were in fact 'suggestions' for a course of elementary instruction in physical science that had been drawn up and presented by Armstrong. Introducing these, Armstrong reiterated the objectives which he saw for such a course of action,

---

[34] Ibid., p. 23.
[35] Ibid., p. 24.
[36] Report of the 1889 Newcastle-upon-Tyne Meeting (59th) of the British Association for the Advancement of Science. London: John Murray, 1889, p. 228.
[37] Ibid., p. 228.
[38] Ibid., p. 229.
[39] Ibid., p. 229.

> ...to train boys and girls to use their brains, to train their intelligence; to make them observing and reasoning beings, accurate observers, and accurate thinkers; to teach them to experiment.[40]

The following year he added a selection of 'illustrative exercises' to these suggestions.[41] From 1890 Armstrong addressed meetings, wrote education articles, served on numerous committees and even held in-service courses for teachers – all calculated to further the cause of his heuristic philosophy. It is important to analyse these suggestions, as they form the core for the type of school science instruction which was implemented in Ireland with the foundation of the Department of Agriculture and Technical Instruction in 1900.

Owing to his experience at Finsbury Technical College Armstrong had now developed a more logical scheme of work; he was also aided in receiving feedback from the London Board schools on the success of particular object lessons. There were six stages in his course, each of which described the element of 'doing'; the initial four stages are listed as follows:

> **Stage 1**. Lessons on common and familiar objects or simple object Lessons, '...real objects which were part of a normal child's experience' would be used to establish a grounding in both Geography and Natural History. The children should be induced to describe these objects from observation. Geikie's *Science Primer on Physical Geography* was suggested.
>
> **Stage 2**. 'Lessons in measurement', beginning with linear measurements and area, the child would then learn to use the laboratory balance, determine the relative densities of common materials and measure temperature. This would introduce the child into the realm of elementary physics and meteorology. This stage would follow after the children had learned the simple rules of arithmetic.
>
> **Stage 3**. Elementary Chemistry, where the physical and chemical changes of heat on common substances would be examined. '...the gradual formation of a skin on the surface of fused lead and tin is also easily perceived'.[41] Observations like this would lead to further questions and

[40] Armstrong, H. E. *Suggestions for a course of elementary instruction in physical science*. Paper read at the 59th Meeting of the British Association for the Advancement of Science, 1889, p. 230

[41] Ibid., p. 233.

experimentation. Student note-taking would be introduced. By the end of this stage, the foundation was laid for the study of change, that is, chemical studies proper.

Stage 4. The Problem Stage or Chemical Change in more detail – rusting of iron, 'detective-style', and twelve more structured problems, all involving active work on the part of the learner, leading to a concept of analysis. The aim was '...to constitute a well-defined sequence of steps to a sound understanding of the main principles of chemistry: at the same time their design and treatment were intended to inculcate a scientific attitude of mind'.[42]

The final stage would be where most pupils would end their exposure to this heuristic approach. Those who intended to go on further would pursue a course partly involving lecture demonstrations combined with practical experimentation, until the concepts of chemical combination and volumetric analysis were understood. What is interesting is that chemical symbols, equations and atomic theory were only covered towards the end of the course, although this particular approach was not unusual for the science classrooms of the time.

Armstrong had to admit that one of the most constraining elements for adopting such a course would be time. It was proposed that even if the course were to be given by a series of lecture demonstrations it would still be beneficial. Later under the auspices of the Intermediate Board of Education in Ireland, attempts to circumvent this class-time problem would be made by running practical science classes on a Saturday, similar to the classes on teacher training which Armstrong founded in Berner Street, East London between 1891-1894. Armstrong summed up the scheme by stating that '...the course which has been sketched out is one which doubtless might well be modified in a variety of ways according to circumstances'.[43] This is what the Department of Agriculture and Technical Instruction did in 1900, when it set about introducing its heuristic syllabus into the schools of Ireland. More detail on this will be given in Chapter Four.

In 1891, and later in 1896, Armstrong pushed his campaign on heurism further in two very important ways. First by getting involved with St. Dunstan's school and secondly, in the field of teacher training. Armstrong

---

[42] Eyre, J. V. *Henry Edward Armstrong, 1848-1937.* London: Butterworths Scientific Publications 1958, p. 270.

[43] Armstrong. *Suggestions for a course of elementary instruction in physical science,* p. 250.

certainly had good fortune on his side when in 1888 Charles Maddock Stuart, a chemist by training, was appointed as headmaster to a new school – St. Dunstan's in Catford, close to Armstrong's home in Lewisham, and attended by one of his boys. This was a surprising appointment for that time and extremely fortuitous for Armstrong. Stuart had been a pupil of Frankland, and had also done some of his scientific training in Germany, so it was not surprising that the two men had a mutual interest in heurism from the moment they met. As Armstrong had previously no experience in the field of school science, he now saw a glorious opportunity of becoming involved in the teaching of science at St. Dunstan's. Together with William Mayhowe Heller, a former pupil of Armstrong, they engaged in promoting a heuristic system of teaching there. Not only did it encompass science, but eventually geological geography and manual instruction in wood and metal. In 1890 Stuart wrote to Armstrong regarding a new pupil who had been trained almost entirely through laboratory work. In the letter he revealed the closeness of his ideas to that of Armstrong's:

> I have a boy in, by name Dowsett, who has been taught entirely in the Laboratory, and has never used a textbook in his life. Would it be asking too much if when the exam is over you could give me a criticism on his papers, rather on style than on subject-matter, and tell me if you think his ideas are after your own heart or not?... I am rather anxious to take this opportunity of adapting my methods to yours.[44]

In 1896 Armstrong was given permission to hold Saturday morning sessions for London science teachers at the Central Institution. Nearly 200 teachers attended the first two sessions, and the course was repeated over the following three years.[45] One of the men who attended these courses was Hugh Gordon. He had previously engaged in the teacher training project that Armstrong had helped set up from 1891 – 1894 in a converted rice mill at Whitechapel and was succeeded by Heller in 1894. Gordon went on to publish textbooks, the most relevant one being *An Elementary Course of Practical Science,* in 1893. Gordon had witnessed his syllabus being implemented in fifteen London Board schools between 1891 and 1893; this syllabus was based originally on Armstrong's British Association syllabus. A small note on Gordon's text-book mentioned above, is that it was designed to be read by the pupils themselves and was interspersed

---

[44] Copy of letter from C. M. Stuart Headmaster of St. Dunstan's College to Armstrong, June 15th 1890. Source: Imperial College Archives, London.

[45] Brock, p. 28.

with articles from newspapers designed to show to the pupils the day-to-day relevance of the practical work they were engaged in. It would appear that by 1902, Armstrong's 'heuristic-crusade' had achieved its zenith, for there was,

> ...considerable evidence that his campaign to introduce the heuristic method into the schools was meeting with success. Many schools had been equipped with laboratories for practical science and it had been shown that large classes and the requirements of external examinations were not incompatible with heuristic methods.[46]

Nowhere else had this been shown better than in the new Christ's Hospital. This school, which had previously been situated in the Greyfriars district of London, moved to a new 1,500-acre site near Horsham in Sussex. Armstrong persuaded the Council of Almoners of the school to be allowed to design the science buildings. He now had an opportunity not just to influence the theoretical methodology of his heuristic system, but also to determine the physical environment in which it could be employed. His influence in this particular endeavour was remarkable. For the first time in an English school, science was on the same par as other subjects. It was taught in the most heuristic fashion possible, so effectively, that many other subjects, such as languages, history and geography, were taught heuristically also. He would remain a governor of Christ's Hospital for almost forty years. More detail will be given on this in the next section.

1.6 What would a 'heuristic classroom' have looked like during this period?

In his paper *Representing and re-presenting science education*, Nott states: 'The problem is not understanding the rhetoric of heurism but trying to understand just what heuristic teaching 'looked' like.' [47] In an attempt to understand what this heuristic methodology meant, I would like to attempt to bring the reader into a science classroom in the early nineteen hundreds. The textbooks and the methodologies employed as well as the examination papers presented will be discussed, with reference to original material. It is hoped that in this way it will become clear what heurism meant on a day-to-day basis in the science classroom and laboratory.

Firstly there would have been very little evidence of pupils' textbooks as Armstrong's idea on their use was that they defeated to an extent the heuristic idea of the pupil as a discoverer. If the information that the

[46] Jenkins, E. W. *From Armstrong to Nuffield.* London: John Murray, 1979, pp. 42-43.



Plate 2. Pupils working heuristically under the Department. Clongowes Wood College chemistry laboratory, 1902.

pupil sought could be found in a textbook, then the practice of experimentation and enquiry would be 'short-circuited'. Consequently, to employ heurism to its fullest extent meant doing away with any form of written reference other than that of the pupils, which they would keep as a record of their personal work in the classroom and laboratory. This could then be assessed during the school year.

The Irish Teachers' Journal expressed this very point as early as 1900:

> We have already dwelt on the importance of Note Books, and these must be kept by all the classes from the start. The essence of the notes is that they must be the exclusive work of the pupils. The teacher, as we have stated in a previous issue, may give specimen notes as a model for the children to imitate, but he should never give them notes to copy. This is one of the points in connection with science teaching which must be rigidly adhered to.[48]

Most teachers would have used some type of formal reference material. One such book (already referred to in the Preface) was that written by George Watson who was senior chemistry master at Clongowes Wood College in 1909. His book echoes a form of heurism that was used during this period. It is a manual of chemistry experiments, laid out in a logical fashion, with some of the pages uncut. Within these uncut pages lay the results of experiments that the pupils carried out themselves, and only when the teacher was satisfied could the pages be cut open to reveal the 'ideal' results. The experiments contained in the book are the study of salt gas, study of chlorides, equivalents, water, nitric acid, sulphuric acid and ammonia, and the action of nitric acid on metals. Tables, where present, are left blank for the experimenter to fill in. In the Preface, Watson makes it quite clear in heuristic terms that:

> It is manifest that the utility of experimental science from this point of view will be seriously impaired if the pupil has already obtained from a perusal of the pages of an ordinary text-book, where facts and theories are arranged together, a preconceived idea of the result of his experiment, and the nature of his inferences.[49]

Another form of textbook, which also proclaims the same heuristic theme, is *Notes on the First Year's Course in Introductory Chemistry for Intermediate Schools*, by Frederick Cramphorn, who was the senior

---

[47] Nott, p. 1.
[48] *Irish Teachers' Journal,* November 17th 1900, p. 4.
[49] Watson, G. *A Second Year Course in Chemistry for Intermediate Schools*. Dublin: Browne and Nolan Ltd. 1909, p. iii.

science master at King's Hospital, in Dublin. It was also published by Browne & Nolan in 1902. The emphasis of this book as gleaned from the preface is that of pupil-centred learning through practical work.

> Most text-books in elementary practical science contain too much information, and therefore do not leave sufficient scope for original observation and thought on the part of the pupil, who often knows in advance what to expect as the result of an experiment, and this knowledge may have considerable effect in shaping his result. The present work in an attempt to remove this objectionable feature.[50]

What is interesting here is that, as in Watson's book, pupils were expected to fill in blank pages at the end of experiments as they discovered more about the topic they were working on. Tables related to experimental work were also left incomplete, for the pupils to fill in, and every alternate page is left blank on both sides for the pupils' own notes.

Both these textbooks demonstrate the central concept of heurism, that the pupils themselves discover new facts by the act of carrying out experiments in the laboratory. The results of these experiments were unknown to the pupil initially, and when all the work was complete led to a new learning experience.

In the classroom pupils were expected to have a notebook or paper to hand. The teacher began by stating the problem and asking of the pupils whether some past experience of theirs could be used to help solve it. Supposing this involved the balance, then the teacher might ask them what they knew about scales and how they were used. The construction of the balance and the optimum method of using it might lead to weighing an object and recording the result. A pupil could then be called on to read out the result and class agreement sought. A pupil who disagreed with this result could be asked for another reading and the class called on to criticise this answer, and so on, until a general consensus was arrived at. The master had to be careful not to lead the class too much and allow the pupils to see that the readings they recorded were governed by immutable laws of science and not by the teacher's learned opinion. The results could be written on the board, variations noted with a discussion on the latter. This could lead to suggestions from the pupils themselves of ways in which the work might be made more accurate. The experiment could then be repeated along the lines of the new suggestions and so on.

---

[50] Cramphorn, F. *Notes on the First Year's Course in Introductory Chemistry for Intermediate Schools.* Dublin: Browne & Nolan, 1902. From Preface, no page number given.



Plate 3. Pupils working heuristically under the Department. Clongowes Wood College physics laboratory, 1902.

The pupil's own results along with those obtained by others could then be written into the notebook for comparison. The object of this was for the pupils to regard their readings as valuable. Stress was placed on the need to avoid the pupils perceiving that there was a 'right answer' that they ought to have got. Each experiment led to questions which in turn led to fresh inquiries, and thus there was continuity in the class-work and the habit of researching was inculcated in order to seek more and more useful knowledge.

In the laboratory the pupils could either work in pairs or separately. If in pairs it was advisable that one of the pupils should have good knowledge of the work and the others not as much. Talking among pairs was to be encouraged – unlike other classes, and pupils could be given the task of handing out apparatus and chemicals as a privilege. At the conclusion of the work these same pupils could then collect and tidy up material and apparatus distributed earlier. This form of delegation could be done on a rotational basis. Having outlined the work to be done, each boy wrote down what was to be found out, how he intended to do this and the type of answer he expected to determine. An account of the experiment was written out in the pupil's notebook along with a drawing of the particular piece of apparatus. With lower classes a diagram of the apparatus could be drawn on the blackboard and explained by the teacher. Neatness and accuracy of notebooks was emphasised. These notes were to be written during the actual experimental work and the science master could walk around the class inspecting the work to the required level of satisfaction.[51]

The closest idea we can get to Armstrong's heuristic practices as observed in the classroom come not from the man himself, but rather a close personal friend. Chas. E. Browne, who was a former research student of Armstrong's at the Central Technical College in 1897, and who later found himself teaching under a 'payment by results' system at the Robert Gordon College, Aberdeen. Writing to a friend in the Central, Browne described the conditions:

> Financial grants to the College were dependent on examinations; inevitably what most mattered in the eyes of authority was that the maximum number of students should be able to memorise enough facts related to the syllabus to gain a pass. To cram, not to impart understanding, was the order of the day.[52]

---

[51] Norwood, C. & Hope, A. H. *The higher education of boys in England*, London: Murray, 1909, pp. 388-392.

[52] Nott, p. 39.

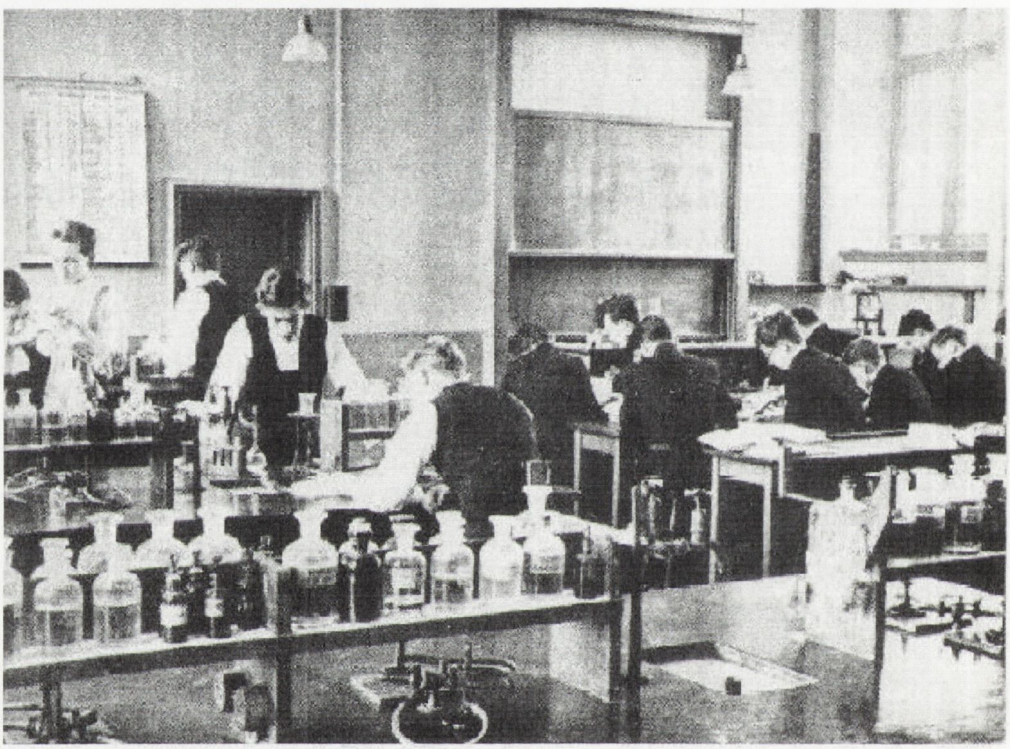

Plate 4. The 'Davy' laboratory at Christ's Hospital School which was designed by Armstrong. Note the separate workbench and writing bench arrangement.

It will be seen that a similar system of science instruction under the Intermediate Board was being carried out in Ireland at this time also. This letter was shown to Armstrong, who was obviously impressed with the sentiments expressed in it, and managed to convince the headmaster of Christ's Hospital in Newgate Street that Browne should be the next head science master. Together in 1899 both men along with Heller planned the new science 'workshops' to be built on the grounds of the new school at Horsham. It was the ideal partnership, Armstrong with his theoretical ideas on teaching science to children heuristically, and Browne the consummate practitioner in the day-to-day running of a science classroom.
A similar type of relationship existed between Armstrong and Heller. When the new science building came into use, it was a two-storey structure containing four large laboratories; each named after great British scientists, Davy, Faraday, Cavendish and Dalton. Each room was about 60 feet by 30 feet, and had smaller rooms adjoining them for stores, and special work. The boys would spend most of their time at the practical benches and their notes were written up at adjoining desks. There were also movable trestles, which were about chest high with flat tops for writing and could be adapted to face the blackboard. The idea was that the boys could discuss possible experiments or the results of experiments with both the teacher and peers at the blackboard and the teacher could then lead them heuristically on a 'voyage of discovery'.[53] Initially, owing to a shortage of science teachers trained in the heuristic method, only junior classes were taught in this way. Browne was the sole science teacher, teaching elementary science to '...lower forms and the less academic students'.[54] Gradually however, with Armstrong's persuasion more science personnel were employed in order to both expand the science teaching and to keep the class sizes to sixteen (as opposed to twenty-five in the other subjects). Each class had two periods of science per week, each period lasting one and a half hours.[55] For both Armstrong and Browne '...heurism was about learning attitudes and capabilities'.[56] The pupil's objectives according to Browne's notes (which survive to this day) were,

---

[53] Ibid., p. 46.
[54] Nott, M. *Rediscovering Armstrong's heurism.* Paper read at the NARST conference, March 1999, p.9.
[55] Ibid., p. 8.
[56] Ibid., p. 10.

> ...a reason for doing something that seems worthwhile. Has intrinsic interest based on curiosity to find out something involved in doing an experiment. To solve a problem that is clearly understood, and simple enough to require very little experience, or little apparatus.[57]

It goes on to detail the '...lessons to be learned from experimental work', and list the following attributes:

1. How to draw conclusions – commenting on results.
2. Habit of studying or criticising results of experiments – leading to questions that entail further research and experiments or reference to books for further information.
3. How to generalise – statements made to cover a large number of cases, a formula, a generalisation.[58]

Nott sees in these course outlines emphasis on reliability and validity, (a carry-over from Armstrong's life-experiences) and certainly from Browne's own clarity about aims and objectives, Nott also saw the role of the 'educator' as crucial:

> Teaching principles: Simple guidance, suggestion – mainly by questions, no telling – Teacher's attitude one of co-inquirer – must not be an authority. If a fact or data has to be given – it should be obtained from a book, and the authority quoted, thus lead to right use of books – for checking up and enlarging experience, it enables a teacher more easily to assume the role of inquirer, as much as he wants the boys to do.[59]

This system of heuristic instruction that Armstrong had introduced at Christ's continued right up to the end of the 1940s. One of the present trustees, and a past pupil of the school or 'Old Blue', swears that even then, when he attended classes that he did not have any formal lessons beyond the 3rd form. He simply researched topics that he was guided to as relevant to his studies.[60] One of its more illustrious past pupils was Barnes Wallis, who attended the school between 1900 and 1904, most famous for his invention of the 'bouncing bomb' used so successfully by the Allies on German dams during the Second World War. Writing in the 1953 "Christ's Hospital Book", he stated:

---

[57] Browne, C. E. *Elementary Science Teaching introduced in the Christ's Hospital Science School*, (From Christ Hospital's Archives). May 1899, p. 1.
[58] Nott, *Rediscovering Armstrong's heurism,* p. 2.
[59] Ibid., p. 2.
[60] Interview with T. Hogarth-Smith, archivist at Christ's Hospital, 23rd July, 2002.

> Science at Christ's Hospital began more than fifty years ago... under the direct supervision of a great scientific educationalist, the late Professor H.E. Armstrong, F.R.S., having as a brilliant assistant 'Uncle Chas' Browne.[61]

The heuristic method which Armstrong advocated was in the opinion of Wallis,

> ...designed essentially for boys whose intellectual powers are above rather than below the norm...if he is to devise and carry out his own experiments every boy must have some manual skill; moreover, Professor Armstrong believed that the theoretical aspects of science are more easily grasped when accompanied by practical experience.[62]

Wallis goes on to describe what a heuristic laboratory looked like in Armstrong's day,

> ...the apparatus used by a boy could stand assembled on his bench for weeks at a time, for indeed a whole term might well be devoted to attempts at finding out for oneself secrets that Nature would reveal only to the genius of a Faraday or a Davy.

The legacy that this particular set-up left behind was described by Wallis, and shows just how different this method of science instruction was in comparison to more modern ones:

> The modern mixture of class demonstration and individual experiment, involving as it does quick changes of many sets of apparatus between one class and another, finds us with store-rooms and cupboards that are too small and inconveniently placed, draw-backs that are magnified to the point of actual hindrance by the now acute and permanent shortage of laboratory assistants.

Another primary source of insights into Armstrong's use of heuristic methods is in the notebook of one of his student teachers. Martha Annie Whitely attended a teacher-training course held at The City and Guilds' Engineering College, for science mistresses of the Girls' Public Day School Company in 1897. Armstrong gave a course of practical work there, and corrected each of the practical books. The pages of her laboratory notebook are littered with Armstrong's comments written on them. They provide an insight into his approach as to how he expected teachers to teach pupils heuristically. There are two hundred pages in the practical book and there are three sections listed under 'Contents'; Air, Fire, Earth, and Water.

---

[61] Browne. *Elementary Science Teaching introduced in the Christ's Hospital Science School,* p. 12
[62] Ibid., p. 12

One does not have far to look before one encounters Armstrong's handwriting beneath this listing. Stated quite simply two sentences sum up his feelings on what follows in the book:

> Emphasis may well be laid on here on the fact that much has been learnt about things – what they are like and so on. But it is impossible not to see that many things change and curiosity is hence excited about the doing of things.[63]

Apart from the occasional grammatical correction, Armstrong's comments appear randomly in the practical write-ups. In an experiment which was done to show the increase in mass of iron nails due to rusting, he makes the following comments at the end of the experiment following from the results of the measurement made of various masses, '...not as seemed possible at first, by a loss in weight. It is important to recall the motive of the experiment, and correct it; and also to dwell on the discovery made and emphasise its importance'.[64]

Later under an experiment to show the volume of air used to allow a candle to combust, he makes the following comment; 'In this case, the reason for making the experiment in the particular way adopted should be explained.'[65] The fundamental issue was that in the acquisition of scientific knowledge all the senses had to come into play. The sense of touch was all-important in that it assisted the eyes in the learning process. Variety in the work was emphasised in order to include all senses, and this was seen as a reason for including more advanced experiments with junior classes. If the teacher chose to demonstrate the experiment to the class rather than let them perform it themselves, he was advised to pass the apparatus around to allow the class to handle and examine it.

We also get glimpses of Armstrong 'at work' in a heuristic fashion from some recollections of his pupils. One of these was E.M. Rich (later to work in the technical instruction branch of the newly established Department of Agriculture and Technical Instruction in Dublin), who described his first encounter with the 'teacher':

> I well remember my first brushes with him. I came to the College with a very good secondary school examination record and primed with a considerable stock of knowledge of chemical facts. To be asked to heat a small piece of sugar on Platinum foil and to record all I saw seemed very

[63] Martha Annie Whitely's practical science notebook, 1897. Source: Imperial College Achives, p. 1.
[64] Ibid., p. 9.
[65] Ibid., p. 21.

small beer. When, however, he showed me that I could not conduct such a simple experiment as that at all scientifically and that in my observations I had missed far more that I had seen, I realized that my examination records were of small value and that I was very much the new boy. I thus soon became reconciled to be led by him through detective methods to discover the facts in connection with the "iron rust murder", and with the "profound" (I use his word) change which takes place when chalk, or shall I call it "chalk stuff," is strongly heated.[66]

1.7 Armstrong and the British Association

Armstrong's system of heuristic teaching employed by both the National Board and the Department can be traced to the report of a Committee appointed by the British Association for the Advancement of Science. That Committee was instructed to inquire into and report on the methods that were used for teaching science in schools at that time. Armstrong sat on this Committee. A preliminary report was presented in 1888, and in the two years following this, further reports were published. Following this the Committee stated that:

> In order that the study of physical science may effect this mental education it is necessary that it should be employed to illustrate the scientific method in investigating nature, by means of observation, experiment, and reasoning with the aid of hypothesis; the learners should be put in the attitude of discoverers, and should themselves be made to perform many of the experiments.[67]

This phrase '...the learners should be put in the attitude of discoverers', is the core belief of Armstrong's heuristic methodology. It was also stated that lessons should have relevance to subjects which were easily understood by the pupils. Examples and illustrations should be taken from everyday life and consequently mean more to the observers. Chemistry was targeted as the most adaptable subject for this mode of instruction, and that a course comprised mainly of chemistry would be the most useful '...in developing logical habits of thought'.[68] It was also felt that measurement should form a critical part of this instruction, particularly in the formative years.

---

[66] Rich, pp. 84-85.
[67] *Irish Teacher's Journal*, August 1902, p. 4.
[68] Ibid., p. 4.

The *Irish Teachers' Journal* in 1902 made reference to this preliminary report when it stated: 'On this report the system of Heuristic teaching of science is based, and Professor Armstrong has since taken a leading part in the promotion of scientific teaching'.[69] It continues:

> The recommendations of the British Association Committee have been adopted in many schools in Great Britain. A course almost identical with that recommended by the Committee has been introduced into National Schools, and an almost identical course has been prescribed for Intermediate Schools. All over the country Laboratories are being fitted up at great expense.[70]

Armstrong came to Belfast in September 1902 as President of the newly established Section L – Educational Science (he had been the instigator for the establishment of this Section) and on the 11th September he delivered his opening address to those assembled, some of whom would probably have been greatly involved in the promotion of school science in Ireland during this period. These were exciting times as the formation of this section in the previous year testified to, as in Armstrong's words:

> Section L (Educational Science) is in advance of the times, being concerned with a non-existent science – the Science of Education. The science will come into existence only when a rational theory of education is developed and applied; but it is clearly on the very eve of coming into existence, otherwise the Section could not have been established; and we may contribute much to its development.[71]

Addressing the subject of Experimental Science he had this to say:

> The fifth subject, which may be considered as an essential part of a sound general education, is Experimental Science, that is to say, the Science of Physics and Chemistry treated experimentally. As a means of mental training, and also viewed as useful knowledge, this may be considered a necessary part of the intellectual equipment of every educated man, and especially so of the office, whose profession in all its branches is daily becoming more and more dependant on Science.[72]

He went on to expound the heart of his heuristic philosophy:

> Just consider what this recommendation means: that it is now publicly admitted by high authority

---

[69] Ibid., p. 4.
[70] Ibid., p. 4.
[71] Report of the 1902 Belfast Meeting (72nd) of the British Association. London: John Murray, 1903, p. 827.
[72] Ibid., p. 828.

that all boys have the opportunity given to them at school of gaining knowledge by experience – by actually doing things themselves, not merely by reading about them or being told about them, because this and nothing short of this is what is aimed at by all who advocate the introduction of Experimental Science as a necessary part of school training.[73]

However, the part of his speech which addressed the Irish situation is perhaps the most interesting of all. Armstrong appeared to have had a very high regard for what the Irish educationalists were attempting to do and the facility of the Irish intellect in accepting it.

> Ireland is fortunate at the present time in that far-reaching changes are being introduced into its educational system. A body of men are engaged in this work who are, I believe, in every way specially qualified to promote reforms and earnestly desirous of developing a sound policy. The Irish people have rich powers of imagination such as no other section of the nation possesses: it is only necessary that these powers be trained to considered and balanced action to make the Irish capable of deeds before which the splendid achievements of the past will appear as nothing.[74]

He warned against the expectation of results within a short time-frame: 'Of course the development of a true policy must come about slowly, and we must not be too impatient of results, but give every encouragement and all possible support to those engaged in the work.'[75]

The next day William Mayhowe Heller who had been charged by the National Board with organising the introduction of elementary science into the National School system, and who (as noted earlier on page 13) was a past pupil and professional colleague of Armstrong's, spoke on his work to date:

> The position of educational affairs in Ireland to-day is one of extraordinary interest. Not only have revolutionary changes in administration of primary and secondary education recently occurred, but far-reaching modifications in curricula and methods of instruction been introduced.[76]

In his closing remarks Heller made a direct reference to technical instruction and the role of his work in the primary sector:

---

[73] Ibid., p. 828.
[74] Ibid., p. 842.
[75] Ibid., p. 842.
[76] Ibid., p. 845.

> Practical instruction in the National school is to-day in Ireland, among many educational problems of importance, probably one of most urgent importance, in that upon its successful introduction depends the future of technical instruction.[77]

By 1908, at the Dublin meeting of the British Association for the Advancement of Science, a committee which had been set up five years previously, as a result of the 1902 Belfast Meeting, and which included Heller (Secretary) together with Armstrong and George Fletcher [78] of the Department of Agriculture and Technical Instruction, (DATI), reported on the work they had pursued with respect to its brief; namely, '...studies most suitable for Elementary Schools'. The chairman in his statement said:

> The Report has been drawn up by Mr. Heller.... very properly refers to the successful efforts of Professor Armstrong during the last twenty years to improve the method of science teaching in our schools. It emphasises the contention of the Committee that the spirit of scientific inquiry must pervade our school teaching if effect is to be given to the educational reforms which we have recommended.[79]

With George Fletcher participating on such a committee, it is most likely that the views and experiences of both Armstrong and Heller, as revealed in their discussions must have had a strong influence on him. To what degree is difficult to ascertain, however the workings of the Department at this time might be an indication of just how strong this influence was. The fundamental principle which this Committee was trying to advocate was that work requiring manipulative skill should become the dominant feature of the curriculum. School lessons were to be primarily practical, and the emphasis was to inculcate accurate observation and correct reasoning. The practice was to precede theory, so that the explanation of any exercise was to follow the ability to perform it.

The report of this Sub-Committee also outlines the choice between heuristic and didactic methods in the strongest tone yet. The method of experimental inquiry is the only natural method of gaining knowledge of scientific facts but such a method is the very antithesis of the didactic method of instruction too generally in vogue.[80]

---

[77] Ibid., p. 846.
[78] George Fletcher was assistant secretary in the Department of Agriculture and Technical Instruction, Dublin, from 1904 until 1922.
[79] Report of the 1908 Dublin Meeting (78th) of the British Association. London: John Murray, 1909, p. 498.
[80] Ibid., p. 501.

At the same meeting another committee which examined the sequence of studies in the Science Section of the Curriculum met. The secretary of this committee was a colleague of Armstrong's, C.M. Stuart, Headmaster of St. Dunstan's School, at which Armstrong's sons had been educated and who had implemented a heuristic policy in science instruction with the co-operation of Armstrong. The results of a questionnaire which had been circulated and which had inquired into the actual practice adopted and the ideal plan of studies advocated by science-masters in selected public schools of various types was examined. In the resulting published report, the following points emerged with respect to textbooks:

> The reports received are clear and emphatic that textbooks are not used, and ought not to be used, in the youngest classes. They are equally clear that text-books are used in the higher classes...There is a loss of keenness on the part of the boys who can find the result of an experiment in the book before they perform it. On Present Methods of Teaching – Laboratory work is universal, and the importance of boy-made notes is frequently mentioned... Almost everyone appears to have tried the heuristic method of teaching, particularly in connection with the chemical side of problems in the laboratory.[81]

The opinions and recommendations of the sub-committee included the following:

> The attention universally given to laboratory practice and to the development in the boys of the powers of *doing* and *describing* deserves nothing but praise. The considerable degree of freedom given to teachers has clearly encouraged independent experiment and thoughtful criticism as regards their work. The resulting variety and elasticity in their methods is, in our judgement, a good feature which we wish to preserve.[82]

Professor L.C. Miall, in his address as president to the educational section stated:

> Dr. Armstrong's heuristic method is well known in this section. He tells us that neither the name nor the thing is altogether new, and the same may be said of nearly every educational expedient... It is now a good many years since I saw Mr. Heller give several lessons on this plan in elementary schools in London, and was then permanently convinced of the real value of the heuristic method. I only wish that we had a score of such, each worked out as carefully as Dr. Armstrong's model.[83]

---

[81] Ibid., pp. 530-531.
[82] Ibid., p. 533.
[83] Ibid., p. 926.

He then continued and revealed in his over-enthusiasm for the heuristic methodology a real danger of this particular system of education if placed in the hands of a fanatic:

> The advocates of learning by inquiry and learning by doing will descend even into the nursery. What an opportunity is afforded by toys! – an opportunity that those who purchase all their children's toys throw away. Surely every little girl ought to be encouraged to make plausible dolls out of the rag-bag, every little boy to make his own menagerie, his own boats and whistles and sledges. Even the bought toy gives opportunity for inquiry. Ask any child if he has noticed that the animals of the Noah's Ark are always thicker at one end, usually the hinder end. There is a reason for this, and a curious reason, which the child may be helped to discover.[84]

Speaking eighteen years later in Cardiff, the new president, Sir Robert Blair, who had been involved in the early years of the Department of Agriculture and Technical Instruction, was critical of the role of, what he saw as non-educationalists who used current ideas based on psychology to further their educational agenda:

> The value to education of science and the scientific method has hitherto been for the most part indirect and incidental. It has consisted very largely in deductions from another branch of study, namely, psychology, and has resulted for the most part from the invasion into education of those who were not themselves educationalists.[85]

Armstrong's heuristic methodology became so popular at the turn of the twentieth century that it was even taken up and practised in Japan.

> English science education has influenced the development of science education in Japan on at least three occasions since the modern system of education was adopted there in 1872...and when the heuristic method of Henry E. Armstrong was particularly influential.[86]

1.8 Inherent weaknesses in Armstrong's heurism applied in the classroom

One of the main problems which many saw in the whole-hearted adoption of the heuristic methodology was in the means of assessment in a formal or even semi-formal framework. How could one examine

---

[84] Ibid., p. 927.
[85] Report of the 1920 British Association .Cardiff Meeting, p. 191.
[86] Terakawa, T and Brock, W. H. *The Introduction of Heurism into Japan*, History of Education Vol.7 No.1, 1978, p. 35.

pupils on such a course proposed by Armstrong? When one examines the 'Christ's Hospital Experiment' it becomes evident that one of the immeasurable aspects of heuristic teaching is in the evaluation of the impact of the teaching on the pupils. In fact the truth of the matter is that by 1908, heuristic methods at Christ's Hospital had to be streamlined in order to facilitate the Board of Education's 'School Certificate' examination system. What developed as a consequence was what one could call 'part-time heurism', in which '...periods of heuristic activity to fertilise the rest of the scientific teaching' [87] occurred.

One of the many fatal blows against Armstrong's heuristic methodology according to Brock was this examination system.

> Yet it must be admitted that by 1937 the heuristic method, as originally conceived, had vanished, killed by the examination system, and the collective criticisms of the new psychology, the general science movement, and brilliant writers like Westaway; while as another war and the need for fresh stringent economies closed the 1930s, some teachers again questioned the British emphasis on, or obsession with, laboratory teaching.[88]

Even the great experiment at Christ's Hospital had to finally accede to the examination system.

Another criticism of the use of heuristic methods was the amount of time that this form of science instruction took with a class. Heller was very much aware of this, yet felt that this sacrifice was necessary as a means to an end,

> ...the ground covered must be very small compared with ordinary methods. Any attempt to accomplish on heuristic lines the work of an ordinary syllabus in the ordinary allotment of time must end in failure.[89]

Convincing practising teachers that the method was more important than the time given to it must have been very difficult. Such teachers would not have been interested in heuristic methods. The following little story will illustrate the kind of difficulty in which Armstrong occasionally found himself as the result of his reforming campaign. At a conference in Ireland the Professor had been advocating the value of the heuristic method and urging that children should be led to discover things for themselves rather than they should be turned into sponges simply absorbing facts. At discussion time this brought to his feet that witty Irish

---

[87] Brock, p. 33.
[88] Ibid., p. 50.
[89] *Irish School Monthly*. Science by Scientific Methods, Vol. 1, No.4. December 1900, p. 115.

educationalist Monsignor Molloy, who enquired whether the Professor really meant that a child should not be told anything which it was possible for him to discover himself. In an unguarded moment the Professor nodded assent, whereupon, amidst loud laughter, in which the Professor joined heartily, Molloy remarked: 'Then he would not tell a boy that Ireland was an island, because he could take a boat and sail around it.'[90] Some of Armstrong's views certainly appear quite radical. 'Gradually I would have nearly all class-rooms converted into workrooms or workshops'.[91] (He never referred to laboratories as anything other than workshops). Another weakness in his heuristic system was that girls appear to have been restricted to such subjects as domestic economy and the likes. Armstrong had quite strong views on the education of girls, in that they ought to be educated with a view towards domesticity rather than for a career outside the family home. In his introduction to Armstrong's biography, W.H. Brock refers to a remark Armstrong's son made in this regard: 'He had little interest in the higher education of women, holding the conservative view that every woman should be a cook.'[92] Hence the emphasis on domestic economy, and girls certainly were not treated on a par with boys. This seems to have been the case in the early years of the Intermediate system that was implemented in Ireland in 1878[93].

His system of heurism was not without its opponents, some of whom were well known and respected scientists of their time. William Ramsay, (who was involved in the discovery of the noble gas argon), said,

> ...it is not to be expected that an average schoolboy should make out such deductions for himself...I believe in facts; and I believe that the basis of theory is not grasped until the facts on which they rest have been learned.[94]

And J.J. Thompson writing in 1918, also vigorously opposed heuristic methods on the grounds that, '...much of this waste of time is due to a conscientious desire of the teachers to encourage the spirit of inquiry by following the so-called heuristic method.'[95]

---

[90] Rich, p. 87.
[91] Brock, p. 72.
[92] Brock, as quoted from J.S.C.I., 60(1941), p. 84.
[93] Armstrong intended his heuristic method of science instruction for boys only, consequently this is the primary focus of this thesis. However, the National Board's and the Intermediate Board's curricula for science instruction included girls.
[94] *Chemists through the years Part I.* Royal Society of Chemistry, edited by Douglas Servant, RSC Education Division. London: 1994, p. 1.
[95] Ibid., p. 2.

Another viewpoint expressed is that the success of Armstrong's heuristic crusade was due in part to the personality of the man himself, and that for heurism to work in the classroom, a very particular character of teacher was required. Armstrong himself was 'larger than life', and this facet of him would doubtless have greatly aided his cause. He was a 'character', an individual who was so much the product of a slower age that many of the twentieth-century generation must have found his mannerisms and ideals odd and irrational. His rude 'bedside' manner was usually, however, a deliberately aggressive tactic to disturb scientific or educational complacency.[96]

Whatever the various viewpoints, by the late Summer of 1916 the mood of science educators was turning from the heuristic methodology of Armstrong's towards a broader view of 'general science' as it was soon to become known. The committee, which J.J. Thompson headed, began its investigation in August 1916 into the 'Position of Natural Science in the Educational System of Great Britain'. Their final report was published in 1918 and it indicated that the school science courses had become too narrow. The heuristic method which favoured the pupils discovering for themselves rather than witness demonstration experiments led to a 'great waste of time.'

> Much of this waste of time is due to a conscientious desire of the teachers to encourage the spirit of inquiry by following the so-called heuristic method; the pupils are supposed to discover by their own experiments, with little or no suggestion from the teacher, the solutions of problems set to them or of problems which they themselves suggest. The spirit of inquiry should run through the whole of the scientific work, and everything should be done to encourage it, but it seems clear that the heuristic method can never be the main method by which the pupil acquires scientific training and knowledge. He cannot expect to rediscover in his school hours all that he may fairly be expected to know; to insist that he should try is to waste his time and his opportunities.[97]

1.9 Armstrong's connection with education in Ireland

Armstrong's first recorded encounter with Irish educational matters would appear to have occurred on 20th March, 1897, when along with William Mayhowe Heller, he was interviewed by the Royal Commission on

---

[96] Brock, p. 52.
[97] Ibid., p. 47.

Manual and Practical Instruction in Primary Schools under the Board of National Education in Ireland, (The Belmore Commission). Armstrong at that time was Professor of Chemistry in the City and Guilds of London Institute and Heller a Science Demonstrator with the School Board of London. One of the Commissioners who sat on the interview board that day was Professor George Francis Fitzgerald, professor of experimental physics at Trinity College Dublin, and a good friend both personal and professional of Armstrong. During the course of the interview Armstrong gave his views liberally on such matters as the teaching of Agriculture, Geography, Inspection and the Results Fees System, Object Lessons and Science Instruction.

The day before this interview, the Commissioners had seen Heller's work first-hand:

> The Commissioners proceeded to Rutland Street School, Whitechapel, where they inspected experimental science classes under Mr. Heller; afterwards they visited Mr. Heller's Laboratory, in Berner Street, where an explanation was given by Mr. Heller of the system of experimental science teaching in certain primary schools under the London School Board.[98]

With the consequent setting up of elementary science in the National Schools in Ireland with Heller as the Head Organiser, Armstrong's direct connection with Ireland began in the implementation of his heuristic methodology through the work of his past pupil.

In 1902, whilst attending a conference of science teachers in Belfast as President of the Educational Section of the British Association, Armstrong came into contact with Br. James Dominic Burke, a Christian Brother who had been teaching his own brand of experimental science in the North Monastery School in Cork City since the mid 1860's. The circumstances of this meeting are documented in the Christian Brothers Education Record at that time. During the Cork Exhibition of 1902, Br. Burke was requested by the newly formed Department of Agriculture and Technical Instruction to join in their section and '...illustrate with them the course of Practical Physics, Chemistry, and Manual Instruction,' [99] which they were then engaged in. The Department fitted up both a Laboratory and Manual Workshop, adjoining each other, which were divided only by a partition. Phillip Harris & Co prepared the laboratory with

---

[98] Copy of 13th and 14th Meetings of Royal Commission on Manual and Practical Instruction in Primary Schools under the Board of National Education in Ireland (The Belmore Commission), March 19th - 20th, 1897. Appendix F. Digest of minutes of evidence, p. 434. Appendix 1, p. 123.

[99] *Christian Brothers Educational Record.* Dublin: William J. Alley & Co., 1903, p. 174

'...experimenting tables, fittings and instruments, at a cost of £500, as an advertisement'.[100] The Christian Brothers themselves supplied both rooms with '...diagrams, samples of timbers, and specimens of wood-work, and hand and eye training executed by their pupils' some as far away as Nenagh and Waterford. Intermediate classes each day in rotation walked from the North Monastery down to these prepared rooms, and classes were conducted by the Brothers under the watchful '...gaze of a constant flow of visitors passing through the Exhibition'.[101]

Lessons were given on Tuesdays and Thursdays, with some on other days, from 2 p.m. to 4 p.m. and on every Saturday night from 8 p.m. to 10 p.m. This continued for the duration of the Exhibition, which lasted for six months.

On the second day of the conference in Belfast, Armstrong left it to travel to Cork, and met Br. Burke, who not only showed him the work of his pupils at the Exhibition, but also showed his eminent guest around the North Monastery. The greatest tribute to Br. Burke must be the fact that on the final day of the conference back in Belfast, Armstrong stood up and addressed the entire assembly with the words: 'Stop talking, and go down to Cork and study the work carried on by Br. Burke'.[102]

---

[100] Ibid., p. 174.
[101] Ibid., p. 175.
[102] Kelleher, D. V. *James Dominic Burke – A pioneer of Irish Education*. Dublin: Irish Academic Press, 1988, p. 144.



Plate 5. The Natural Philosophy Hall, Clongowes Wood College in 1902. This was used as a science demonstration room pre-1900.

Chapter 2

Science Teaching in Irish Education 1878 – 1900

2.1 Introduction

Prior to the Intermediate Education (Ireland) Act of 1878, there was very little, if any, science teaching in the Irish Intermediate schools. Apart from a natural philosophy course that was taught in a number of private schools, the little science instruction that was carried out occurred mainly in the model schools and in a number of ordinary national schools.[1] By 1878 there were quite a large number of Intermediate schools in Ireland, mostly set up by Roman Catholic religious bodies that were independent of any state control.[2] In the majority of the 55 Christian schools then being run by the Brothers, instruction for senior pupils was taken from the following list of subjects: Book-keeping, History, Geography, Globes, Drawing, Geometry, Mensuration, Algebra, Navigation and Natural Philosophy.[3] The Christian Brothers were leading the way in a practical-type of education mainly at the primary level, and the *Irish Times* writing of this particular endeavour stated:

> Before a text-book of Natural Philosophy was heard in the National Schools, the Brothers had large and well-supplied experimental laboratories equal in many respects to those found in important residential colleges. They were conscientious teachers, and their teaching was practical – a better blend of religious and secular instruction was perhaps never devised. The result was that when the Intermediate System gave them the opportunity of entering into public competition they swept all before them, and for the first time the staffs of the rich colleges discovered that a day school in the humblest quarters of Cork or Waterford or Dublin, was able to lead a grade or capture medals in literature, classics or science.[4]

Clearly the Christian Brothers were engaging in a radical form of education, and science instruction was no exception.

---

[1] *Irish Teachers' Journal*, 'Science teaching in schools'. July 26th, 1902 p. 5.
[2] Durcan, T. J. *History of Irish Education from 1800*. Bala, North Wales: Dragon Books, 1972, p. 133.
[3] Report of the Council of Education. Stationary Office, 1962, p. 40.
[4] Quoted in the *Irish Times* from *Edmund Ignatius Rice and the Christian Brothers*, Dublin: Gill & Son, 1926, pp. 482-483. (The date on which this passage originally appeared is not given).

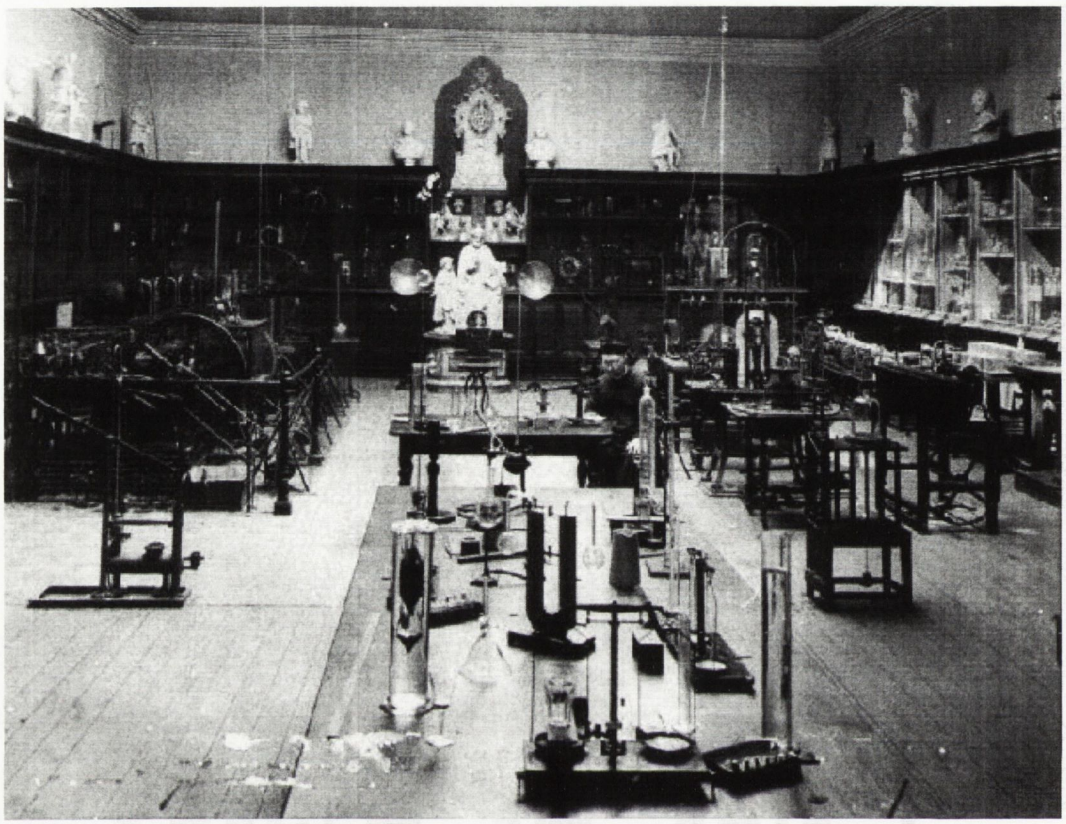

Plate 6. Br. Burke in the old laboratory, North Monastery School Cork. (Photograph courtesy North Monastery School archive).

For example, in his book on Brother James Dominic Burke[5] (a Christian Brother teaching science at the North Monastery School in Cork in the mid-1800s), the author Daniel Kelleher makes reference to Brother Burke and his own brand of practical science instruction.

> In one of his experiments it was necessary to use methylated spirits, and he asked one of the boys to take the temperature of the spirit. This he did by plunging the thermometer into the vessel and reading the scale after he had drawn it out, he gave the temperature as 47 degrees; another boy was called and gave it as 49 degrees, while a third made it out to be 49 degrees. Br Burke remarked how strange that such difference should be possible, and still more strange that the temperature of the room as shown by the instrument on the wall was 55 degrees. We could not solve the puzzle, but the lecturer came to our relief by explaining how the rapid evaporation of the volatile liquid created the cold, giving numerous applications in medicine, freezing machines etc., and showing that the temperature of such liquids should be read with the thermometer submerged.[6]

Br. Burke was indeed a remarkable teacher of science. At heart he was very similar to the pupils sitting in front of him in the classroom, always eager to amaze and astound, yet more than able to explain in simple terms what they had witnessed. He represented the type of teacher in which Armstrong placed so much faith and in whose hands he trusted the heuristic method. The reality was that teachers such as Br. Burke, were rare and those that did exist were far too few on the ground in order to make the necessary impact.

Under the influence of the Science and Art Department in South Kensington, pressure was being brought to bear on the Irish educational establishment. The rapid expansion of technical schools in England, which were organised and managed by the local authorities, allowed this department to turn towards the advancement of science instruction in secondary schools.[7] However, the vast sums of money that were allocated by parliamentary vote in order to achieve these aims had no such bearing on Ireland. Here the majority of the schools were engaged in the examinations set each year by the Intermediate Education Board, which had been set up in 1878 under the Intermediate Education (Ireland) Act.[8] Although some

---

[5] Detail on Br. Burke's involvement with heurism will be given in Chapter 5, section 5.7.

[6] Kelleher, Daniel V. *James Dominic Burke – a pioneer of Irish education*. Dublin: Irish Academic Press, 1988, p. 48.

[7] Birch, P. Personal notes from first draft of his book, *History of St. Ciaran's College*, Kilkenny. St. Ciaran's College Archives, p. 67.

[8] Wallace, J. 'Science Teaching in Irish Schools 1860-1970'. *Irish Journal of Education*, 1972. p. 51.

schools operated under both grant schemes, teachers generally preferred to remain with the Intermediate Board and earn larger grants rather than change their courses in order to secure smaller grants with the Department of Science and Art. It was not until twenty-two years later with the establishment of the Department of Agriculture and Technical Instruction, that a major change in the perception of the Intermediate school educators towards the teaching of science subjects would occur.

2.2 St. Kieran's College and the South Kensington Examinations

The Department of Science and Art had been set up as a Science Division in 1853 after the Department of Practical Art had been established, mainly as a result of the public and political outcry following the Great Exhibition of London in 1851. Proof that Great Britain was behind other countries industrially and scientifically, particularly those countries that traded competitively with her, was evident at this exhibition, so the need for a drive to educate the country in a scientific context was perceived. This Department sought to '...foster technical training, after the Great Exhibition of 1851 caused public attention to be drawn to the fact that Britain was falling behind other countries in her rate of industrial progress'.[9] Its object was to '...extend a system of encouragement to local institutions for practical science similar to that already commenced in the Department of Practical Art'.[10] Put more directly, its aim was to establish and administer science schools throughout the country.

From 1859, schools registered with the South Kensington Department were said to be 'organized' and as such could put forward candidates for an annual examination in science, and on the basis of these results grants were paid. These 'organized' science schools ran 'organized' science courses, fulfilled the regulations, and no doubt the monetary grants that could be obtained provided a large incentive for the development of a strong science-based curriculum in these schools. The South Kensington Department did not lose the opportunity to promote its policy of science education through the use of monetary incentives.

In order to pursue a wider curriculum some schools gave 'organized science courses' but did not become 'organized science schools.' It is highly likely that in this situation, such a course would have been followed by a student who wanted to specialise in science on the way to a university course. Science

[9] Ibid., p. 50.
[10] Report of the South Kensington Board, 1853, quoted from Birch, pp. 67-68.

teaching was fostered in this way to the extent that it was estimated that up to a quarter of the grants paid out by the South Kensington Department found its way to about 250 schools in Ireland by 1879,'...in 1879, one quarter of the total monies distributed by the Department went to 251 schools in Ireland.'[11]

St. Kieran's College in Kilkenny had the distinction of being the first Irish school to associate itself with the Department of Science and Art based in South Kensington, London.

> In the year 1874 students of St. Kieran's College sat for the first time for examinations under the "Department of Science and Art", generally known as the "South Kensington Examinations".[12]

Subjects taught in the college under this scheme included chemistry, mathematics, magnetism and electricity. Co-incidentally one of the external examiners was Professor Tyndall, a colleague of Edward Frankland. Both men could be loosely termed 'heuristic practitioners', having taught at Queenland School Hampshire, where they had established a more practical way of teaching.[13] This was detailed in the previous chapter.

The influence of this Department produced definite effects on the subsequent development of secondary science education in Ireland. It introduced two innovations that were to become features of Irish education, namely a "payment by results" scheme, and a growing bias in favour of subjects with a scientific slant. The South Kensington examinations, as evidenced at St. Kieran's College, promoted the study of science, and gave monetary grants to the school for this purpose. Under this scheme greater attention to science was encouraged and rewarded because grants were given to the teachers of participating schools for students successfully passing the annual 'Kensington examinations'. Thus was initiated a system of payment by results, which was more fully developed under the Intermediate Board in 1878.[14]

That it helped promote science teaching in the Irish schools is beyond doubt, in fact it would appear that Irish schools were taking their fair share of the grants available, as stated above. In 1880 the Annals of St. Kieran's record the following:

---

[11] Wallace quoting from the Intermediate Board of Education Annual Report of 1899.
[12] Birch, p. 67.
[13] McMillan, N. & Meehan, J. *John Tyndall – 'X'emplar of scientific and technological education.* Dublin: ETA Publications, 1980, p. 43.
[14] Birch, p. 67.

> Certificates in Mathematics, Chemistry, Magnetism and Electricity were awarded by the Science and Art Department, London, to about 30 of the students, who distinguished themselves at the examinations in May.[15]

The number of pupils taking the 'Kensington Examinations' was increasing in the late 1880s, and this was coupled with the apparent ease with which it was possible for a candidate to obtain a pass in the subject. St. Kieran's benefited from this association; for example in 1889 it received a total of £160 from the Department as well as laboratory equipment at various times and at reduced prices. More importantly, success in these examinations allowed the students to pursue professional careers that previously would have been open only to the nobility and the wealthy. This perceived progress was applauded publicly. For example, in 1894 the *Kilkenny Journal* proclaimed the following:

> We know the brilliant success which had often crowned the efforts of Irish talent even when struggling against the greatest difficulties. What happy results, therefore, may we not expect now that a fair test is applied and a fair field is open to our Irish youth.[16]

After 1895, when over £110 was drawn by the college from the Department, the position of the school in relation to the South Kensington Department is not clear. The annals of the college record that:

> According to a document just before the Intermediate Commission in 1899 by Thomas Preston, Inspector of Schools under the Science and Art Department, St. Kierans was not then connected with the Department.[17]

2.3 The organisation of the Intermediate system with respect to Science

The new Intermediate Education (Ireland) Act of 1878 allowed for 'secular' education and provided exhibitions, prizes and certificates to pupils, on the basis of public examination. As stated above these exhibitions gave pupils from a poorer social background a far better chance at receiving an education which might otherwise not have been available to them. Differentiation between pupils was also made on the basis of written examination results. A school was defined by the Act as: '...an educational institution (not being

[15] Annals of St. Kierans, December, 22nd 1880.
[16] The *Kilkenny Journal*, 22nd November 1894, (quoted from Birch, p. 75).
[17] Birch, p. 143

a National School) which affords classical or scientific education to pupils not exceeding eighteen years of age.'[18] £1,000,000 was placed at the disposal of the Board from the funds administered by the Commissioners of Church Temporalities under the Irish Church Act of 1869. The annual income derived from this amount was to be used by the Commissioners and any surplus was to be invested in the purchase of Government securities.[19]

The subjects were divided into seven divisions, one of which included Natural Science. There were three grades in each subject at first – Senior, Middle, and Junior, with a fourth grade, the Preparatory grade established in 1892.[20] The monies to be earned by the successful pupils were much higher in Greek, Latin and English, and the number of marks which could be achieved in these subjects were also higher compared with the others. Consequently, the classics tended to be favoured, which led to a neglect of the Sciences. In this way the leaning towards a 'Grammar School' type education prevailed for at least twenty years under the Intermediate Rules.[21]

In 1902, as a result of the Intermediate Commission of 1898, the scheme was modified and the group system was introduced to take the place of the one-subject system. Two separate courses were provided in the three grades, Junior, Middle and Senior. They were the Grammar School Course which would cater for university candidates and those who intended to enter the higher branches of the civil service, and the Modern Course, '...in which natural and experimental science and modern languages were to have a special weight attached to them.'[22] Each of the subjects had equal marks. The system was modified in 1903, and the Modern Course was further subdivided into:

- the Modern Literary Course
- the Mathematical Course
- the Experimental Science Course.

---

[18] *Irish Educational Review*. Dublin: Browne & Nolan, 1893, p. 211.
[19] Council of Education Report, p. 44.
[20] Ibid., p. 46.
[21] O'Connor, D. C. *Secondary education in Ireland 1878-1968*. M. Ed. thesis, St. Patrick's College, Maynooth, p. 63.
[22] Ibid, p. 63.

2.4 The progress of science under the system from 1879 – 1900

The Annual Reports which were published by the Commissioners of the Intermediate Board of Education is a resource that provides a viewpoint on the development of science instruction in each successive year. Each year examiners' reports on the particular examination results and the progress made or not made, as the case might be were published.

The uptake by the pupils of science subjects during the years 1880 to 1888 was so strong that some of the Board members appeared to have perceived science as a real threat to the more classical subjects. Consequently changes were made, for in 1880 under the revised Programme of Studies and Rules for Examinations (they were revised each year subsequently), Zoology as a subject was removed from the science course in the Middle Grade, although Chemistry remained as did Descriptive Astronomy under the Senior Grade. Both Animal Physiology and Chemistry appeared at Senior Grade.[23] By 1882, with limited finances, both the value and the number of exhibitions were reduced. Botany and Animal Physiology were removed from the course for the boys, but remained on the course for the girls. The removal of Botany is followed, for it was becoming a popular choice. So it would appear that those in authority placed lesser value on the science subjects than the classical subjects, and it remained up to the few who had a voice to oppose this trend. The *Christian Brothers Education Record* says of this period:

> Many efforts were made in after years, by men who should have known better, to obtain a reduction of the marks in the remaining science subjects, and their efforts would certainly have prevailed but for the wakeful interest shown by those who had at heart the practical education of the many rather than the literary ornamentation of the few.[24]

From its genesis the Intermediate Board examinations proved to be very popular with the existing educational establishments. In 1880 4,100 boys and 1,400 girls were examined at 128 centres, and £9,680 was paid out in results fees. In 1890 the Local Taxation, Customs and Excise Act was enacted. Under this Act, monies accrued from taxes on beer and spirits became available to the Intermediate Board. This money hence became known as "whiskey money", and it almost tripled the annual budget of the Board

---

[23] *Christian Brothers Educational Record.* Dublin: Fowler, 1905, p. 219.
[24] Ibid., p. 220.

from £30,000 to £80,000. The income from this tax peaked in its first year at £105,000, but owing to the temperance movement this sum of money would decrease dramatically to £84,000 by 1905.[25]

With the advent of a higher budget the Board felt free to increase the value of certain subjects, and yet again science was neglected under the new rules. Consequently the numbers presenting for science each year began to decline rapidly. According to Kerr,

> ...from 1892 to 1898, the number of boys examined in the three higher grades of the full examination increased from 2865 to 4285. During this period, the number offering science subjects fell from 2288 to 705.[26]

By 1898 there were only six Intermediate schools in the country that were equipped with laboratories,[27] and this situation prevailed until the establishment of the Department of Agriculture and Technical Instruction. This fact was recorded in the minutes for the meeting of 15th April 1902 of the Board of Technical Instruction which refers to the Intermediate schools: 'A year ago there were not six laboratories in these schools.'[28]

When one looks at the previous statement of the Board and compares it to the fact that by 1902 there were 150 school laboratories provided under the newly established Department this would indicate that something was wanting in the system prior to 1900. On one hand there were those who argued that the system allowed science into the secondary schools on a similar footing (examination-wise) with the main language courses, and that in order to earn any substantial money prize equal attention had to be given to a broad spectrum of subjects which included science by every student over 12 or 13 years of age.[29] On the other hand however there were those who felt that the system was aiding the demise of science. When addressing the Lord Lieutenant in June of that year, the Council of the Royal Dublin Society '...called attention to the way in which the teaching of science, in the intermediate schools, has been 'practically exterminated' by the operation of the present system.'[30]

---

[25] *The Irish School Weekly*. Vol. LIII, No.4, May 6th 1911, p. 118.
[26] Kerr, J. F. *The Development of the teaching of Science in Ireland since 1800.* Ph.D. thesis, Queens' University Belfast, 1957, p. 87.
[27] Report of Messrs. Dale and Stephens on Intermediate Education in Ireland, Cd. 2546, **XXVIII**, 1905, p. 27.
[28] Minutes of the 9th Meeting of the Board of Technical Instruction, Apr.15th 1902, p. 55.
[29] Corcoran, T. *Clongowes Record 1815-1930.* Dublin: Browne & Nolan, p. 145.
[30] Molloy, G. 'Secondary Education in Ireland. Criticisms and Suggestions'. *Irish Ecclesiastical Record*, Vol. IV. Dublin: Browne & Nolan, 1898, p. 486.

Fr. Molloy in a presentation to the Intermediate Commission of 1899 used the following statistics, recorded in Table 2.1, in order to demonstrate the destruction, which the Intermediate system had wrought on the teaching of science in the Secondary Schools. The figures reveal the situation when one looks at the total number of pupils who presented themselves for the examination of the Intermediate Board in the years 1887 and 1888 against the number of pupils who presented for Natural Philosophy and Chemistry at the same time:

Table 2.1 Showing numbers of pupils presenting for Natural Philosophy and Chemistry for 1887 and 1888.[31]

	TOTAL NUMBER	NAT.PHILOSOPHY	CHEMISTRY
1887	4,613	2,611	1,376
1888	4,551	2,565	1,357

Ten years later although the total number of candidates had risen considerably the numbers in the respective science subjects had fallen dramatically. See Table 2.2.

Table 2.2 Showing numbers of pupils presenting for National Philosophy and Chemistry for 1896 and 1897.[32]

	TOTAL NUMBER	NAT.PHILOSOPHY	CHEMISTRY
1896	6,503	618	359
1897	6,661	596	312

These figures represent a drop of 56% to 9.2 % for Natural Philosophy and 30% to 4.6% for Chemistry, and provides further proof that the system as it existed in 1898 militated against all but a minority of pupils perceiving any of the science subjects as an examination option.

2.5 Science as a subject and the way in which it was taught

Reconstructing the way in which science was taught in the classroom between 1878 and 1900 in order to gain an insight into the methodology is difficult to do. Most of the direct evidence, which could be gleaned

[31] Fr. Molloy's testimony to the 1899 Intermediate Education (Ireland) Commission, (C. 9512), **XXIII**, p. 487.
[32] Ibid., p. 487.

from the participants themselves, is long gone, and there appears to be very little historical detail recorded. However, using an indirect approach it is possible to glean something of the nature of the subject as it was taught during these years. To do so it is necessary to examine textbooks, examination papers, examiners' remarks and articles written during this time in educational journals and other sources.

2.5.1 The teaching of Science with respect to the text-books of the time:

One of the more interesting aspects of the textbooks, apart from their academic content, are the pages at the front usually under the title of a 'forward'. The philosophy of the author towards science instruction is sometimes contained within these pages, and in some cases the aims and aspirations of the author are also outlined. The advertisements which appeared in the teachers' journals show that textbooks from this particular period displayed a marked concern for the importance of the examination system that prevailed at this time.

> The study of a textbook or manual of the subject is, however, most valuable in enforcing, impressing, and systematizing the instruction, and as offering a ready means of reference and recapitulation. In this book an endeavour has been made to explain the facts as clearly yet as scientifically as possible: a reason has been given for every rule. The study of the Questions and Papers given in the Appendix will form a valuable preparation for examination work.[33]

As noted earlier, fuelling this emphasis on examination work was the Science and Art Department, South Kensington which was conducting science teaching with an unashamedly direct emphasis on the examinations that all participants were compelled to take in order to benefit from the substantial grants that were available.

Perusing the journals such as *Science and Art and Technical Education – A journal for Teachers and Students* during the last few decades of the nineteenth century, one cannot but be struck by the amount of emphasis on text-book and revision aids which are advertised. For example, the *Journal of Education* which reviewed an elementary chemistry textbook stated the following:

---

[33] *Irish Teachers' Journal*. Advertisement for science textbook written by Harrison, W. Jerome. 'The Science of Home Life'. London: T. Nelson and Sons, 1888.

Elementary Chemistry, by M.M. Pattison Muir. This book is a valuable contribution to chemical literature. It does not profess to be a descriptive catalogue of chemical facts regarding the properties of the individual elements and compounds; but an attempt is made to present the principles of chemistry as rising out of and resting upon chemical facts, and the book is intended to be used in conjunction with lectures upon elementary chemistry.[34]

Examination aids were also available as the following advertisement shows.

Revision Sheets. The failure of Students to pass the May Examinations of the Science and Art Department frequently arises not so much from want of knowledge of the subject-matter, as from a want of familiarity with examination papers and careful practice in well-arranged examination questions. These sheets are intended to meet this difficulty, as well as to afford the student an opportunity of thoroughly revising his work.[35]

Interestingly in this particular volume the solutions to the Science and Art Department examination questions for 1891 are given.

The *Irish Teachers' Journal and Assistant* which was published in Dublin from 1864 to 1904 also reflects this strong emphasis on the examination system in advertisements such as:

The Coming Examinations. Teachers preparing for the approaching Examinations will find it useful to have a copy of the Questions given at the last Easter Examinations before them: these will be found in the Educational Almanac for 1881, and also the Questions given to the Teachers in Training. As there has been a considerable demand, Teachers wishing to have copies should procure them at once.[36]

It is apparent that there was a shift away from this pre-occupation with examinations in the last few years of the nineteenth century, when a more practical form of science instruction was proposed. The textbook 'Elementary General Science' which was written by Simmons and Jones stated this quite clearly in the forward.

Within the past few years distinct advances have been made in the methods of teaching science. It is becoming more and more widely recognised that the only scientific knowledge worth having is

---

[34] *Journal of Science and Art*. Vol. V, No. 56, Nov.1891, p. lxxii.
[35] Ibid, p. viii.
[36] *Irish Teachers' Journal*. Vol. XV, No. 14. April 2 1881, p. 166.

> that gained by individual observation and experience; and public examining bodies are one by one bringing themselves in line with this sound educational principle by causing their examinations to be more a test of familiarity with experimental methods and results than of information acquired by reading...[37]

The textbook adopted a style of including a large number of simple and practicable experiments that could be performed by the individual student; the object was to combine a class-book and a practical exercise book on the rudiments of physical and chemical science. This movement towards more emphasis on the practical nature of science in the demonstration form, was indicated by the Matriculation Syllabus which, in a note prefixed to the syllabus, stated:

> In particular, the subjects of the present syllabus will be treated wherever possible from an experimental point of view. Candidates will be expected to have performed or witnessed simple experiments in illustration of the subjects mentioned in this syllabus.[38]

A further insight into the way in which science was taught around 1890 is revealed in the *Christian Brothers Educational Record.* An article entitled: 'Notes on the teaching of Chemistry', suggested that two textbooks be used. Taylor's "Chemistry for Beginners," was considered to be well adapted for home-lessons, and the other, Reynolds' "Chemistry," Part I., to be studied in class. The latter was recommended as being especially good for the 'Kensington Chemistry Examination'. It was noted however, that even these textbooks would not be enough for an honours candidate to be 'made up in', and it was suggested that the student refer to the Intermediate Programme in Chemistry and write out a series of notes or short articles on such points which were not covered in the textbook. These notes, copied by the student, '...and committed to memory, will be found very useful'.[39] Definitions which did not '...stand out sufficiently from the text' and which were not '...put in such a form as to render it easy for boys to grasp them and commit them to memory', should be dictated to them by the teacher, who would then have copy them into their text-books at the top or bottom of the page. In this way they could be '...easy of reference and come in as portion of the day's lesson, such, for example, as the definition for atomicity, equivalent, empirical formula, &c.' During class time, which took up two hours of the timetable per week, it was suggested that

---

[37] Simmons, A. T. and Jones, Lionel M. *Elementary General Science.* London: Macmillan and Co., Ltd. 1898, p. v.
[38] Ibid, p. v.

students could answer questions selected from the Intermediate Chemistry Papers, and that it would be excellent training,

> ...if these answers be occasionally written on slates. Pupils were also expected to follow a course of home-lessons, the contents of which would be covered during normal class time.[40]

In studying Reynolds' book in class it would be,

> ...a great aid to the pupils, as well as a guide to the matter to be committed to memory, if they be provided with questions on the subject, and have their books marked to correspond with the question.

The pupils were expected to write down a series of questions on each chapter, numbering the answer in the textbook to correspond with the number of the question.

> This may be considered somewhat troublesome, but it can be done before the press of the Intermediate work comes on, and once done the question-books will last for a number of years, and will be found very useful.[41]

Such was the theoretical side of the subject covered by the Christian Brothers. However it was tempered with the practical methods employed in the school laboratory, '...it is of the utmost consequence that the principal experiments described in the text-book should be gone through for the class.' [42] The experiments included the following: Experiments showing the difference between chemical and physical changes, mechanical mixture and chemical compound, electrolysis of water, the preparation of the following gases and the principal experiments connected with them – oxygen, hydrogen, nitrogen, ammonia, nitrous oxide and nitric oxide, the chemical changes which takes place during the burning of a candle, and in the process of breathing, together with the processes of filtration and the distillation of water. In order for this experimental work not to encroach on the time allocated for the ordinary class-work, it was suggested that,

> ...a suitable time for performing them would be at the close of the school work on Saturday; and if the apparatus be previously arranged, and everything at hand for the experiment, a very short time will suffice.[43]

---

[39] *Christian Brother's Educational Record*, 1891. Dublin: William J. Alley & Co., 1891, p. 360.
[40] Ibid, p. 360.
[41] Ibid, p. 360.
[42] Ibid, p. 361.
[43] Ibid, p. 360.

It is more than likely that these self same methods were also being used by Brother Burke in his Science School in Cork at this time. The Jesuit father Henry Gill both research scientist and science teacher, taught at the Jesuit Colleges of Belvedere and Clongowes. His methodology in the teaching of Physics under the Intermediate system was as follows; Three hours class time per week were allocated to the subject. He expounded the fundamental laws of physics: Mechanics, Sound, Light, Heat, Magnetism and Electricity. These laws were then illustrated by him using demonstration experiments. The boys' role was to take part in the experiments under his direction – this took the form of one or two boys taking measurements in turn. The whole class recorded these results, and worked out the calculations founded on the formulae, which had been explained. Each boy kept a notebook in which the laws, formulae, experiments and numerical results were entered together with appropriate diagrams.[44]

2.5.2 The teaching of Science as reflected in the examination papers

The Intermediate Board of Education published examination papers each year from 1879 onwards. The object of these papers was undoubtedly to determine whether or not a particular candidate possessed enough factual knowledge in that subject, and if so then a pass could be awarded. Looking at the way in which the language was used in the question construction, one is left with little doubt but that this was indeed a 'fact-based' test for the candidates involved. This was evident from the beginning of the scheme, for in an introduction which was published in 1879 (which included the first set of examination papers together with the answers and solutions), the following paragraph appeared:

> The Answers and Solutions have been prepared with the intention of showing students who presented themselves for Examination how far they reached the required standard, and in what they may have failed; and also of placing before intending candidates models not merely of the matter and scope necessary for their purpose, but, what is scarcely less important, the style and method of so grouping their replies as to give cohesion and clearness to their papers.[45]

The First Intermediate Board Examination Papers for June-July of 1879, under Division VI Natural Science had three grades and each of these grades had four sections as detailed below:

---

[44] Gill, H. 'Science in our Schools'. *Studies*, Sept.1932, pp. 467-468.

[45] The Intermediate examination papers issued at the 1st Examinations under the Intermediate Education Act (Ireland) 1878. Dublin: Browne & Nolan, 1879. From the Introduction, no page number printed.

Table 2.3 [46]

Under Division VI – Natural Science.

Junior Grade – Section A – Natural Philosophy

Section B – Chemistry [2.5 hrs long]

Section C – Physical Geography

Section D – Botany

Middle Grade - Section A – Natural Philosophy

Section B – Chemistry [2.5 hrs long]

Section C – Botany

Section D – Zoology

Senior Grade - Section A – Natural Philosophy

Section B – Zoology

Section C – Geology

Section D – Descriptive Anatomy

Looking at the Intermediate Examination Papers which were published before 1900, in particular natural philosophy at senior grade for June-July 1879, where there were 18 questions, with the last four questions marked as optional. The predominant phrases are: 'State…' 'What is meant by…?' 'Explain the…'. All 16 of the questions could have been answered with reference to a textbook alone. Two of the questions might require that the pupil had witnessed a teacher demonstration, the second question suggesting that perhaps there had been room for experimentation on the part of the pupil themselves.[47] 'Show how to find the principal focus of a mirror', and, 'Describe an experiment to show that there are two kinds of electricity'. However, when one turns to the back of the book of examination papers the solutions contained therein to all of these questions including the two mentioned above, one sees that the answering scheme shows a theoretical basis for the correct answer.[48] Chemistry was not examined this particular year.

Eighteen years later in June 1897 under the subject Natural Philosophy at Senior Grade the emphasis on the

[46] From the 1879 Intermediate examination papers published under the Intermediate Education Act (Ireland). Dublin: Browne & Nolan, pp. iii-iv.

[47] Intermediate examination papers, 1897. Dublin: Browne & Nolan, p. 96.

[48] Ibid., pp. 90-109.

theoretical was even more marked. This examination included the following interesting instruction. 'No credit will be awarded for an answer unless the work is given in full'. There were 10 questions and no optional ones. All of the questions were theory based. None of the questions appeared to require any practical experience on the part of the pupil. 'What is meant by...?', 'What is...?', 'Define...' are the features of this paper. Even the 'Describe...' questions could have been answered in a 'got up' form from theory. For example, 'Describe Galileo's telescope, and show by a figure that a distant object observed through it appears erect. What disadvantages does this form of instrument possess?' and, 'Describe Melloni's thermopile; why must a galvanometer of low resistance be used?' [49]

In the Chemistry paper at Senior Grade, whilst many of the ten questions contain the 'Describe the...' form, all they require from the pupil is that obtained from a textbook or memorising of tests. For example, 'Describe the characteristic chemical properties of the non-metals as a class, and contrast them with those of the metals', and 'Describe and explain two methods for the extraction of lead from galena. Express the reactions which occur in these processes by equations'. (Equations are expressly asked for in some of the questions). Question 6, which involves the displacement of iron by copper sulphate solution is the only question which might relate to an observed reaction in the classroom, although the form of the question is once again in a theoretical tone: 'Explain what occurs when metallic iron is placed in a solution of copper sulphate. To what two important purposes may the reaction which takes place be put?'[50]

In conclusion, in the particular subjects listed above it can be seen that the questions had a bias in favour of the theoretical. In very few instances was there any emphasis on the experimental nature of the subject. To examine such subjects in a written form only re-emphasised the non-practical nature of the subject. However when we look at the format of the questions which appeared on science papers after 1900 following the intervention of the Department of Agriculture and Technical Instruction, it will be seen that there was a definite shift towards questions which were far more practical.

2.5.3 The teaching of Science detailed in the examiners' reports

The examiners' reports which were published also give us a sense of how science as a subject was faring. From these reports it is evident that as early as 1883 there were problems in the way some of the science

[49] Ibid., pp. 184-185.

subjects were being taught. The first direct reference to the terms 'cram' and 'getting up' are used, and this particular problem was to become the trademark of the majority of these reports over these years with respect to the teaching of science in the secondary schools. The word 'cram' would in fact become identified with the Intermediate system prior to 1900 in the context of the mere learning of many facts which were crammed into the pupil's brain to be released upon the examination paper if and when they were required. There was also very little experimental work involved in the course. One examiner gave his report in 1883 on the state of Natural Philosophy at the Junior Grade and outlined what he saw as the principal deficiencies. Candidates were being prepared solely by reading books and very little effort was made on the part of the teacher to provide them with the opportunity to see first hand either the experiment or the apparatus they were reading about. He even suggested that the teachers in question should at least demonstrate these experiments to assist in the pupil's understanding. Whilst the average answering of the section of Natural Philosophy examined was fairly good, he detected that there was,

> ...a general ignorance displayed of certain of the questions, and am of the opinion from an examination of the papers that the subject is at present insufficiently taught, many of the answers having left on my mind an impression that the subject had been made up hastily under a 'cramming' system.[51]

Another examiner at Middle and Senior Grade levels condemned this cramming system further

> ...on the other hand, many of the candidates in both grades had evidently never seen experiments performed, and had simply committed portions of the text-books to memory; these had no chance of success.[52]

In 1886, Mr. Arthur William Scott who gave his report on Natural Philosophy for Senior and Middle Grades (Girls and Boys), also identified 'commendable industry in learning the book work'. However these same pupils appeared to be baffled when the question was put from another angle, or if the question on a principle was put to them in a slightly different way.

---

[50] Ibid., pp. 185-186.
[51] Intermediate Board annual report 1883. Examiners' reports for 1883, p. 41.
[52] Ibid., p. 41.

Diagrams that were drawn by the candidates, usually incorrectly, appeared to come from the textbook rather than actual laboratory observation.

> Most of the candidates made a singular mistake in describing the spectroscope, they drew diagrams placing the collimator and telescope at right angles to the respective faces of the prism, while nearly every one seemed to be unacquainted with the use of the comparison prism placed over half of the slit, I conclude from this that the candidates "got up" the description from the text book and had not worked with the instrument.[53]

He felt that every school science laboratory should have a spectroscope, and as the price of such apparatus had fallen considerably, it was in the best interests of the school that such instruments should be purchased. In the following year Messrs Edmund W. Davy and Richard J. Moss who reported on Junior Grade Chemistry commented on the fact that whilst the answers written by the candidates were quite 'creditable', and that sound knowledge was displayed, once again they questioned the almost:

> ...entire absence of, experimental illustration. It cannot be too often repeated that chemistry, in common with other experimental sciences, must be taught experimentally. Statements of chemical facts may be committed to memory, but no true chemical knowledge is acquired in this way. Direct observation by experiment must be resorted to, and the reasoning faculties must be exercised upon the facts observed if any substantial progress is to be made in this branch of knowledge.[54]

The report was emphatic in its accusation about the lack of experimental method in the instruction. Reference was even made to the 'reasoning faculties', one of the premises on which Armstrong's heurism was built; in other words faculty psychology. Science instruction had taken on a 'learning by rote' style, one favoured by both teacher and pupil when grants were being competed for in the annual examinations. Some examiners went even further by suggesting that the way in which science was being taught without any form of practical work made it no different a subject to say the study of history.

> It is evident that the kind of knowledge they possess is not that practical kind capable of useful application. Except in a few cases, I could detect no evidence of a practical study of the science.

---

[53] Intermediate Board annual report 1886. Examiners' reports for 1886, (c. 468), **XXVI**, p. 26.
[54] Intermediate Board annual report 1887. Examiners' reports for 1887, p. 25.

> This, I think, is greatly to be deplored... Unless the science is studied experimentally it seems to me to offer no advantages over the study of such a subject as History, in which great proficiency may be attained by mere reading; aided by a retentive memory.[55]

He went further, trying to list the benefits that he felt the subject offered to those engaged in it. According to Moss, the study of Chemistry offered:

> ...mental training of great value. It cultivates in a special degree the habit of accurate observation, and offers peculiar facilities for the practice of inductive reasoning; while, at the same time, the facts learned have a direct bearing upon most of those phenomena of nature with which we come in contact in everyday life.[56]

The report indicated that lack of proper apparatus which would have greatly assisted in a more practical approach to science instruction also appeared to have been a reason why the practical side of the subject was neglected:

> ...for the subjects of magnetism and electricity – required in the Senior Grade – appear to be imperfectly taught in many schools. This, no doubt, arises from the want of the necessary apparatus. I would recommend the construction by the teachers of simple and inexpensive apparatus, which is quite feasible in the subjects of light and magnetism and electricity.[57]

And in the same report both Barrett with Messrs. P.J. Carroll and J. McGrath also emphasised the need for apparatus in order to promote the practical nature of the subject.

> Until schools and colleges are provided with the apparatus which is essential for the proper teaching of physics, little more than book knowledge can be expected from the majority of the pupils.[58]

By 1890 the situation had become progressively worse. The gap between what the examiners were expecting from pupils and the way in which pupils were being prepared for these examinations was widening.

---

[55] Intermediate Board annual report 1896. Examiners' reports for 1896, p. 64.

[56] Ibid., p. 64. Remarkably, it might have been Armstrong speaking on the subject of the benefits of heuristic methods, bearing in mind that the above comments were made scarcely years after Armstrong had first heard the term heurism itself.

[57] Intermediate Board annual report 1888. Examiners' reports for 1888, (C.5355) **XXXIX**, pp. 25-26.

[58] Ibid., p. 26.

This became apparent in the large number of pupils who were now failing in the science subjects, and those who did very well were small in number.

The same Mr. A.W. Scott that was mentioned on page 50, reported on the Junior Grade – Boys and Girls expressed this sentiment in his report:

> The result cannot be considered quite satisfactory as will appear from the number of failures (over 50 per cent). … Many of the candidates appeared to have learnt or "got up" certain questions, and when others of a somewhat similar character appeared, they, without reading or considering the question proposed to them, sent up an answer that they had previously committed to memory. We think that the teaching of elementary Mechanics is too much a matter of getting up work from books and that the introduction of a few simple experiments, which need not require expensive apparatus, would give more clearness and precision to the subject.[59]

The same comments appear again and again in the reports, over-preparation of the pupils by 'cramming' with an over-emphasis on the amount of bookwork. Any form of practical work was absent in most cases probably due to lack of finance in order to purchase the necessary apparatus, but also due in part to the lack of time in which to set up even the simplest experiments.

Whilst Scott was critical of the way in which science was being taught he had an optimistic viewpoint and still insisted that, considerable progress had been made under the scheme. He reported that almost thirty four percent of boys at senior grade chemistry had failed to obtain the minimum number of marks in order to pass. Another thirty nine percent had got a 'mere pass' and almost twenty seven percent had got a pass with honours. Only four percent had got at least eighty percent of the total marks, while just over seven percent had been given marks at all. He saw no great worry in the poor performance of some of the candidates examined. 'These results are, I think, satisfactory; the failures do not seem to me to be in excess of what must always be expected in an examination of this kind'.[60]

In spite of the increased failure rates, by 1890 almost two-thirds of the candidates were being examined in either physics or chemistry,[61] and natural science appeared to be a very popular choice. One of the aspects of this was that for a good many of those exposed to it the study of science was obviously not having much

---

[59] Intermediate Board annual report 1896. Examiners' reports for 1896, pp. 65-66.
[60] Intermediate Board annual report 1890. Examiners' reports for 1890, pp. 29-30.
[61] Wallace, p. 51.

meaning in explaining their common everyday life experience. The basic principles appeared not to have been taught or explained, for Mr. J.H. Stewart says of Middle Grade in Natural Science that,

> ...many of the students showed a good acquaintance with the experimental details of the subject, but, in a large number of cases, there was no evidence of illustrative teaching. The numerical questions were best answered, and those requiring the expounding of principles worst.[62]

Natural Philosophy in the junior grade for boys came in for some strong criticism by some of the examiners. They were also unhappy about the large number of failures, and they felt that the boys were 'getting up' the question in advance, thus ignoring the underlying principle of the concept been examined.

> The question on the wheel and axle was constantly attempted by an application of the ordinary formula, and not from the principle of work done. The boys had evidently "got up" the question, and had sent it up as they had learned it, without trying to understand what was proposed...The examiners desire to call attention to the practice which seems to prevail of "getting up" special questions, in hopes they may appear on the paper. Thus, in question 3, elaborate descriptions of the method of finding the centre of gravity of a body were given, while the question asked – Why a body suspended freely from a fixed point assumes a certain position? – was not answered, but assumed as self-evident.[63]

The examiners attacked the concept of 'paper science', that is science taught only from books and learned by heart as little use to anyone. They rightly stated that the study of nature when conducted in a scientific spirit had great educational value. Elaborate apparatus particularly for younger boys was not needed, rather intelligent teaching. Specialisation in a portion of the course leading to some sound understanding was considered a far better option than attempting to cover the entire course with poor understanding, and consequently obtain very few marks at all. They concluded their report by re-emphasising the connection between science and art. 'We desire to draw attention to the necessity for neatness in the answers and diagrams, so that boys may learn to reason from their own drawings, instead of learning to repeat from memory.'[64]

---

[62] Examiners' reports for 1890, p. 30.
[63] Ibid., pp. 30-31.
[64] Ibid, pp. 30-31.

Science as it was taught was being perceived by the pupils as mere facts to be learnt and not necessarily understood. Writing in his 1896 report on natural philosophy at senior grade, boys and girls, the examiner Mr. John Burke stated that: 'In many cases, however, it must be said that evidence of mere reading was quite manifest, and often the effects of cramming quite clear.'

He reported that the question that year on the monochord had been answered correctly only by two of the candidates. Most had simply written down a formula they had attempted to memorise and most had done so incorrectly. He then stated that:

> It cannot be too earnestly urged that, whilst bearing in mind the utmost importance of a thorough training in the methods of experiment from which the fundamental laws are derived, as an essential condition for the obtaining of a firm grasp of the principles of physical science, the applications of the subject to every-day life should be kept clearly in view. An important element in education is to get the student to take a lively interest in his work, and unless he can be made to realize its immediate value, and its bearing upon things that may directly concern him he will seldom give his serious attention to it. It is eminently desirable that the student should be encouraged to observe and propose questions to himself and to his teacher, and exercise his ingenuity with his elementary knowledge of science in general to the solution of such simple physical problems as may present themselves to his mind.

The qualities that were listed above, applications of the subject to every-day life, interest, observation, question and exercise of ingenuity, were certainly not present in the system that was in practice at this time. The examiner may have been espousing the ideal; on the other hand he may have been expressing a popular view that was coming into vogue at this time, one which was advocating a radical change in the methodology towards science instruction. This examiner felt strongly enough to even brand the practice of 'cramming' as equivalent to that of 'cribbing' in an examination as neither served to benefit the process of education.[65]

Mr. Richard J. Moss, who reported on chemistry for all grades, stated that here was one marked characteristic with regard to the answering of questions. He had found that questions, which simply tested the memory, were as a rule correctly answered whereas questions involving reasoning, based upon even the

[65] Examiners' reports for 1896, pp. 64-65.

most elementary chemical knowledge, were rarely answered correctly. When the question gave an opportunity to the candidates, they generally answered it in the very words of the textbook. However, if the question required an application of a fact the answer often displayed a poor level of conceptualisation on the part of the pupil of this aspect. For example he stated that very few were able to state why it was that a given volume of a gas was supposed to contain the same number of molecules as the same volume of another gas under similar conditions of temperature and pressure. In many cases Avogadro was referred to as an authority on the subject, and a statement of the law associated with his name was given as an answer to the question, instead of describing the observations and experiments from which the law had been deduced. The apparently simple question – "How many volumes of nitrogen, and how many volumes of oxygen are contained in three volumes of nitrogen monoxide?" – was answered correctly by only eleven per cent. of those who attempted it. In most cases the volume corresponding to the atomic weight of an element was confused with that corresponding to its molecular weight. A similar error was common in the answers to other questions dealing with the relationship of gaseous volume and molecular weight. In answering the question – "If a litre of hydrogen weighs 0.089 gramme at a temperature of 0°C and a pressure of 760 mm of mercury, what is the weight of a litre of ozone at 0° C and 190 mm pressure?" – Many candidates plunged at once into tedious calculations which a little thought would have shown to be unnecessary, whereas the only calculation required was the multiplication of the fraction 0.089 by 6.

Questions on practical or applied chemistry were rarely attempted, and when attempted the answers showed, as a rule, complete ignorance of experimental work. From the answers to the question – "Describe the appearance of iodine at ordinary temperatures, and state how it behaves when heated" – it was evident that very few had ever seen this important element, and fewer still had had the opportunity for observing the effects of heating it. He ended his report on a depressing note:

> On the whole the results are disappointing. In a few isolated cases the answering was remarkably good and showed a real acquaintance with the subject, but in the majority of cases it is evident that the candidates knew nothing of Chemical Science, they have wasted their time committing portions of chemical books to memory.[66]

[66] Ibid., pp. 66-67.

In his report, John Burke for the same subject at junior grade for boys and girls outlined the damage which the present method of science instruction was doing, and extolled the virtues to be obtained from a proper approach to this subject. The answers to the questions he was marking displayed very little of the pupil's own individual thoughts, instead what was evident was, '...merely a recitation of something previously committed to memory.'[67]

On the other hand, he noticed that those questions which were perhaps at first sight not quite so familiar, but which nevertheless were probably simpler, requiring merely a knowledge of fundamental principles and only a little thought, were seldom correctly answered. The inherent danger as he saw it was that the emphasis on too much memory work in the form of facts, formulae and definitions was '...done at the expense of crushing the powers of observation and the inventive faculty'. These aspects, which were given to all pupils in varying degrees, and which were so much a part of pupil development, he wisely saw as being ones which could not be ignored at this stage in their science education.

> There is no time of life where those qualities which are so essential to a scientific mind can be so easily drawn out as in early youth, when that boyish enthusiasm, that childish spirit of inquiry that demands the why and the wherefore for everything, can be so fruitfully watched over and encouraged. To excite curiosity in the phenomena around us ought to be the guiding principle in the teaching of science; and in proportion as a person creates a real interest in everything that comes before the mind of his pupil, is he as a teacher of science a success or a failure.[68]

Once again, the words of the examiners point to the true meaning of science education. Curiosity is indeed the hallmark of the novice in a science classroom; to tap into this and to instruct accordingly, Burke could see was the missing ingredient in Intermediate science instruction as a new century loomed.

In 1898 only 705 of the 4,285 candidates who entered for the Board of Intermediate Education's examination took science papers, and (as indicated on page 37) only six secondary schools were equipped with laboratories.[69] By 1899 the subject appeared to be almost extinct – the take-up was poor, yet the standard of those students putting themselves forward for the chemistry examination very good. Writing in his report for junior, middle and senior grades, boys and girls, Mr. Walter E. Adeney stated:

---

[67] Ibid., pp. 67-68
[68] Ibid, pp. 68-69.
[69] Dale & Stephens 1905 Report, p. 27.

> The papers sent up in the Junior and Senior Grades were, on the whole, decidedly satisfactory. Good papers were also sent up in the Middle Grade, but the percentage of failures in this Grade was higher than those in the other two. There can be no doubt that in the few schools in which Chemistry now appears to be taught, good instruction is being imparted in the subject. The work done by the few (9) candidates in the Senior Grade was a credit to both teachers and pupils. The same remark applies also to several of the candidates' papers in the Junior Grade.[70]

This was the sum total of all that was reported in this particular year – in contrast with an average of at least three full pages of examiner's reports each year previously. It was a reflection on the poor state of the way in which the subject was being taught and examined. The teaching of science had assumed the form of theory only and the practical nature of the subject had been ignored.

2.5.4 The way in which science was taught as revealed by the Samuelson Commission

Another revealing aspect of the way in which science had been taught under the Rules of the Intermediate Board is contained in the Samuelson Commission which sat in the latter half of the nineteenth century. On 4th June 1883 evidence was taken in Dublin before the Royal Commission on Technical Instruction, from Professor W.F. Barrett and Professor Hartley of the Royal College of Science of Ireland who spoke about their perception of how science was been taught under the Intermediate Board. Hartley made reference to the fact that the marks allocated for classical subjects and literature in the examinations was higher than for mathematics and science. This meant that the way in which prizes and exhibitions were awarded on the basis of the marking of the examinations militated against the science subjects. He felt strongly that the Board was not doing enough to encourage science teaching. On the 13th June the Commission moved to Cork, and there they interviewed Brother James Dominic Burke. He was asked by the chairman, Bernhard Samuelson M.P. F.R.S.,

Have you at present laboratories in which chemistry and the physical sciences are practically taught?

- Yes.

Do the boys work in these laboratories?

---

[70] 1st Report of the Commissioners on Intermediate Education (Ireland) Palles, 189(C.9116,C.9117).**XXII**.

– Yes, but not to a great extent. They see things done experimentally, and are allowed to take part in experiments themselves.

Is it your intention to extend that practical instruction?

– Yes. The want of funds, I may say, is the only drawback to us in that department.[71] When asked if the Intermediate Board examinations encouraged more practical teaching than the Science and Art Department, Br. Burke replied that it did not encourage more practical teaching. There then began a sequence of questioning which attempted to get to the core of the problem of teaching and assessing science practically.

Would you consider it desirable, in order that boys might be capable of being presented for examination under the Intermediate system of instruction, in science, more especially in chemistry and physics, that it should be accompanied by practical work in a laboratory as a necessary condition?

– Well the Commissioners of Intermediate Education lay it down as an essential thing now, in the teaching of these branches, that the teaching throughout shall be accompanied by illustrations and experiments.

What means have they of ascertaining that this has been really done?

– The style in which the questions are given. They are given in such a manner as to test whether the boys have really seen the experiments or not, and I should say that no boy who has not seen the experiments can answer satisfactorily or be entitled to a respectable pass... A boy standing an examination in natural philosophy or chemistry without having seen physical apparatus at work or having been shown a chemical substance would furnish an excellent illustration of cram.[72]

Writing in the *Christian Brothers' Educational Record* for February 1905, Monsignor Gerald Molloy made two points that summed up the progress of science instruction from the establishment of the Intermediate Act in 1878 to 1900:

> Previous to the re-constitution of the Board in 1900, the influence of these rules and regulations was not favourable to the development of Experimental Science in the schools. For some reason or other, the number of candidates in Physics and Chemistry had steadily fallen away, from year to year, until it was reduced to less than ten per cent of the total number examined.

---

[71] Royal Commission on Technical Instruction (Samuelson). 1st Report, 1881, C.3171, **XXVII**, pp. 327-328. Dublin: HMSO 1899.

[72] Ibid., pp. 331-332.

> Moreover, as the examination was conducted entirely by written papers, the tendency of the system was to discredit practical work in the laboratory, and to encourage the pupils to get up their knowledge almost exclusively from books.[73]

The influence, of the Board's Programme he felt was unfavourable to the study of Experimental Science in two ways. First, it led to a falling off in the number of candidates who presented this subject for examination; and secondly, it encouraged a bad method of teaching.

Writing previously in the *Irish Ecclesiastical Record* in 1898 Molloy had also expounded on the negative effect that the Intermediate system was having on the science subjects when he said:

> Again, in such subjects as Physics and Chemistry, a practical acquaintance with the work of a laboratory, as distinguished from mere book work, is of great educational importance and value. But, as a rule, it is only book work that can be tested by a written examination; therefore practical work '...doesn't pay', and it is neglected.[74]

The Irish Teachers' Journal of 1902 in an article entitled 'Science teaching in our schools' stated that '...all science teaching was crushed out of existence' by the results system under the National and Intermediate codes.[75]

2.6 The 1898 Commission on Intermediate Education (Palles Commission)

This Commission, with Lord Chief Baron Palles in the chair, was set up to examine the system of Intermediate Education in Ireland which had been established under the Intermediate Education (Ireland) Act of 1878, with the focus of its brief being on the practical working of the scheme. Furthermore, it was given powers to recommend any changes that it considered necessary and, if so, whether further legislation would be required in order to bring these changes into effect. The state of science as a subject taught and examined was the poorest in the twenty or so years of the Intermediate system. The falling numbers of those presenting science as a subject for the Intermediate Board examinations spoke starkly. The number of pupils receiving instruction in Science in Intermediate Schools was exceedingly small. As stated earlier within the years 1892 to 1898, though the number of boys who were examined in the three higher grades of

---

[73] *Christian Brothers' Educational Record,* February 1905, p. 220
[74] Molloy, G. *Secondary Education in Ireland,* p. 486.
[75] *Irish Teachers' Journal.* 'Science in our schools', p. 5.

the Intermediate Examinations increased from 2,865 to 4,285, the number of scholars offering recognised branches of science decreased from 2,288 to 705; and the instruction given to these candidates had practically no genuine educational value owing to the absence of any proper equipment.[76]

Monsignor Gerald Molloy in giving evidence before the Commission spoke about the advantages and disadvantages of the system. He outlined three positive aspects of it, the: '...perfect impartiality of the administration of the endowment'; this impartiality he saw as universally acknowledged and this perception led to great public confidence in the working of the system. Secondly, the system '...has established an independent and authoritative standard for testing the educational work done in the schools, so far as that work can be tested by written examinations.' Finally he saw the system as helping the,

> ...poorer classes of pupils of considerable ability, to get a better education than they could have got without the assistance of the Intermediate endowment, by means of the exhibitions offered for competition.[77]

He then went on to give the more negative aspects of the system. Two of the reasons he gave concerned science: that the system as it existed in 1898 discouraged altogether '...the teaching of physics and chemistry'; and '...that so far as it allows these subjects to be taught, it encourages bad methods of teaching them.' Both science and non-science subjects yielded similar 'money result' gains, and therefore the former had been dropped. The evils of the system he saw lay in money being used as the incentive.

> But what I regret in the system is that in this country where there is a natural love of learning for its own sake, which has always existed from the earliest times, and which has survived under the most adverse circumstances – that now, when a better time seems to be coming for the education of the people, the system of education should be put into such a shape as to hold money gain as the one all absorbing influence that is brought to play upon the pupils of all the schools, throughout the whole country.[78]

When asked about the value of practical work he spoke about the benefits of this work and its vital necessity in order to properly assess the pupils concerned.

---

[76] Dale & Stephens 1905 Report, p. 27.
[77] Palles Commission. Evidence 1899 (c.9512) **XXIII**, 1. Dublin: HMSO, p. 4.
[78] Ibid., p. 5.

In your opinion can teaching in natural science, by examination of the students, be properly tested without a practical examination?

– Oh, no.

Conducted, I suppose, in an ordinary laboratory?

– Yes.

Therefore, as long as the examination is confined to written questions there is no mode of testing whether the pupils have been properly taught?

– No.[79]

In closing his evidence he condemned the examination system of the Intermediate Board, saying that in effect it was holding the teachers to ransom.

> It is the state of thraldom in which the teachers of the whole country are kept; they are in fetters, tied up not merely by a programme to a large extent fixed, but tied up to the whims and caprices of the examiners, from year to year.[80]

On 9th February 1899 Professor G.F. Fitzgerald, fellow of Trinity College Dublin, was examined on the 17th day of the commission's sitting. He spoke in no uncertain terms about the need to make at least one natural science subject compulsory for the Intermediate examination.

> ...I would call attention to the way in which the immense majority of those who have written on the subject here speak of science; they speak of science as if it were not an essential part of every good education. I think that a person who has not had a systematic training in how to deal with nature, and to speak to nature is very nearly as uneducated as a person who has not had an efficient systematic training on how to speak to his neighbours.

Chairman: *Then you would make one natural science subject an essential to pass?*

- Yes, I would, and I would thereby be doing merely what has been done in nearly every other country except Ireland.[81]

He also spoke about the need to increase the number of marks in the various natural science subjects in the Intermediate programme, in order to bring them on a par with the classics such as Greek and Latin. When

---

[79] Ibid., p. 6.
[80] Ibid., p. 8.
[81] Ibid., p. 425.

pressed on the trade-off between either increasing the number of marks allocated to say natural philosophy or introducing a practical form of assessment he chose the latter without hesitation.

But you would not, of course, do that if you were unable to have a practical examination which would be taken into consideration in the passing of the students?

– No, I certainly should not; I do not think so at all. I think it is very little use, indeed, to teach students natural philosophy of any kind if you do not give them an opportunity of practical experience.[82]

When the Most Rev. Dr. Walsh asked Fitzgerald to consider the remarks made in the latest published report (1897) of the examiner for the Intermediate Board in natural philosophy in the Senior Grade, which were:

> The general impression I formed was that most candidates had got up their work only from books, that it was imperfectly prepared, and that they read the least amount which they thought would satisfy the examiner.[83]

He put it to Fitzgerald that this remark revealed that there was '...a good deal of downright sham work going on under the name of natural philosophy'. Fitzgerald had to concur. It was then left for the final question to be put and the answer received was the most honest that could be spoken.

Bearing in mind that the examiner speaks thus of the majority of the candidates, what do you think of it in connection with this fact – that 67.3 per cent. of the boys examined in natural philosophy last year passed. You do not regard that as a guarantee that there is sound scientific teaching?

– Certainly not.[84]

Captain W.de W. Abney Director of the Science Division, Science and Art Department, South Kensington, who was questioned on February 8th 1899, spoke about the stages of a science course as the Department saw it:

> The first two years ought to be general education. The knowledge of a certain amount of elementary science will do nobody any harm, but always a great deal of good, particularly when it is carried out practically, because after all is said and done, you are educating not only the memory

[82] Ibid., p. 426.
[83] Ibid., p. 428.
[84] Ibid., pp. 432-433.

but the eye and the hand at the same time, and I do not think there is anything so good educationally as science and art.[85]

He was precise and to the point when he spoke about the state of practical science under the Intermediate Board rules and regulations.

I think you had almost better give up teaching science altogether than not have practical work, and I do not see how you can have practical work under the Act as it stands at present.[86]

Towards the end of the interview one particular point came up which the Board wanted clarified.

... the point I want to get at is in what way we have ostracised the study of chemistry: it certainly never was our intention to do so?

– Because you make it more profitable for the teacher, by the number of marks you give, to teach Latin instead of teaching chemistry.[87]

In his closing remarks the representative of the Department of Science and Art in Ireland made a heartfelt plea that finally something might be done to redress the balance and restore to the Intermediate system good methods of science teaching and assessment.

I have been acquainted with Ireland for many years; I have spent a great deal of my time in Ireland, and I can only say that the question of Irish education has been one of very great interest to me from the very beginning, and I feel very strongly that Ireland has suffered very grievously in regard to scientific education from no fault of its own. I only hope that this Commission will be able to put things on a better basis, and that it will be more satisfactory in the future.[88]

The findings of this Commission of the main defects which was felt about the Intermediate system as it existed in 1898 and which were related to the Commission by the various witnesses are not surprising. Quite a sizable number of witnesses, ninety seven in all, felt that it had improved education in the country, with thirty five of these going further by saying that in their opinion it had encouraged attention to intellect and neglect of backward pupils. Thirty of the witnesses felt that it encouraged 'cramming', with twenty-one of these stating that it encouraged memory rather then intelligence. Other factors mentioned included: over

---

[85] Ibid., p. 396.
[86] Ibid., p. 398.
[87] Ibid., p. 399.
[88] Ibid., p. 401.

emphasis on the examinations which in turn sacrificed teaching methods, led to overwork, encouraged head-hunting by school managers of students with good ability. Seventeen witnesses expressed their opinion that it discouraged science whilst interestingly only one person spoke of it favouring science subjects.

In its final report the Commission proposed that rather than payments be made on the basis of individual examination results, they should be paid as a block capitation payment. In truth the final report represented a compromise of sorts. That the system had created competition of the most excessive severity was undeniable, that it was doing more harm than good remained undecided. In any case the Commission decided on reform. Three major changes resulted, first the structure of the Board was changed and its members were increased in number from seven to twelve. This was done in order to achieve a broader representation of interested parties. Second, apart from the capitation system of grants, four groups of subjects, classical, modern literary, mathematical and scientific were introduced. This latter move was to encourage the element of specialisation among pupils who were adept in certain subject combinations.[89]

Finally, curricular changes were proposed to,

> ...encourage the teaching of modern subjects, particularly mathematics and science, and special grants were recommended for the provision of equipment for science teaching.[90]

But the teaching of science in the Intermediate schools was to receive a revival of huge proportions within a year of this final report, a revival spearheaded by the Technical Branch of the Department of Agriculture and Technical Instruction and led by men such as Horace Plunkett, T.P. Gill, George Fetcher, Robert Blair and E.M. Rich.

---

[89] *Irish Educational Review*. Vol. I, June 1908, p. 548.

[90] Parkes, S. M. *Guides to Sources in the History of Education*, No. 5. Irish Education in the British Parliamentary Papers in the 19th century and after, 1801-1920. *History of Education Society* in association with Cork University Press, 1978, pp. 30-31.

Chapter 3

National Schools and the Heuristic Method of Science Instruction

3.1 William Mayhowe Heller

Heller's total dedication to the promotion of heuristic practices among science teachers may be traced back to the influence of his father Thomas Edmond Heller.

Thomas Heller gave up an important Headmastership to undertake the duties of General Secretary to the National Union of Elementary Teachers. During his period of office, the membership of the Union doubled. He also founded both the Provident Society and the Benevolent and Orphan Funds. As a member of the London School Board he did much to establish the evening continuation schools and practical cooking classes for working girls. As a mark of recognition for this life's work the University of St.Andrew's conferred a degree of LL.D. on him in 1891. He died nine years later.

William's exposure to this dynamism might in part account for his own achievements in the field of science instruction. He was born in London in 1868, and his early education occurred at Westminster School. He then went on to study at the City and Guilds College where he was a pupil of Henry Edward Armstrong. He became headmaster of a large model school in Birmingham and was involved in setting up and running a 'heuristic approach' at St. Dunstan's alongside Armstrong between 1888-89. Appointed a peripatetic science demonstrator for the London School Board in 1894 (taking over from Hugh Gordon who in turn had succeeded Armstrong); he held training sessions in heuristic methods at a deserted rice mill in Berner Street, Whitechapel. He carried on this work for three years.[1] Heller came to Ireland in 1900 by invitation of the National School Board, carrying with him the methods learned from this training experience. His brief was to oversee the introduction of elementary science into the Irish National Schools under the new proposed syllabus of 1900. This syllabus was the result of an extensive study by the Belmore Commission (1898-1899) to which Heller had submitted evidence which consisted of written material in the form of syllabi. He was also interviewed by the same Commission in 1898, as was Armstrong. Appointed chief organiser to the national schools with respect to science he worked extensively from 1900 to 1919 on the implementation of the elementary

[1] Brock, W. H. *H. E. Armstrong and the teaching of science, 1880-1930.* London: Cambridge University Press, 1973, p. 29.

science programme. He went on to become senior inspector in the secondary and technical schools, first working for the Department of Agriculture and Technical Instruction (which had been set up in 1899) until 1922, and then in Technical Instruction within the newly formed Department of Education until his retirement. In 1932 he was president of the Education Section of the British Association for the Advancement of Science (a post Armstrong both created and held in its inaugural year). His presidential address, 'The advancement of science in schools – its magnitude, direction and sense', outlined his life-long philosophy on this subject. He was a member of the council of the Lord Kitchener Memorial Trust Fund and acted for many years as the council's Irish representative in connection with the selection of candidates for Kitchener scholarships. He was also very prominent in the Masonic Order and attained considerable status within it. His wife, Dame Clossett Heller, was well known in music circles in Dublin during this period as a vocalist and musician, and he travelled with her to various world-wide choral gatherings.

He lived in Dublin for nearly fifty years, a good part of this at 99, Upper Leeson Street and died on 13th May 1949, aged 80 having lost his wife four years earlier. He is buried alongside her at Mount Jerome cemetery. A simple epitaph on his grave reads: 'William Mayhowe Heller – Senior Inspector Board of Education'.

3.2 Armstrong's influence

As a pupil of Armstrong's at the Central when the heuristic system was coming into vogue, Heller must have been impressed with the imposing, dedicated and resilient professor and his methodology, for many years later in 1916 he said of the man:

> There is probably hardly a teacher of science today whose methods, consciously or unconsciously, have not been modelled by Armstrong's crusade. As an original thinker on education Armstrong ranks with Huxley; as a constructive reformer he is pre-eminent. It is sometimes difficult to understand how he acquired his keen insight into the aims and methods of schoolwork. It is the experience of more than one of his old students who have embraced the teaching profession, that only after some years of schoolwork did they appreciate to the full the fundamental importance of much that he taught them. Though years of strife with the

> conservative forces of educational tradition may occasionally have led us to policies of expediency, our courage has been maintained by the faith that he gave us.[2]

They worked together alongside Charles Maddock Stuart who was then Headmaster of St. Dunstan's College, a new school close to Armstrong's home at Lewisham. Stuart had also been a student of Franklands at the Royal College of Chemistry. Armstrong saw the potential and '...influenced him from the beginning'[3]. Heller assisted practically in putting the heuristic system into operation at St. Dunstan's, and no doubt gained first-hand experience of the difficulties. The system was soon extended to encompass elementary mathematics, geological geography and eventually to manual work in wood and metal. It was a success. So much so that Armstrong decided to go further and train teachers into this system. Armstrong was appointed science demonstrator in 1891 by the London Board and started to hold teacher-training sessions in heuristic methods in Whitechapel. Heller would eventually run these also and continued to do so for three years until coming over to Ireland. Armstrong in his paper *The Heuristic Method of Teaching* says of Heller,

> ...he showed equal devotion to the work, and not only carried it on in the boys' schools, but succeeded in introducing it into several girls' schools; he paid special attention also to the scientific side of domestic economy, and may be said, indeed, to have given the first impetus to rational teaching of this all–important subject.[4]

It was in his capacity as Science Demonstrator with the London Board that he put forward his proposed experimental science syllabus to the Belmore Commission.

3.3 His philosophy and thoughts on science education.

If we examine how Heller was teaching around the time of the Belmore Commission in 1898 we can see the influence of Armstrong's philosophy. An insight into his methodology comes from Appendix C. which was included in Armstrong's *The heuristic method of teaching.* The method was outlined under the title: *The method adopted by Messrs. Gordon and Heller in giving instruction in Elementary Schools.* The demonstrator usually spent a few minutes questioning the class with regard to the work

---

[2] Browne, C. E. *Henry Edward Armstrong and Charles E. Browne.* Imprint: Christ's Hospital. London: Harrison & Sons Ltd., 1968, p. 24.
[3] Brock, p. 28.
[4] Armstrong, H. E. *The Heuristic Method of Teaching or the Art of Making Children Discover Things for Themselves – A chapter in the History of English Schools.* 1898. Special Reports on Educational subjects. Vol. 2, 1898 (Sadler Report), London: printed for HMSO by Wyman & Sons Ltd., p. 396.

accomplished during the previous fortnight, and dealt with the difficulties that had occurred, taking care to determine and emphasise just what the pupils had learnt from the experiments they had performed; he then invited suggestions as to what the next step was. Very good suggestions were often made, but as a rule the class had to be led to the next question that needed answering. As soon as it was clearly understood what was to be the particular object of inquiry, two or four boys would get the apparatus out, assemble it, and make, for example, the necessary weighings. There was seldom any necessity for the demonstrator to handle the apparatus at all, and the fact that the demonstration experiments were performed by the boys themselves ensured that the other pupils paid careful attention to proceedings. Between the demonstrator's fortnightly visits there were, as a rule, three intermediate lessons, which involved recapitulating the last lesson, to catch up on work still outstanding, and in writing up notes. Otherwise lessons would be written up and notebooks attended to. In many schools one or two experiments were kept always going on a table in a corner of the room, and a few boys – usually not more than four – were always engaged at experimental work, so that in the course of the fortnight every boy in the class would have performed the chief experiments connected with that portion of the work under consideration.[5]

How Heller felt about this method of instruction may be seen from Appendix D 'Impressions of three years' experience of science teaching in East London schools'. Heller was then Headmaster of the Municipal Technical Day School in Birmingham.

> When at the invitation of the London School Board I resigned my position at King's College and became a "science demonstrator" under the Board, it was with some misgiving as to the outcome of the work I was about to undertake. The inducements were mainly two, first, that the crusade to be carried on was of the same character as that in which I had been engaged in two secondary schools, though the difficulties and dangers were greater; secondly that the brunt of the battle had been borne by my old friend and fellow student, Hugh Gordon, who had already broken down the first line of the enemy's defence. [6]

He continued:

> The success he achieved points a moral as to the future conduct of heuristic teaching in schools of every grade which my own experience abundantly confirms. The change in method

[5] Heller, W. M. *Impressions of three years' experience of science teaching in East London Schools.* Appendix D, Sadler Report, 1898, p. 428.
[6] Ibid., pp. 428-429.

must be sudden, complete, and revolutionary; no attempt must be made to gradually displace the old by the new, for in so doing both must inevitably become ineffective.[7]

Speaking at the 1908 Annual Meeting of the British Association in Dublin along with Armstrong, Heller spoke on the Constructive Work of an Inspector of Schools, he says:

> The inspector had a magnificent field for scientific research around him. He could watch, foster, and institute educational experiments of all kinds; and by encouraging teachers to meet together to discuss the details, aims and methods of their professional work, in which he should show keen interest himself, he could secure educational progress in his sphere of influence.[8]

At the 1932 British Association conference his presidential address, which was read by his wife incidentally, as he had had an accident that prevented him from delivering it himself, he wrote about elementary science:

> In the elementary schools little substantial progress has been made; here more than elsewhere the child is dependent upon the school for his educational equipment for life; if he does not get some introduction to natural knowledge at school, he will find few opportunities later. I could not speak so confidently if I had not conducted large-scale experiments in both England and Ireland. That both these experiments were subject to serious interruptions does not in the least affect their value. What has been done, can be done, and I am sure will be done again.[9]

He also wrote about the training in science of the general subjects teacher and his experience in Ireland:

> Years ago I inspected a country school in the South of Ireland; the teacher – an elderly man – assured me his pupils were 'mad on science'; the school was full of devices for making instruction real and exciting; senior pupils had preserved his keenness often found only among the juniors, and would argue with one about anything. On leaving, I asked the teacher why he had succeeded when others failed. With a twinkle in his eye, he replied: 'I dunno, sir, but perhaps it is I wasn't trained.[10]

Heller obviously had a sense of humour very much in keeping with the country he worked in. His philosophy was undoubtedly influenced by Armstrong; he felt that the aims of science teaching were

---

[7] Ibid., p. 429.
[8] The *London Times*, September 7th 1908, p. 4.
[9] Address by W. M. Heller (on Sept. 2nd, 1932) to the British Association for the Advancement of Science. Report of the Annual Meeting, York. London: Office of the B. A. 1932, p. 211.
[10] Ibid., p. 223.

admittedly the aims of all sound education, '...it must provide the pupil with that knowledge and those mental and personal characteristics that the demands of employment and leisure will make upon him'.[11] In concluding he wrote:

> This survey of the advancement of science in schools has left me with certain outstanding impressions: The curricula of many schools – especially secondary schools – are based upon the demands of external examinations, and take little thought of the human material handled or the shape into which it should be moulded to fit accurately into its place in the machine of life. It results in mass-production from the same mould without reference to the markets it is intended to supply. School science for the average boy or girl should, in the first place, provide broad and real knowledge that will, as far as possible, render intelligible the phenomena of common experience; and, secondly, provide a training in the formation of sound judgements and alertness. Its teaching cannot be adapted to traditional linguistic methods. Science teaching is a profession the preparation for which is at present neither deliberate nor adequate.[12]

3.4 The Belmore Commission – George Francis Fitzgerald and William Mayhowe Heller meet in London

In March 1897 representatives of the Belmore Commission travelled to London to interview selected witnesses with regard to elementary science instruction. One of the men on this commission was Professor George Francis Fitzgerald, who at that time held the chair of Experimental Physics at Trinity College Dublin. They met and interviewed both Armstrong and his colleague Heller. During their visit to both classrooms and laboratory, they witnessed first-hand Armstrong's heuristic methods as practised by Heller:

> On Friday, March 19, 1897 Fitzgerald and ten other commissioners went to Rutland-Street School, Whitechapel, ...where they inspected experimental science classes under Mr. Heller, afterwards they visited Mr. Heller's Laboratory, in Berner-street, where an explanation was given by Mr. Heller of the system of experimental science teaching in certain primary schools under the London School Board.[13]

---

[11] Ibid, p. 213.
[12] Ibid, pp. 227-228.
[13] Belmore Commission Final Report. Appendix F Digest of minutes of evidence, p. 434.

The following day they interviewed both Armstrong and Heller for the best part of four hours. During this particular phase of his career Heller was deeply involved in teaching 'Course H' as Science Demonstrator with the London Board. His method of instruction to the teachers was almost the same as that for his pupils. Armstrong paid credit to this innovative venture when interviewed by the Belmore commission in London in 1897 when he said that this course had been successful and that many of the teachers were interested in its success.

Armstrong had set up the Berner Street School as a means of developing teacher training in heuristic methods, and Heller was engaged in science instruction there. Exactly what the members of the commission witnessed is not recorded, however it is possible to understand why a combination of Heller's deep conviction in this form of science instruction as constructed by Armstrong, with his sheer professionalism and attention to detail, must have made this encounter quite memorable for some of those present. In a letter that Fitzgerald wrote to Heller barely two months later, on 6th May 1897, it is clearly evident that he was impressed, and Fitzgerald indicated most strongly that he was not going to let pass this opportunity for the introduction of heuristic methods into Irish schools.

> I have been so fully impressed with the advantages and workability of your system that I shall use my endeavours to have this rational system introduced wherever practicable in our Irish schools, and feel no doubt that wherever any science education is practicable, your system, modified as to its detail to suit localities, etc., but unmodified as to its ideals and essential methods, will be found by far the most practicable of any, and by far the most valuable as regards its results.[14]

3.5 The revised programme and Heller's appointment by the National Board

In an article entitled 'The introduction of Practical Instruction into Irish National Schools' which was written in 1902 the author details the enormity of educational change which the country experienced. Within twelve short months the whole system of primary education including curriculum, instructional methods, the administration of the parliamentary grant and the inspector-teacher relationship had changed radically. Almost 9,000 National schools were to be affected by this 'Irish experiment'.[15] Perhaps this was reflective of Heller's view expressed above that any change had to be '...sudden,

---

[14] Extract of letter written by Prof. G. F. Fitzgerald to W. M. Heller, published in *The Heuristic Method of Teaching,* H. E. Armstrong in Sadler Report, pp. 432-433.

[15] *Irish School Monthly*, Vol. III, No.2. October 1902, Dublin: Blackie & Son, Ltd., p. 35.

complete and revolutionary'. What made the Irish experience different was that in a similar effort in England the initiative came from the local councils themselves, whereas in Ireland this same initiative originated from a single Government department.

It is not possible to definitely show Fitzgerald's connection with Heller's appointment by the Commissioners. In the documents that have come to light two facts are confirmed. The post for Head Organiser for Elementary Science Instruction was advertised in both Irish and English newspapers, and that Starkie, as chairman of the commissioners announced Heller's appointment. It is highly likely however, that Fitzgerald made a very strong case for this appointment, based on the evidence of his letter to Heller which is detailed above, and when Heller made mention of Fitzgerald and the help he gave him, for writing in December 1902 he stated,

> ...and last, but not least, I am indebted to the late Professor Geo. F. Fitzgerald for much help and kindly suggestion both before and after my advent in Ireland.[16]

Yet again the system of networking appeared to be at work.

Having witnessed Heller's work in London and received witness statements from him, the Commissioners moved on. In the meantime Heller submitted his Course H syllabus in experimental arithmetic, physics and chemistry to the Board. In this course the emphasis was placed on heuristic methods of instruction with the pupils doing much of the work themselves:

> In connection with Object Lessons and Elementary Science Lessons, as in connection with Manual and Practical Instruction, the Heuristic method should be continuously employed. The pupils should cultivate the habit of obtaining knowledge directly and at first hand, *finding out for themselves,* and thus developing the faculty of observation.[17]

Heller could not have spelt out the method more clearly to the Commissioners, and this emphasis on pupil-centred science instruction must have appealed to the Board members.

With the publication of the Commissioners final report in June of 1898 the strong emphasis on manual and practical instruction in the revised programme was confirmed. The new Resident Commissioner Dr. Starkie was charged with overseeing this endeavour. Starkie also sat on the Board of the Intermediate Commissioners. The new Department of Agriculture and Technical Instruction, which began its work in 1899, saw that there was a bias towards the academic in the National Schools to the

---

[16] *Irish School Monthly*, Vol. III, No.4. December 1902, p. 120

[17] Appendix F, Revised Programme of Instruction in National Schools under Notes, Hints and Observations for the information of Managers and Teachers, pp. 74-75.

detriment of training in a skill. Many believed that for the future training of technical workers in the 'new Ireland' a sound basis had to be established at primary level. Hence new and very practical subjects were introduced by the Commissioners of National Education into the syllabus such as elementary science and physical drill. Needlework, cookery, laundry-work, singing, drawing and manual instruction were reorganised. Strangely, agriculture as a subject was dropped – a decision which would prove ill-advised, particularly in the rural schools. The old payment by results scheme officially passed out of the Irish education system on 1st April 1900.

Details of the proposed Course I on Experimental Science for the various standards included the following topics:

3rd Standard. Measurement of lines, areas and volumes. Water displaced by a body immersed in it. The seesaw or lever leading to a knowledge of the pair of scales or balance. Relative weights of different kinds of material.

4th Standard. Floating bodies. Weight of a body in water. Air has weight. Water pressure. U-tube, barometer, syphon. Measurement of hotness by thermometer. Evaporation, moisture in the air. Soluble and insoluble substances. Experiments to elucidate nature of burning in air. Changes in appearance and weight of various substances heated in air.

5th Standard. The units of heat and temperature. Revision of relative weight experiments. The rusting or slow changes occurring to iron, copper, lead and phosphorus in air. Active and inactive part of air.

6th Standard. Revision of heat experiments. Lime, chalk and marble. Effects of heat, water and acids on each. Measurement of gases evolved. Chalk gas proved to be identical with that produced by burning carbon in oxygen. Experiments to show chalk = lime + carbonic acid gas. Hard and soft water.[18]

This course was structured in such a way as to resemble almost exactly Armstrong's proposed elementary instruction in physical science syllabus which he had presented to the British Association in 1889, detail of which is provided on page 283. 3rd Standard would engage in stage 2 of Armstrong's course, that is, lessons in measurement, and this would lead into 4th Standard when the pupils would

[18] Quane, M. *Henry Edward Armstrong – William Mayhowe Heller and the implementation of Elementary Science in the National Schools System from 1900-1922.* M. Sc. thesis, Trinity College Dublin, 1999, pp. 55-56.

move into the realm of elementary physics. The last two years the pupils would spend investigating elementary chemistry, and the effect of heat on common substances would be examined.

On his appointment by the National Board of Education as Head Organiser of elementary science, and with not a moment to lose Heller initiated training classes for teachers in elementary science, and on 13th October 1900 the first of a series of courses began. 'Mr. Seymour took the chair and in a few well chosen words, congratulated the teachers on the rare opportunity they had of studying science under the guidance of Mr. Heller.'[19] Heller told the assembled gathering that all present would '...go through a course of practical science much more extensive than anything which can be attempted with the pupils in the schools'. He began his course in typical heuristic aplomb – with a demonstration on the proper use of the balance, '...as the basis of all practical science was accurate measurement'.[20]

Heller's courses were complemented by the textbooks, which were available at that time to these newly trained teachers. Some of those which were suggested included *Murche's Science Readers*, with the recommendation that:

> The true teacher of science will adopt only the Heuristic method, he will bring his pupil face to face with the great problems of nature as if he were the first discoverer. Having done so the teacher will take care that the usual teaching devices are resorted to, in order to fix permanently in the minds of the pupils the fact which has been thus discovered.[21]

Another textbook recommended was *A Manual of Elementary Science* by Gregory and Simmons.

> The experiments can in very many instances be performed with simple apparatus which can easily be fitted up by those who have had little training in laboratory methods. As a rule the experiments precede the theory, so that the work from first to last follows the inductive or Heuristic method, in which the pupil is expected from facts observed by himself to arrive at the theorems which these facts establish.[22]

In 1906 Heller himself would add to this list when he published the contents of the courses he gave in his own textbook for elementary science in schools. Two very influential journals which were in circulation at this time were *The Irish Teacher's Journal* and the *Irish School Monthly*. The function of the latter was to supply teachers with informative material, some of which could be utilised in their day-to-day teaching activities. In the words of its editor he hoped to make it,

---

[19] *The Irish Teachers' Journal*, October 1900, pp. 8-9.
[20] Ibid., pp. 8-9.
[21] *The Irish Teachers' Journal,* November 1900, p. 11.

> ...so essential to the teacher that it will become as much a part of the school equipment as the Rules of the Commissioners.[23]

3.6 Heller's courses

When Heller's science course was announced by the National Commissioners in September 1900, the interest it aroused in the Irish teachers was apparent in that over 300 applications for permission to attend were received for a mere 40 places.[24] He began by running science courses for teachers at the beginning of September 1900. The demand was considerable, and the *Irish School Monthly* announced that:

> Mr. Heller's Science Course will commence about the beginning of September. The Commissioners have already received over 300 applications for permission to attend, but as only about 40 can be summoned, a considerable number of teachers must be disappointed. [25]

The advice given to teachers by the Commissioners was that they were on no account to attempt to teach experimental science classes until they had attended Heller's course.[26]

Addressing teachers at the opening of his science course Heller made reference to the heuristic method of science instruction, which the National Board of Ireland intended to implement into its schools. He quoted Armstrong, using the following words: 'If we can but graft on the modern tendency to be practical, a proper utilisation of heuristic methods, we cannot fail to succeed in training up a race of competent workers of all grades'.[27] Here was the direct connection between science education and technically skilled Irish workers. For Heller, the objective of elementary science taught heuristically was to produce a graduate imbued with the extra characteristics of enquiry and research, and of originality and of thought: - characteristics that it was believed could be found in the German, Japanese and American peoples.

He maintained that in order for the teacher to imbue his instruction with the spirit of scientific enquiry, considerable experience in teaching science scientifically was necessary. Heller was approached by the editor of the *Irish School Monthly* late in 1902 and asked if he would be interested in contributing a series of articles on the teaching of elementary science. As Heller himself said: 'It has been my

---

[22] *The Irish Teachers' Journal*, March 1901, p. 10.
[23] *Irish School Monthly*, Vol. I, No.1, September 1900, p. 3.
[24] Ibid., p. 34.
[25] Ibid., p. 34.
[26] *Irish School Monthly*, Vol. I, No. 7, March 1901.

intention for some years to put on paper the results of an experience gained under varied conditions, but the pressure of a somewhat busy life has prevented me from carrying my intentions into effect'.[28] Having very little time at his disposal he agreed to carry out the commitment enlisting the help of a colleague of his, Mr. E. G. Ingold. The eventual result of this collaboration was a science textbook, which was published in 1906 entitled, *Elementary Experimental Science – an introduction to the study of scientific method*, which would remain in use until the end of the scheme. Ingold was associated with Heller for some years in '...the development of rational methods of science instruction in primary and secondary schools.' [29]

Heller saw elementary science teaching as '...fundamental instructions in the A.B.C. of Science and Scientific Method'.[30] This he saw as the groundwork and training required for the study of science in the higher forms of the secondary or technical school. The use of a textbook was seen merely as the teacher delegating responsibility elsewhere. In the first of these articles *Elementary Science and Object Lessons*, Heller made a direct reference to the heuristic method then in use in the Irish schools:

> We have heard a good deal of late of the word "heuristic", which has become the war-cry of those educationists who merely ask that the natural intellectual instincts of the child shall be encouraged and given a chance. Like all war-cries it irritates those who do not understand its meaning...[31]

This may in part explain why the Department and its officials avoided the use of the word, as seen in the evidence which George Fletcher assistant secretary with the Department gave to the Digby Inquiry, and which is detailed in section 6.10. Heller also saw the heuristic method as carefully directed enquiry.

The core of any heuristic syllabus incorporated that of the balance and Heller and Ingold's article on the use of this piece of equipment reflects this. The article entitled, 'Measurement of Mass – the Lever – the Balance', appeared in the July 1903 edition of the *Irish School Monthly* teacher's journal, and detailed part of the course which Heller had given to teachers. It opened with the concept of force and its meaning with respect to gravity. Heller suggested that a lesson on the force of gravity be given, during which a number of experiments on falling bodies should be made. One of these experiments

---

[27] *Irish School Monthly*, Vol. I, No.4, December 1900, p. 115.
[28] *Irish School Monthly*, Vol. III, No.4, December 1902, p. 117.
[29] Ibid, p. 117.
[30] Ibid, p. 117.
[31] Ibid, p. 118.

could consist of allowing bodies of various masses to fall from similar heights to show that they all strike the ground at the same time. In this way some '...incorrect ideas will probably be removed.' [32] The terrestrial globe could be used to elicit from the pupils the idea of a central attraction, and the notion that it is the weight of a body which is the force which attracts it towards the centre of the earth. The mass of a body is the amount of material in the body, whereas the use of the term 'a box of weights' is incorrect. However, it was not considered,

> ...desirable *at this stage* to draw further distinction between the units of mass and weight. Practical experience would seem to show that dynamic ideas and the laws of motion, should come only when the pupil has had a thorough course of instruction in measurement and elementary mathematics.[33]

To the questions 'How are we to measure these forces that the earth exerts upon all bodies?' and 'What are equal weights?' the observation that whether heavy or light, large or small, bodies fall to the ground in the same time from the same height leads one to suggest that rapidity of fall cannot be used as a means of measuring these forces. However, if different bodies are hung in succession to the same piece of elastic or spring it can be seen that some bodies stretch it more than others. So equal weights can be defined as those which stretch a piece of elastic to the same extent. Five experiments then followed, to make a number of equal "weights", to measure the extension of an elastic or spring balance when a series of different loads are hung on it and to investigate the law of the lever, to find the weight in grams of one of the bags of shot used above by means of see-saw, and to find the weight of wooden cubes by the see-saw. The first of this series of experiments was to assemble a number of small calico bags filled with either shot or sand and with a hook from a piece of elastic with two knots on it. Each bag was to be adjusted in such a way that it stretched the piece of elastic to the same extent measured against a metre stick. The reading taken was from the position of the second knot.

Thus was obtained a number of equal "weights". The second experiment was simply Hooke's Law. A table of results could be compiled as such:

---

[32] *Irish School Monthly*, Vol.III, No.11, July 1903, p. 375.
[33] Ibid, p. 375.

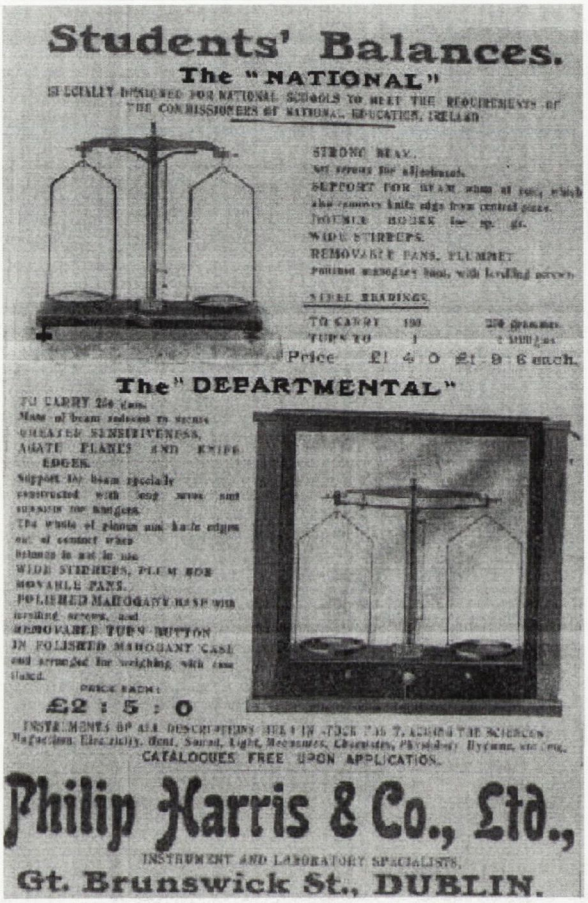

Plate 7. Advertisement in Teacher's Journal 1907 for school balances. The 'National' was for use in the primary schools whereas the 'Departmental' was for the Intermediate schools.

Number of Bags	Distance between knots	Extension	Extension produced by 1 bag

The seesaw was introduced using the experience and observations the pupils would have made in their playing on it. The pupils were to construct their own miniature see-saw from either a foot or metre stick and place the calico bags already created as loads at various positions on either side of the fulcrum. The term 'moment' was not to be used but rather 'turning power', as the latter would mean more to the pupil. Now came the time when all these discoveries could be used to find the weights of bags of shot, '...it is clear we can employ the see-saw law to find the weight of various objects, and as we shall use a box of brass gram weights for this purpose, we must see exactly what weights we have.' [34] There then followed a detailed breakdown of all the weights in the box. Heller insisted that the pupils should always record the weights obtained in decimal notation. Experiment number four used these weights arranged on a seesaw to determine the weight in grams of the bag of shot.

The final experiment not only determined the weight of wooden cubes using the seesaw, it also led to the 'discovery' of density.

> Experiment V – To find the weight of wooden cubes by the seesaw. Weigh all the wooden cubes on the seesaw, using the 50 gram weight exactly as in previous exercises; take two positions for each cube. As you know the volume of each cube (64 c.c. or 8 c.c.) find the weight of 1 c.c. of each kind of wood. See which of the woods will sink and which will float. Tabulate your results. An examination of the results leads us to a most important conclusion. If one cubic centimetre of a material weighs more than a gram, that material will sink in water, and if it weighs less than one gram, the material will float in water.[35]

It was now time to introduce the balance or pair of scales to the pupils, and the connection between it and the seesaw was to be emphasised. Heller himself saw the necessity of proper training in the use of this instrument, as consistent accurate measurement in the science laboratory relied on it.

> The reforms in Science Teaching have centred round the fundamental principle that knowledge must be gained by *experimental enquiry*: if experimental results are to be used as a

[34] Ibid., p. 378.
[35] Ibid., pp. 378-379.

> basis of accurate reasoning, these results must be accurate, and hence arose the necessity for an instrument for measuring weight (mass) which would be both accurate and simple for young children to use. It was only after a long and weary agitation that schoolmasters were brought to see that an instrument, which children could use with ease, as well as respect, was a necessity and not a luxury; now there is not a science teacher in the three kingdoms who would revert to the half-crown pair of scales, an exceedingly difficult instrument to use or respect, and with which you could never teach a boy or girl any methodical habits. Fifteen years ago there were probably not a hundred balances, such as are to-day, used in Irish primary and secondary schools, in the whole Kingdom; probably now considerably over 50,000 are in daily use.[36]

Interestingly around this time Philip Harris were advertising two types of students' balances, one the "National", a less accurate and open scales which was '...specially designed for National Schools to meet the requirements of the Commissioners of National Education, Ireland'. The other, the "Departmental", in a polished mahogany case, was aimed at the Intermediate Schools. The former sold for £1. 4s. 0d the latter £2. 5s. 0d.[37] Heller was adamant that if the proper procedure was learnt by the pupil in laboratory weighing this training would be 'splendid':

> If these rules are observed it is absolutely impossible for a child of average intelligence to make an incorrect weighing, and the discipline of methodical weighing is a splendid training. Never allow two scholars to take part in the same weighing; it is impossible to get concentration or expeditious weighing if you do. After some practice weighing should be made in *two minutes*, and it is of the utmost importance that children should be trained to carry out such operations with expedition as well as with accuracy.[38]

He even suggested that the teacher could organise a class-weighing tournament in order to promote accuracy among the pupils. Heller also intimated that the demand made by practical subjects on the school timetable might well be the fault of the teacher, even a good teacher,

---

[36] Ibid., p. 379.
[37] *Irish School Monthly*, Vol.VI, No.9 April 1906, p. 293.
[38] *Irish School Monthly*. Vol.III, No.11 July 1903, p. 381.

> ...it is creating a bad habit to allow a boy or girl to take half an hour over a piece of work that should be completed in ten minutes, but one continually sees this happening in needlework, cookery, carpentry, and most of all in the laboratory.[39]

With the completion of this first course of training on 16th November, he had established himself as the consummate professional for *The Irish Teachers' Journal* wrote on 24th November:

> Mr. Heller proved himself a very able teacher, indeed, of practical science. He has shown himself a master of the subject. He is a clear and lucid lecturer; an able and experienced demonstrator, and a most painstaking and successful teacher.... He is filled with enthusiasm for his subject, and has succeeded in infusing some of that enthusiasm into those he had to teach. If Science teaching will not succeed under his guidance we do not see how it can be made to succeed in our Irish Schools.

During his five-week course he had performed nearly two hundred experiments on such topics as densities, the construction and use of barometers and thermometers, rusting and burning, specific and latent heat, the action of acids on metals, the air and its composition, chalk and limestone, hard and soft water. All attending teachers sat an examination which included quantitative experiments such as finding the exact amount of hydrogen gas generated by a gram of zinc: the percentage of oxygen in a given specimen of copper scale; the percentage of increase in weight when phosphorus is burned in air; the number of calories required to change one gram of water at 100^0C into one gram of steam at 100^0C.[40]

3.7 Progress of elementary science instruction 1900 – 1912

One of the ideas of the vice-president of the Department of Agriculture and Technical Instruction, Sir Horace Plunkett regarding the primary and secondary schools was to bridge what he saw as an educational gap between them. No more so was this evident than in the rural districts of Ireland. He intended to do this with a scheme of agricultural education here so that the education of the country child would not stop at sixth class in the primary school but be continued. The door to secondary education would be opened and the teaching would be adapted in order to advance him in the practical training necessary for his career in life.[41]

---

[39] Ibid, p. 381.
[40] *The Irish Teachers' Journal*, November 1900 p. 3.
[41] *The Irish Teachers' Journal*, October 1900, p. 3.

For some this new scheme was out of character with the general ethos of the Irish National Schools, particularly the rural ones. They felt that the framers of the programme should have gone into schools first, examined their fittings and appliances, observed the pupils attending classes and studied their needs and capacities.

The teachers also needed to be observed and their training and preparation examined before designing a programme to suit the immediate needs of the surroundings. Consequently the scheme was believed to be doomed to failure:

> ...we fear the new programme will be like the denizen who takes up his abode in a new country and ignores his surroundings. Its life will be a short one, and most of it will be passed in extreme discomfort, unless it is speedily subjected to large modifications. [42]

The sudden change in the scheme took the existing system by surprise and so quite a number of teachers continued to teach under the old programme, and it took many years to amend this behaviour. Journals such as the *Irish School Monthly* published articles aimed at easing this transition for teachers. For example during the summer of 1901 the following article was published in an effort to explain the new approach which the Department intended:

> Course in Science
>
> [The following instructions have been issued by the Agricultural Department for the teaching of Science. They will be found useful by Teachers of National Schools]
>
> The committing of facts to memory, however important or useful, is not Science teaching; and it is hoped, therefore, that during at least the first two years of the course the textbook will occupy a very small (if any) share in the work of instruction. The object in view is the introduction of the scientific method of Science teaching as a means of mental discipline; and it is because the methods and spirit of teaching cannot be measured by the ordinary form of written examination, that the annual written tests have been abandoned in favour of inspection.
>
> The principles underlying the scientific method are (1) careful and accurate collection of facts; (2) observation of the inter-relation and sequence of facts; (3) construction and testing of hypothesis to account for facts; and it is possible, even in the simplest exercises, to have due regard to these principles. To the scientific method, the mere *telling,* or *learning,* of facts is

[42] Ibid., p. 4.

therefore opposed. The work is to be practical, and by this is meant the working out of the exercises by the pupils themselves... As far as possible, the "research" method should be adopted even in the earliest exercises; but the teacher will probably find that at one time the "research" method, and at another the method of "verification", will best serve the interests he has at heart, and carry along his work without undue loss of time.... Pupils may be allowed to work in pairs, but not in groups of three or four... The apparatus used should be simple and inexpensive as possible. At the present moment it is not proposed to issue a list of necessary apparatus; the choice is left to individual Schools. But one balance (costing from 30s to 40s.) will be necessary during the first two years for each pair of pupils in any one laboratory class. Afterwards a few more delicate balances will be required... The record of the exercises is only less important than the exercises themselves. A laboratory book of uniform size, and with a fair proportion of pages of squared paper should be in the possession of every pupil. The method of performing an exercise should be described in a few sentences, the apparatus should be neatly sketched, and the results of observations entered in ink (arithmetical results, tabulated in ink) at the time of working the exercise.... It may occasionally be found advisable (owing to the nature of the experiment or to the character of the apparatus required) to perform an experiment in the classroom and to omit it from the laboratory course. Such cases must be exceptional, and they must be clearly separated from what is understood to be the work of the pupils.[43]

Because elementary science was to be a compulsory subject in all National Schools it was imperative that the teachers charged with the instruction of it would be properly qualified. Consequently very careful emphasis was placed on the fact that teachers of national classes should not attempt to teach the elementary science course to their pupils until they had first enrolled on an organizer's course, and obtained a certificate of competency to prove such attendance. Heller began these courses within weeks of this appointment by the National Board, although he felt that no amount of training could create a heuristic science teacher. In a paper which he read at the British Association Meeting at Belfast in September 1902 he declared that:

> I am sure it will be equally necessary and desirable to give many of our national teachers the opportunity of going through their various courses a second time after two or three years

[43] *Irish School Monthly*, Vol. XXXV, No.33. August 1901, pp. 6-7.

> experience in teaching the subject in their schools. It cannot be insisted upon too strongly that no such course, that no Training College, can teach a teacher how to teach...his own attempts at teaching during the first few years after leaving the training class or college will be his real training period; he *must* learn the art of teaching by heuristic methods.[44]

Heller's optimism at this meeting to the implementation of elementary science in the revised programme is clear.

> In modern history of Education, there is probably in no country such an example of complete change both in administration and methods of instruction as has recently occurred in Ireland; whether we shall in the future be justified in substituting the word *reform* for the word *change* time alone can show.[45]

Although the scheme had been in practice for almost three years, by 1903 there was an air of optimism in the country with regard to this new approach toward science instruction. This mood reflected itself in many of the articles written during this period in the Irish education journals. For example:

> The teaching of elementary science has come to stay, and all teachers would be well advised in making themselves familiar with the methods now generally followed. The labours of such men as Armstrong... and many others have been successful in getting science a place in many schools. We hope the day is not remote when it will find a place in all schools, and wherever it is introduced at all, if it is to be taught successfully, it must be taught experimentally.[46]

In his report for 1904 on the progress made, Heller expressed his view that the subject was both useful and desirable in the National Schools. *The Irish School Weekly* praised him for his work by publishing the following.

> And everybody must further admit that no person could have worked more energetically in the cause of Science than he has done during the past five years. If Elementary Science should turn out a failure in the Irish National Schools, it will not be for lack of enthusiasm or organization on the part of Mr. Heller.[47]

However Heller was shortly to lose some of his staff, and the courses of instruction he had so admirably established and run since 1900, were to be curtailed. As early as 1902 funding for his

---

[44] *Irish School Monthly*, Vol. III, No.2. October 1902, p. 39.
[45] Ibid., p. 35.
[46] *The Irish Teachers' Journal*, October 1903, p. 6.
[47] *The Irish Teachers' Journal,* December 1905, p. 84.

scheme was being cut, and there was difficulty in obtaining travelling expenses for his staff in their visits to the various schools around the country. There was also the problem with respect to the provision of enough suitably qualified teachers. Heller estimated that only 4 per cent of teachers had undergone the full course and that only 3,774 or 30 percent had qualified in the first part – that would allow them to teach Fourth and Fifth Standards. Lack of the necessary finances was the explanation given by the Commissioners. Heller himself felt that teachers who had not completed his course were unqualified to give the quality of instruction which he deemed necessary. When we look at his notes we see the depth of treatment which he considered necessary in each of the topics. Some detail on the courses he organised for teachers is presented in section 3.6. The fact that the majority of National teachers failed to complete his course must have seemed to him that the scheme was not going to achieve what he intended, and that the previous results system which had been practised pre-1900 was proving very difficult to supersede. With the realisation that the teacher training programme was not reaching enough teachers and that funding for the programme was running out it is therefore not surprising that his 1904 report is filled with a sense of disappointment. Heller would appear to have realised that without a successful training scheme the programme would struggle. His mood would not have been helped by an article which appeared in *The Irish School Weekly*, which stated that it would appear contradictory, for a heuristic course, that Heller assessed successful graduates in his courses by using formal examinations:

> At the end of the course an examination is held, sometimes purely theoretical, but sometimes theoretical and practical; very considerable value is attached to the results of this final examination in determining the qualification.[48]

Yet in the same year the National Board instigated new regulations whereby the higher classes of the National Schools were permitted to adopt the Intermediate programme. This is an indication of the high standards that were being achieved by some of the schools.

The fact that the equipping of laboratories in physics and chemistry in the National Schools followed similar lines as those of the Intermediate schools indicates the closeness of both science courses.

> Already, several large schools are making arrangements to equip a laboratory for physics and chemistry after the plan of the Secondary Schools; and the programme is apparently the same.[49]

---

[48] Heller as quoted in the *Irish School Weekly*, Vol. VII, No. 4. December 1905, p. 86.



Plate 8. An object lesson being given in the early 1900's to primary pupils.

These new regulations which were seen to bring both primary and secondary closer together, a situation which could benefit the entire country. The provision of Leaving Scholarships might enable the more talented pupils continue their education at the higher grade schools and even university. However, for the majority of the National Schools, where the general standard among its pupils was not as high, the elementary science programme was not very successful, this despite the various modifications made during the first four years. The first three standards were to allow the pupils be given conversational object lessons on animals, plants, common things, and natural phenomena. Consequently the study of science proper did not begin until fourth standard. Here awaited difficult concepts such as the law of the lever, equilibrium, densities of various liquids, weighing air and the construction of the barometer. The scheme would appear to have been devised for the older and more mature pupils than those found in the National Schools of Ireland.

In schools of two or less teachers and in schools where the proper facilities and apparatus were not available, the instruction of elementary science through the heuristic mode was proving very difficult. So by 1906 rural schools of two or more teachers were no doubt pleased to read in the programme for schools, that the formal programme in elementary experimental sciences '...need not be taken up', and that the teacher could if desired '...substitute a course of nature-study object lessons'.[50] In rural schools with only one teacher there was no mention of elementary science as a subject; instead the section was simply headed "Object Lessons". For these schools it looked as if the introduction of elementary science as a subject was over. It was left therefore to the urban schools to maintain the momentum which had been established in 1901. However, even here, one-teacher schools were exempt from the course. Unfortunately with the re-introduction of the object lesson into the school, the opportunity of exposing the pupil to the scientific method under the heuristic scheme was lost. Instead of discovering for themselves in a laboratory setting, the pupils were to be subjected to the object lesson plan in the classroom. This involved in the first place observation; and in the second, information. Some changes from the 'old' object lesson plan were envisaged however. It was intended that, ideally pupils should be able to touch and handle the object in question; therefore these objects should be carefully chosen with this in mind. A carefully structured question and answer session between pupils and teacher was also hoped for,

---

[49] *Irish School Monthly*, Vol. V, No.1. September 1904, p. 34.
[50] *Irish School Weekly*, Vol. XLIV, No.1. September 22nd 1906, p. 553.

> ...the teacher should not endeavour to force his own preconceived scheme of the lesson too strongly upon the class, but should utilize, if occasion arise, the questions and suggestions of the pupils.[51]

Further it was hoped that 'subject' teaching might also occur. This would deal with '...the phenomena of everyday experience', and '...should, wherever possible, be made experimental.'[52] It was intended that subjects which had been part of the experimental science course could be used. The heuristic method was not abandoned, and articles published at this time went to great lengths to make sure that this did not occur. For example:

> Note any facts of exceptional interest in connection with the object, which facts cannot be elicited by *heuristic* teaching; place these in as interesting a form as possible and narrate them to the class.

In reality however it was only a matter of time before teachers would once again return to the more didactic approach to teaching classes, and the object lesson would once more reign supreme in the classroom. This had already begun to happen by 1907, when school inspections under Heller ceased. The heuristic approach would be consigned to the past, and laboratory equipment would sit on the shelf to gather dust yet silently proclaiming an era of science instruction that had once existed in the primary schools of Ireland.

3.8 The National Board's Heuristic policy

> The Object Lesson is not a lecture. According to the Commissioners, the Heuristic method should be continuously employed. By this method, children are expected to find out things for themselves, when, by judicious questioning, their attention has been directed to them.[53]

So said an article published in the *Irish School Weekly* in October 1900. It heralded the end of the old system and introduced an ambitious initiative, as was noted in the previous section, that it was hoped would change the graduate of the primary school. *The Irish Teachers' Journal* of Primary and Intermediate Education published the following on 23rd November, 1901: 'It is also well to remember that all scientific teaching should be inductive, or, as the modern phrase has it, heuristic'.[54]

---

[51] Ibid, p. 553.
[52] Ibid, p. 553.
[53] *Irish School Weekly*, Vol. I, No.2. October 2nd 1900, p.
[54] *The Irish Teachers' Journal*, November, 1901, p. 5.

In many of the articles published around this time the name of H. E. Armstrong is evident. Through the frequency of mention his name was linked to the new programme of elementary science, and he was considered to be the touchstone in this regard.

> Professor Armstrong contends that from the earliest moment the pupils must be led to write out careful descriptions of the things they have collected and examined, of what they have seen, and of the experiments they have performed.[55]

Advice was given to the teacher about the way the pupils should present their laboratory reports, the focus being on the valuable literary training which was seen to be gained through this method of science teaching. Again and again Armstrong was quoted in these articles with references to his emphasis on the value of laboratory notebooks. For example:

> Professor Armstrong states that there is no point in connection with the teaching of science of more importance than the preparation of proper notebooks by the pupils. There is no divergence of opinion as to the value of properly kept Note Books. The mere writing out of the account of the experiments not only affords most valuable literary training to the pupils, but also gives them practice in writing, in spelling, in drawing, and in arithmetic, as well as in English composition.[56]

Apart from this literary training other benefits were outlined. The fact that pupils were forced to think about the purpose of every step in the experiment they were describing, and also to reason out each step in the chain of argument which leads up to the conclusion to be drawn from the experiment. This was the core idea of Armstrong's heurism. In this way, '...the principles of science, and above all, the scientific method will be more firmly stamped on the minds of the pupils, and as the notes must frequently be written at home, the pupils will be trained to the habit of independent self-exertion'.[57]

The ultimate aim of this training in scientific method was to turn the mind of the science pupil into one of investigator – a self-motivated one and in so doing instil in the pupil all the inherent qualities of an investigator, to be painstaking, persevering, and accurate observers. These school habits it was thought would remain with them for the rest of their lives. This was the basis of the faculty psychology which influenced Armstrong's heuristic methodology. The articles also suggested that should this programme be carried out the benefits to those working under it would be considerable, but that in order to carry

---

[55] *The Irish Teachers' Journal*, April 1901, p.5
[56] Ibid., p. 5.
[57] Ibid., p. 5.

out the programme efficiently great energy would be needed from those implementing it, i.e. the teachers themselves:

> We do not write this in any spirit of fault-finding with the New Programme, but we think it desirable that our readers should realize fully the nature of the task before them, and that they should at once recognise that they cannot hope for much success in their science teaching if they are not prepared for a good deal of hard work, both inside and outside school hours. It is only fair to add that if the work be hard, it is at the same time work of a most fascinating character.[58]

Writing in the *Irish School Monthly* in September 1903, Heller details the methodology demanded of teachers engaged in practical science instruction:

> Many bad habits are easily acquired by children during practical work unless these are carefully guarded against. Numbers should never be jotted down on odd pieces of paper; all work in pencil should be just as neat and understandable as if in ink; let every number be properly described as in the above example; above all, avoid anything in the nature of a formula especially "Rule of Three"; if the exercise does not appeal step by step to the child's intelligence, it is perfectly useless and would be far better left alone.[59]

3.9 Problems for the technical schools

In a paper read at the British Association Meeting in Belfast in 1902 Heller, then Head Organiser of science instruction to the Commissioners of National Education, made reference to the importance of the connection between the National and Technical Schools:

> Practical Instruction in the National Schools is, perhaps the most important problem in Irish educational affairs to-day; the splendid efforts of Mr. Plunkett, in establishing a system of Technical Instruction throughout the country, cannot bear full fruit until the National School is producing material, with a taste for, and capable of benefiting by, the instruction given in the Technical Schools; on a sound foundation of Practical Instruction in the National School, with a ground floor of Technical instruction, the upper stories of a noble fabric of Industrial Development may be built.[60]

---

[58] Ibid., p. 4.
[59] *Irish School Monthly*, Vol. IV, No.2. October 1903, p. 45.
[60] *Irish School Monthly*, Vol. III, No.2. October 1902, p. 40.

There had been calls from many educational writers for closer co-ordination between the primary and the technical school. For example the *Irish School Monthly* said that:

> The Primary School and the Technical School ought to be in the closest touch. On the day a pupil is free to leave the Primary School and enter a trade he ought to be able to find a place in the Technical School [61].

The English system of 1900 established a block grant method for the payment of teachers. The Board of Education was set up and took over the educational functions of the Science and Art Department, the Board of Agriculture, and the Charity Commissioners. The primary and secondary schools were brought together under the same system of inspection. Almost the opposite occurred in Ireland.

Even as early as July 1901 views were been expressed in educational journals about the lack of unification amongst the various boards. For example writing at that time the *Irish School Monthly* stated that:

> The new Intermediate Programme has conspicuously failed to provide for the continuity of education from the elementary to the secondary stage, and we rejoice to see that the press and the public have recognised the fact. The supreme folly of appointing a new Commission to inquire into Secondary, Higher, and Technical Education, without any reference to the material to be worked upon – the pupils in elementary schools – would be possible in no country but this.[62]

In September 1902 at a conference of science teachers held in Dublin, Heller made a proposal to form an association of teachers representative of all types of education, primary, secondary, technical and university. The aim of this association was to debate problems relating to their respective work. Heller's own view was that this organisation might break down '...our watertight compartments of education', and that the interchange of views among teachers of all grades and denominations would '...lead to some constructive suggestions as to the much desired co-ordination in Ireland of educational affairs.' [63]

The new society, christened the Dublin Education Society, had its inaugural meeting at Leinster House, Kildare Street on 18th February 1903. Its charter was '...to gather the experience of many', for an

---

[61] *Irish School Monthly*, Vol. VIII, No. 2. October 1906, p. 67.
[62] *Irish School Monthly*, Vol. 1, No.11. July 1901, p. 278.
[63] *Irish School Monthly*, Vol. III, No.2. October 1902, p. 71.

exchange of views based on this experience for the '...benefit of all'.[64] The subject chosen for discussion for this first gathering was: "What constitutes good school discipline?"

However from 1900 there was a problem due to a regulation whereby pupils leaving the national school after fifth grade found themselves too young to be admitted into the technical school. This led to an educational hiatus between the ages of 13 and 14, one which appeared to have been overlooked by the Department in the preparation of its programme. It also affected the majority of primary school pupils in the country. It soon became obvious that the standard of education for entry required by the technical school fell far short of the technical school's expectations, particularly in the field of mathematics. Consequently many of the technical schools found themselves employing primary teachers to instruct first year pupils in this subject. It was not until 1904 that this situation was corrected; however the damage had been done. At a critical period in their formation between 1902 - 1903 the technical schools were deprived of suitably educated pupils to ensure that the scheme got off the ground smoothly.

To add to this confusion was the lack of a common policy between the technical school and the evening continuation school in these early years of the Department's work. The evening schools were established to educate those primary pupils who had left school prior to achieving sixth grade certification. It was more than likely that those teaching pupils in these schools were the very same teachers as those employed by the Department to instruct first year technical students in mathematics. Yet no common policy existed to unite both endeavours.

3.10 The demise of the heuristic scheme

As early as March 1901 the heuristic scheme of science instruction as implemented by the Commissioners of National Education came under criticism from some of the education journals, chief among them was the *The Irish Teachers' Journal* which wrote:

> Life is not long enough for any person to investigate anew the whole body of science, and consequently we must in a scientific age like the present, even when we follow the Heuristic method in our own inquiries, be prepared to accept implicitly the results of others' inquiries.[65]

Heller's initial problem of a lack of suitable teachers trained in heuristic science instruction was overcome by initiating training programmes nationally. These six week courses which were given

---

[64] *Irish School Monthly*, Vol. III, No.8. April 1903, p. 263.

during the summer holidays, were run in an effort to supply teachers immediately to the elementary classes. And it was hoped that over the four summers a supply of more experienced teachers would be maintained in order to keep pace with the pupil's progress in science. However, with the reduction of his funding in 1907 this training scheme had to be scaled down and eventually curtailed. This was a serious blow to Heller's scheme of teacher instruction. In 1906, six of Heller's staff were redundant, and he was working with only two of his original team. One of these, a Miss Maguire was charged with overseeing the Southern section of the country which consisted of about 700 equipped schools. Eventually she abandoned trying to visit these schools, and spent the last few years of her work conducting teacher training courses based in the convent schools.

In his 1905 – 06 report to the Commissioners of National Education, Heller signalled that he felt that some schools were interpreting this reduction in his staff as a sign that the Commissioners policy with regard to elementary science was changing.

> Teachers appear to have become so unsettled by the changes in methods and programmes that they erroneously interpreted the changes in organization of last March as a *volte-face* in policy on the part of the Commissioners with regard to the position of scientific instruction in schools.[66]

As stated earlier Heller had said when he was headmaster of the Municipal Technical Day School in Birmingham in 1898 in connection with introducing a heuristic method of instruction that: 'The change in method must be sudden, complete and revolutionary; no attempt must be made to gradually displace the old by the new for in so doing both must inevitably become ineffective'.[67] Great difficulty seems to have been encountered by teachers of the new heuristic method of instruction in their pupils' attitudes towards this new emphasis on pupil centred education. 'An attitude of mind seems to have been created in the pupils that makes them almost resent being asked to think out the answer to the question themselves.'[68]

He had observed early in the programme a tendency on the part of the teachers to practice only a limited amount of practical work in the laboratory. Time and time again they would emphasise the written part of the work and minimise the laboratory work. This was not what Armstrong imagined a

---

[65] *The Irish Teachers' Journal*, March 1901, p. 6.
[66] Heller, W. M. 1905–06 General Report, Appendix to the 72nd report, p. 204.
[67] Heller, W. M. *Impressions of three years experience of science teaching in East London schools,* Appendix D, (Sadler report), Vol.2 Wyman & Sons, London: 1898 as quoted in MSc thesis, p. 59.

heuristic course to be. In his 1908 – 09 report Heller came close to openly criticising the very teachers the scheme depended on, but balanced his opening remark with a depth of understanding with regard to the huge expectations placed upon them, '...the teachers have not exhibited in any marked degree a spirit of self-help, nor was it to be expected in a subject and in methods so new to them.' His opinion with regard to the way in which science was being taught reflected a sense of futility with some of the teachers engaged in the scheme. He wrote: '...didactic method is mistaken for teaching, and science is regarded as a *subject* rather than a method of, and instrument in, *educating*;' [69] By 1914 elementary science was being slowly replaced by rural science and officers from the Department of Agriculture and Technical Instruction were engaged in giving classes in this subject (including the school garden) as early as 1912. In his 1914 report, with the primary school heuristic programme failing, Heller wrote:

> Educationally, the principal purpose of science instruction is to teach children to experiment, which is chiefly an intellectual rather than a merely practical training.... Some course of elementary physical science, such as our programmes present, is the very alphabet of any serious study of plant life or of domestic science. Any attempt to shirk it will lead, as it always had led, to superficiality and failure.[70]

---

[68] Heller, W. M. 1900-01 General Report. Appendix to the 67th report, p. 158 as quoted in MSc thesis, p. 76.
[69] Heller, W. M. 1909–10 General Report. Appendix to the 76th report, p. 197.
[70] Heller, W. M. 1913–14 General Report. Appendix to the 79th report, p. 197.

Chapter 4

The Department of Agriculture and Technical Instruction and Secondary School Science from 1900 - 1924

4.1 Technical education in Ireland prior to 1900

Ireland's industrial and technical situation in 1895 was described in the Freeman's Journal and re-echoed in the Recess Committee's Report as,

> ...a poor country, practically without manufacture – except for the linen and ship-building of the North, and the brewing and distilling of Dublin – dependent upon agriculture, with its soil imperfectly tilled, its area under cultivation decreasing, and a diminishing population without industrial habits or technical skill.[1]

The two Technical Instruction Acts of 1889 and 1891 which enabled local authorities in England to raise a rate of 1d. in the pound for either rate relief or technical instruction was totally inadequate in Ireland, as the following figures attest, '...in 1893 the amount of public money expended per head of population, devoted to Science and Art and Technical Instruction, was distributed as follows: -

Table 4.1[2] showing amount of public money expended on

	Amount	Rate per pound
England	£772,850	6.5d
Wales	£55,000	5d
Scotland	£69,000	4d
Great Britain	£878,100	6.75d
Ireland	£21,200	1d

While as regards Technical Education alone, they show that, inclusive of small contributions from the rates, the sums expended in 1893 was £696,328 for Great Britain and £4,944 for Ireland.

---

[1] The *Freeman's Journal,* March 30th, 1895.

[2] Report of the Recess Committee on the establishment of a Department of Agriculture and Industries for Ireland. Appendix O. Dublin: Browne & Nolan Ltd., 1896 p. 378.

This assistance from the votes amounts to a bounty to English manufacture, and in justice it should either be extended to Ireland or withdrawn.[3]

Only with the enactment of the 1898 local government legislation was a system put in place for this form of funding to be availed of in Ireland, and provide '...for the local authority structures for a decentralized system of technical education'.[4] By the close of the century, technical instruction, whilst scarce in the cities, was almost non-existent in the smaller towns and rural areas.[5] Any monies raised went to both the National and Intermediate Education Board, but none went towards technical education:

> In Ireland the beer and spirit duties were applied partly in increasing the salaries of National School Teachers, and partly towards Intermediate Education; but no portion of these funds was placed at the disposal of local authorities, or made available for purposes of Technical Education; and the result has been that the Technical Education Act has only been enforced in a few towns.[6]

Technical instruction was defined by the 1899 Act as:

> ...instruction in the principles of science and art applicable to industries, and in the application of special branches of science and art to specific industries or employments. It shall not include teaching the practice of any trade or industry or employment, but, save as aforesaid, shall include instruction in the branches of science and art with respect to which grants are for the time being made by the Department of Science and Art...[7]

More will be said on the state of technical education in the country during this period of Irish history in the next chapter.

The teaching of science in secondary schools was also in a precarious state. School science laboratories were few, and properly qualified teachers with science degrees or diplomas were uncommonly rare. Consequently, by the time the Department of Agriculture and Technical Instruction had been founded in 1900, the state of science instruction in the country was, to say the very least, in a poor state of affairs. The figures alone demonstrate the fact that any branch of science as a subject taken for the Intermediate

---

[3] Graves, A. Memorandum on Agricultural and Technical Education. From the Recess Report, 1896, p. 378.

[4] Hyland, A and Milne, K. *Irish Educational Documents*. Vols. 1 & 2. Dublin: C.I.C.E., 1992, p. 275.

[5] Hoctor, D. *The Department's Story – A History of the Department of Agriculture.* Dublin: Institute of Public Administration, 1971, p. 16.

[6] Graves, p. 377.

[7] Durcan, T. J. *History of Irish Education from 1800.* Bala, North Wales: Dragon Books, 1972, p. 128.

examinations was effectively discouraged due to the underdeveloped state of science instruction in the schools. In 1868, there were 76 schools in Ireland in which science was being taught. As the grants from the Science and Art Department in South Kensington fell, so did the numbers. In 1872, grant expenditure exceeded £9,000, whereas in 1900 this figure had fallen to less than £4,000. This drop could be attributed to the increase in the numbers of pupils presenting themselves for monies from the Intermediate Board rather than the Science and Art Department.

The facilities for technical education in 1896 comprised the following: under the National Board: The Albert Model Farm at Glasnevin, The Munster Dairy School (managed by a local committee) and an agricultural course given to pupils in the sixth standard of all National Schools,

> ...44 of which (out of a total of 8,505) have small farms, while 30 have small gardens attached for the purpose of practical illustration. In a few schools manual instruction is given...[8]

Other training facilities included, seven Reformatory Schools for boys and girls convicted of crime, and 69 Industrial Schools for the destitute children of improvident parents, (in both of which classes of schools technical instruction is given).

The Royal College of Science in Dublin had the aim:

> ...to supply, as far as practicable, a complete course of instruction in science applicable to the industrial arts, especially those which may be classed broadly under the heads of – (1) mining, (2) agricultural, (3) engineering, (4) manufactures,[9]

worked under the Science and Art Department, and therefore was financed by the Treasury. A Technical and Science and Art School in Kevin Street worked under the Corporation and was managed by a committee and supported by grants from the Corporation, the Science and Art Department, and the City and Guilds of London Institute.

A Fishery School in Ringsend endowed by the Earl of Pembroke, (which also received contributions from the Corporation, and the Science and Art Department).

---

[8] Report of the Recess Committee, p. 88.
[9] Ibid, p. 89.

A Metropolitan School of Art, also in Dublin, under the Science and Art Department. In Belfast a Weaving School, a School of Art, and some working men's classes were partly maintained by the Corporation and partly by the Science and Art Department and the City and Guilds of London. In Cork there was a School of Art similarly maintained, and at the Christian Brothers' Schools there was a Technical Laboratory, in which some technical instruction was given.

According to the Report of the Recess Committee of 1896, this list hid the fact that very little if any practical education was taking place in most of these institutions:

> With the exception of the schools for children of the criminal and improvident classes, which answer their purpose sufficiently well, the Munster Dairy School, and the three Art Schools, the system of practical education here outlined, may be broadly said to have no real life.[10]

The Department of Science and Art in South Kensington was distributing some capitation grants for the promotion of the study of scientific subjects in elementary and secondary schools. However, these became less accessible as the standard was raised in order to '...offer special provision for secondary school in England'.[11]

In 1889-90 Irish pupils amounted to 11.2% of the total recognised by the Science and Art Department, and received 14.5% of the grants, the respective figures for 1897-8 were 2.3% and 1.2%.[12] Table 4.2 makes this clear also.

Table. 4.2 Pupils in Classes in connection with the Science and Art Department[13]

Year	Country	Art Pupils	Science Pupils
1889	Great Britain and Ireland	65,231	98,000
1893	Great Britain and Ireland	107,571	148,683
1889	Ireland	4,580	9,597
1893	Ireland	3,503	7,561

[10] Ibid, pp. 89-90.
[11] Atkinson, N. *Irish Education a history of educational institutions.* Dublin: Allen Figgis, 1969, p. 108.
[12] Ibid., p. 109.
[13] Report of the Recess Committee, p. 90.

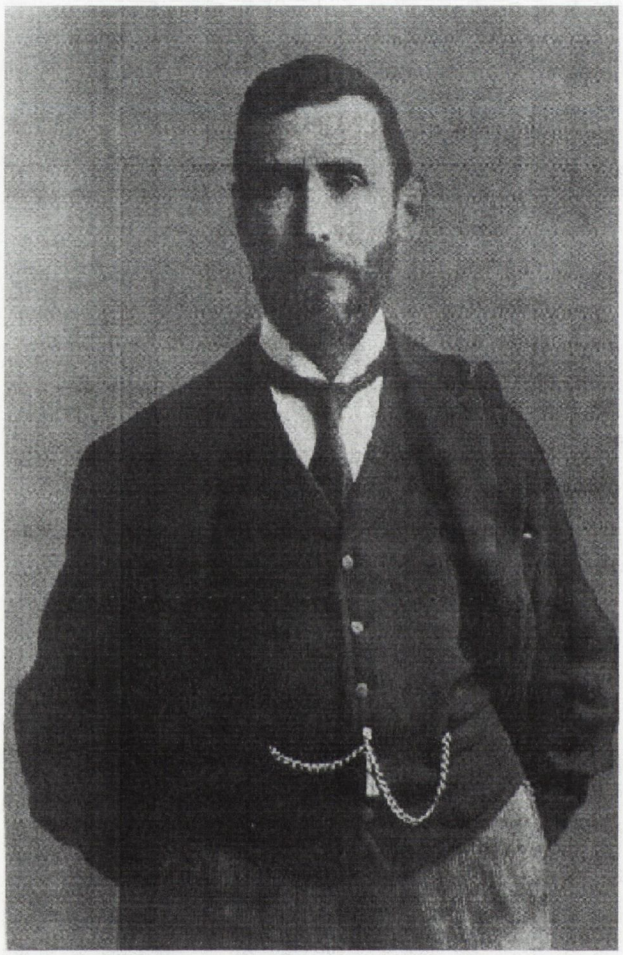

Plate 9. Sir Horace Plunkett, first Vice-President of the Department of Agriculture and Technical Instruction.

From these figures it can be seen that whilst in England the number of Science and Art students increased by 50% in five years, there was a decrease of over 20% in Ireland during the same period.[14]

It fell to two men, each the opposite of the other in religious as well as political beliefs, to establish a system, which would revolutionise both science and technical instruction in the secondary schools. One, Sir Horace Plunkett had the foresight to found the Irish Agricultural Organisation Society and develop the co-operative movement in Ireland. He also served on the Congested Districts Board which was allied to the aforesaid society and convened the Recess Committee of 1895-96, of which he was chairman. He became the first Vice-President of the new Department of Agriculture and Technical Instruction on its foundation in 1900. The other, Thomas Patrick Gill was associated with Plunkett in his pioneering work and acted as Honorary Secretary of the Recess Committee. That both men had met almost by chance was providential for Irish science and technical education at this particular time. Daniel Hoctor in his book *The Department's Story – A History of the Department of Agriculture* describes an ideal partnership which occurred at the right moment in Irish History.

> Gill had in abundance the qualities needed to make up for Plunkett's defects; as a Nationalist and a Catholic, he had considerable influence with that large section of the population which would naturally be suspicious of Plunkett. Working together, they made an excellent combination. These two men may be fairly credited with being the two principal architects of the DATI. Both of them played an outstanding part in the work of the Recess Committee which recommended the establishment of the new Department and both worked together in the Department for seven critical years.[15]

4.2 The Recess Committee

Plunkett was instrumental in establishing the Recess Committee, so named as the committee met during the Parliamentary Recess of 1895, in order for members of Parliament to attend.[16] The idea behind the Committee was to combine two major forces of leadership which were emerging in the country at that time.

---

[14] Figures from memorandum of Arnold Graves, Appendix to the Recess Committee's Final Report, 1896, p. 382.

[15] Hoctor, p. 28.

[16] Carton, J. J. *The Development of Technical Education in Ireland, 1889-1930.* M. Ed. thesis, Trinity College Dublin, 1972, p. 34.



Plate 10. Mr. T. P. Gill, Secretary of the Department of Agriculture and Technical Instruction, 1901-22.

These political and industrial/commercial forces were to be used as a focus to concentrate public opinion.[17] Notable members included Mr. John Redmond MP, Right Rev. Monsignor Molloy and the Jesuit educationalist Rev T.A. Finlay S.J. They met in the Mansion House, Dublin. Part of the strategy of this committee was to send commissioners to Europe on a mission to bring back information on how other countries were implementing agricultural and industrial policies. The recommendations the committee finally made included setting up a new Government Department, with a ministerial head. Furthermore, the report suggested that the Science and Art Department in London would be,

> ...an unsuitable body to control technical instruction in Ireland because of the tendency towards uniformity in over-centralised administrations.[18]

The recommendations made by the Recess Committee were very closely aligned to those that were finally implemented, i.e. central control vested in a Government Department and local control in the hands of a County Committee.[19]

> 'Conclusion arrived at:
>
> ...It is (1) that the administration of State aid to Agriculture and Industries in Ireland on the principles to be described, can be most effectively carried out by including the two branches of Agriculture and Industries, and the Technical Instruction relating thereto, under the care of one Department of Government specially created for the purpose; and (2) that this Department should consist of a Board with a Minister of Agriculture and Industries responsible to Parliament....[20]

Of the three recommendations suggested, the last one confirmed that the method of instruction was to be practical. 'For the promotion of both Agriculture and Industries – By practical education.'[21] And the Committee re-emphasised this practical element when it stated:

It is impossible to consider this branch of our subject without being convinced that the full development of the industrial spirit of the Irish people, and the full realization of our industrial possibilities will not be

---

[17] Plunkett, H. *Ireland in the new century*. First published 1904. 2nd Edition, London: Kennikat Press, 1970, p. 213.
[18] Carton, p. 35.
[19] Carton, p. 37.
[20] Report of the Recess Committee, p. 2.
[21] Ibid., p. 2.

attainable until the whole system of education in Ireland, elementary, secondary, and higher, has undergone a radical change.[22]

With reference to secondary school science the committee recommended that a basic science course be set up, illustrated by experiments and object lessons, this course to be given by the science teacher from the neighbouring Practical School. The course was to be structured according to local needs and conditions.[23] In order to train teachers to teach these subjects it recommended that either a separate training college be established or one attached to the Royal College of Science.

Funding was to be provided from the local rates, but it was suggested that the Imperial Treasury would have to contribute more than it had done in the past. At this time (1893) the monies being expended in Great Britain as distinct from Ireland were: £696,328 for the former and £4,944 for the latter.[24] According to Carton the influence of the Report of the Recess Committee, '...ramified through all sectors of Irish education and helped focus attention on the whole question of technical and scientific education in Ireland.'[25]

The Recess Committee report led to the establishment of the Belmore Commission on manual and practical instruction in the schools of the National Board of Education. Consequently, the recommendations of the Belmore Commission meant that the curriculum in the National schools was broadened to encompass such subjects as elementary science, needlework, etc., it also prevented pupils from being educated in the National schools in a technical sense. There is no doubt that the historical timing of the Recess Committee (1895), the Belmore Commission (1897), and the Intermediate Education Commission (1898) combined with a more conciliatory British Government led not only to the establishment of the Department of Agriculture and Technical Instruction but also to the structure which Horace Plunkett envisaged.

4.3 The Establishment of the Department of Agriculture and Technical Instruction (DATI)

The Agriculture and Technical Instruction (Ireland) Act, which established the DATI in 1899, changed the system which had existed since 1878. For a London Government that was deeply committed to the policies

---

[22] Ibid., p. 87.
[23] Carton, p. 39.
[24] Report of the Recess Committee, appendix O, p. 378.
[25] Carton, p. 47.



Plate 11. The old offices of the Department of Agriculture and Technical Instruction, 1-5 Merrion Street.

of conservatism and unionism, and strongly opposed to the demands of the Irish Nationalists, this particular strategy might even be seen as evidence of a policy of Home Rule appeasement. However, there is no doubt that the newly formed Department was given all the bureaucratic teeth it needed to bring about long-needed change. This Act was to Intermediate education what the Belmore Commission was to the National education. The two main changes were that,

1. Grants would be paid to schools simply on the basis of attendance and inspection, without any consideration of the 'results system', which was still in operation in the National Schools. (The new Department would effectively take over the functions of the Department of Science and Art, South Kensington).
2. For the first time a sector of Irish Education would be placed under a wide measure of local control, through Education Committees appointed by local authorities.[26]

In the early years of the DATI the inexperience of the newly formed councils proved at times exasperating,

> ...and to increase the difficulties of the problem in Ireland the Councils (County and Urban), through whom it is proposed, as far as possible, to work schemes of technical instruction, are themselves new to their duties; in fact, they are in their first period of office.[27]

The initial outlay of £55,000 given to the Department towards the development of a practical based form of technical instruction, with a total expenditure of £190,000 over the twenty-two years. In total the Department received a capital sum of about £200,000 and an annual endowment of £166,000. For a country, with little industry, a poorly educated workforce and very little natural resources, this amount of investment was unprecedented.

The newly-established Department did not, however, see itself just as a body existing merely for the purpose of administering State subsidies in the form of hand-outs; it saw its main role as, in the words of the Vice-President, to be that of "...helping people to help themselves".[28] Plunkett himself saw the work of the Department as an attempt to establish an all-important relationship between industrial education and industrial life.

---

[26] Atkinson, p. 109.
[27] Department of Agriculture and Technical Instruction. 1st annual general report 1900. Dublin: HMSO 1901, p. 55.
[28] Ibid, p. 163.

The instruction would be directed '...with a conscious and careful regard to the probable future careers of those we are educating.'

He called this an 'experiment', as it had never before been attempted in the country. The Department was conscious of the fact that for the development of scientific industries the products of the education systems had to possess a sense of original, accurate and logical thought:

> There can be little doubt that scientific industries have suffered in the UK not only through defects in higher scientific education, but, to an even greater extent, through defects in general and secondary education. In the majority of secondary schools, according to the Report the curriculum has been so hampered by the exigencies of examining authorities and of examinations, that the teacher has been compelled to devote undue attention to storing the minds of the students with facts for reproduction at the expense of the time which should be devoted to stimulating their reflective powers and making them think. The outcome of the system is that the boys who learn science do not acquire the power of original, or even of accurate logical thought, and that those who do not learn science have no belief in its practical value. In afterlife those who enter upon industrial pursuits too often regard science with distrust, and to some extent this distrust is merited, owing to the insufficient preparation and training of those who offer themselves for responsible posts in scientific industries.[29]

The rural problem was at the heart of the 'Irish Question' as far as Plunkett was concerned.[30] Many people in the country had high expectations that this new Department had the power to change the country's economic situation. The *Leader* a nationalist newspaper on December 7th 1901 with respect to the ideals expressed on technical instruction in the Department's first Annual General Report stated:

> These are new and pregnant educational ideals, not so much in themselves as coming from an Irish Government Office. A Department whose guiding spirits keep them steadily in view cannot go far wrong and deserves to succeed.[31]

And writing in their report on Intermediate Education in Ireland, Dale and Stephens praised the Department in its early years:

---

[29] D.A.T.I. Journal. *Science training in the secondary school,* pp. 65-66.
[30] Plunkett, p. 263.
[31] Ibid, p. 255.

> We are glad to be able to report that the Department of Technical Instruction and the Technical Education Committee established under the Act of 1899 have already shown themselves alive to the inadequacy of private effort in this matter, and have taken the first steps to remedy the deficiencies which we have pointed out.[32]

4.4 The state of science instruction under the new Department

In 1900, the DATI took over the administration of the Parliamentary Vote for Science and Art, which had formerly been administered from South Kensington, and £55,000 was allocated for Technical Instruction with the concurrence of the Board of Technical Instruction. Likewise the inspection of experimental science and drawing also became the responsibility of the Department.

> It was accordingly arranged, in a conference between the two Boards, that in dealing with those subjects that were common to both, they would adopt a common Programme, with a common system of examination and inspection. It was agreed, more-over, as a matter of convenience, that the inspection and examination would be carried out by the officers of the Department, who would furnish to the Intermediate Board, each year, a list of the pupils who passed and of those who passed with Honor.[33]

Initially the Department did not issue a detailed programme of study that schools had to follow. The strategy behind this was that each school had the opportunity to implement its own individual brand of instruction and that school managers would have 'considerable latitude in modification of details'.[34]

The Department did however offer suggestions as to how courses could be planned in terms of the amount of school time necessary, and the following table shows gives an example of this.

---

[32] Report of Messrs. F. H. Dale & T. A. Stephens. His Majesty's Inspectors, Board of Education, on Intermediate Education in Ireland. Cd 2546 **XXVIII**. Dublin: Alexander Thom & Co. Ltd., 1905, p. 11.

[33] Christian Brother's 1905 Educational Record. Dublin: Fowler, p. 24.

Table 4.3 showing the two course structures, which were offered to schools working under the Department[35]

Programme of Experimental and Practical Science	
PRELIMINARY COURSE: (Compulsory).	SPECIAL COURSE: (Optional).
First Year: mainly Elementary Physics with Drawing.	I. Physics; a two years course.
II. Chemistry: a two years course.	
Second Year: mainly Elementary Chemistry with Drawing.	III. Mechanics: a two years course.
IV. Botany: a two years course.	
V. Physiology and Hygiene; a two years course.	
VI. Domestic Economy; a two years course.	
VII. Geology; a one years course.	

.

The Preliminary Science Course consisted entirely of practical work in the laboratory made up of three hours per week. To qualify for a Pass, an extra hour per week had to be given to Drawing. The Special Courses in Science were made up partly of laboratory work and partly of lectures, which were illustrated by experiments. Three hours per week had to be given to this work. For a pupil to take a special course they had to have been awarded a Pass in the two years of the Preliminary Course, and to obtain a Pass in any Science subject, each candidate had to be certified by an Inspector of the Department. This meant that they had completed, and been certified for, the prescribed course in the laboratory properly equipped under a teacher approved by the Department. Candidates who secured a Pass could submit for an Honour examination, which was conducted mainly by written papers.

The course to be followed in Elementary Chemistry by the Intermediate pupils was essentially the same as that followed by the pupil studying chemistry in the National School, and again the emphasis was on pupil experimentation followed by reasoning from observation in order to draw appropriate conclusions.

---

[34] D.A.T.I. 3rd annual general report 1903, p. 12.
[35] Christian Brother's 1905 Educational Record, p. 24.

The course in Elementary Chemistry involved the study of air and nitrogen, combustion and oxygen, hydrogen and water, chalk and lime, carbon and its importance in organic substances; the practical work consisted in accurately describing given substances, and in quantitative experiments on the following subjects – (a) The alteration in weight of substances on heating. (b). The measurement of the volume and weight of gases given off on dissolving substances in an acid or in heating. (c). The production of crystallised substances, and the estimation of water of crystallisation. (d). The weight of carbon dioxide, and of water produced by burning organic compounds. (e). Volumetric experiments in alkimetry without the use of formulae. (f). The volumetric measurement of chalk in water. All formulae and equations, all ideas of molecules and atomic weights were avoided in the course, and chemical names were only introduced in proportion as their meaning could be established. The main object of this course was to train the pupil in the experimental solution of simple problems, in reasoning from observation, and in accurate work with a definite purpose, while the instruction given would lead to a sound knowledge of the nature of air, water, fire, earth, and food.

> If our readers will compare this course with that provided for our pupils, they will find it a little more extensive, but otherwise identical. Thus we see that the science course is not new; the mode of treatment is not new; the experiments are not new; and there is no valid reason for delaying the introduction to the visit of the Organizer or anybody else.[36]

From 1905 onwards the Preliminary Course was compulsory for all pupils going forward for the Intermediate Board examinations. However, those who took a group of subjects, known as the Classical, and which included both Latin and Greek, did not have to do this course. The Special Courses were not compulsory, but it was thought that pupils who had acquired an interest for the study of science in the two years of the Preliminary Course would choose one or more of these courses of their own free will.

About 250 schools from all counties were now working under the common science programme of the Department and the Intermediate Board. They varied in size from 20 or 30 pupils to 200 or 300 pupils each. These schools presented about 8,000 pupils to the examinations of the Intermediate Board; and quite a large proportion of the candidates who presented science subjects at Intermediate level qualified for grants under the Department.

---

[36] *The Irish Teachers' Journal.* February 1901, p. 3.

Some who qualified did not present for the Intermediate Examinations, these were known (by the Department) as "non-Intermediates". This situation might have occurred because either they were not considered up to the standards of the Intermediate Examinations or that they wanted to pursue a course exclusive to technical education. They constituted about one quarter of the science students in the secondary schools. Including both "non-Intermediates" and "Intermediates", the number of pupils following the Experimental Science, under the joint Programme of the two Boards, was well over 10,000 in 1905 and increasing. These figures were impressive considering that the programme could only be implemented in stages corresponding to the various course years. Table 4.4 details the increasing numbers of pupils from the programme's genesis in 1901 through to 1903 nationally. It can be seen from this table that the numbers of pupils working under the Department were considerably less in the West of Ireland, and reflect the under-development of the necessary infrastructure here.

Table 4.4 Numbers of Pupils who worked through the Preliminary Course during the years 1901-03[37]

	1901-02	1902-03		Total in 1902-03
	First Year	First Year	Second Year	
Leinster	2,732	1,948	1,420	3,368
Munster	2,098	1,563	1,058	2,621
Ulster	1,596	1,160	867	2,027
Connaught	189	285	99	384
All Ireland	6,615	4,956	3,444	8,400

For 1903-04 the returns showed that the number of students under instruction in the two years of the Preliminary Course was over 9,000; and the number under instruction in one or other of the various Special Courses was over 1,500[38].

So within three years the system appeared to have been very successful. The feeling at the time was that the subject was popular with both pupils and teachers. The fact that teachers were prepared to give up free time during the summer holidays to attend the teacher training courses was testimony to their determination to make the system work. Pupils appeared to like the laboratory work particularly; and many of them who had

[37] D.A.T.I. 4th annual general report 1904, p. 58.

been regarded as dull and inert in other subjects had shown themselves to be much more adept at this type of work.

For the first time in the history of this country, secondary education came into the reach of many. In fact, for some it came free, provided they could obtain prizes or exhibitions for their examination results. Consequently, the civil services, universities and the professions were now open to many of the Catholic middle classes. One of the aims of the newly established Department of Agriculture and Technical Instruction was to bring technical education in Ireland 'up to speed' with that of England; therefore vigorous efforts were made to improve the teaching of science.

It is evident that at the turn of the twentieth century the Department had a monopoly on science education. Most of the monies the schools required in order to conduct practical science courses efficiently came from the Department. There was a high degree of bureaucracy in the form of rules and regulations which the schools had to adhere to and were laid down by the Department in order for the schools to obtain the grant monies available. The methodology of the science instruction had to conform to the Department's expectations and had to pass the scrutiny of Departmental inspectors. Evidence for this also emerged at the Digby Inquiry in 1907, when the Department's scheme during this period was testified to by witnesses. Details of this Inquiry are given in Chapter 6. Speaking in 1911 George Fletcher makes mention of these early days:

> They (the Department) determined that the teaching of Science in Schools dealt with by them should be essentially practical in character. They therefore declined to recognise any Secondary School which had not a properly equipped laboratory, or which had not a teacher who had received training in Experimental Science... From the very beginning the Department resolutely discarded written examinations as a basis for the distribution of their funds for education.[39]

A system of Departmental inspection to judge the efficiency of the teaching replaced the Intermediate Board examinations. Non-conformity to the rules meant that grants would be withheld.

---

[38] Ibid., p. 58.

[39] Fletcher, George. *A Decade of Technical Instruction in Ireland*, DATI Journal Vol.XII, Oct.1911 to Jul.1912, p. 305.

4.5 How the Department went about its work

Up to 1900, science had mostly been taught in the secondary schools from books and diagrams with the occasional teacher demonstration. Object lessons at elementary level appeared to be the norm. There was little or no practical work done by the pupils themselves, and very few schools possessed properly equipped laboratories. Effective science instruction was rare due to the low number of properly qualified teachers. According to Carton[40], the English and Scottish models strongly influenced the formulation of the early schemes of technical instruction under the 1899 Act in Ireland. Deputations from the Department were sent across the British Isles to glean information, which could be used in setting up the Irish system. The influence of Armstrong's Finsbury Technical School in London was apparent in the appointment to the Cork Technical School of Mr. O'Keeffe, a technological teacher who had fifteen year's experience in the Finsbury School. He was,

> ...also expected to help in the organisation of the scheme, and in encouraging and stimulating the existing schools so that they would feed suitably qualified entrants into the central institute.[41]

In the First Annual General Report of 1900-01, the Department laid out its strategy under the sub-heading 'Aid to the Schools'. Owing to the Intermediate system the '...schools were ill-prepared for the change proposed'.[42] The Department listed three main problems:

1. They were without definite aims in such Science and Art instruction that they had been giving.
2. They had, as a rule, neither laboratories nor specialised art rooms.
3. There was, on the whole, a dearth of science teachers with experience of experimental work.[43]

The initial strategy of the Department was to publish a pamphlet with their programme which outlined the aims of the instruction and suggested syllabuses of the first two years' work. The Department also took the unusual step of bringing the heads of schools into direct dialogue on the subject at a conference in 1901. Attending the conference, which met at the offices of the Department, were up to thirty heads of the more important day schools, together with the Sub-Committee of the Intermediate Education Board and chief officers of the Department. The gathering met for three hours, and the contents of the pamphlet (which had been sent out to all attendants several days previously) were debated critically. The adoption of such an

---

[40] Carton, p. 71.
[41] Carton, p. 72.
[42] D.A.T.I. 1st annual general report 1900, p. 67.

initial strategy in order to bring all 'on-board' would seem to have been very successful, as only few changes had to be made to the document before the Intermediate Board would accept it.

Another important conduit for science teachers was the Technical Education Board, which had been set up in 1899 to enable science teachers meet annually. Its object was to '...stimulate and enlighten all science teachers.' [44] This it did in papers read on various scientific subjects and methods, providing information on laboratory equipment including the manufacture of certain scientific instruments, and more importantly, '...the gradation of courses of science for primary and secondary schools and technical and other colleges.'[45] The presence of increasing numbers of teachers at the annual meetings is testimony to the interest which existed in the country at this time. Its inaugural meeting occurred in 1899 and about eighty people attended, the following year almost two hundred attended and in 1901 at the South Western Polytechnic in Chelsea, those present numbered almost three hundred. Two of the key speakers at the 1901 meeting were of interest in an Irish context: Sir W. de W. Abney then Principal Assistant-Secretary of the Board of Secondary Education in Kensington and Professor Armstrong. Abney focussed on,

> ...the great necessity of the extension of science teaching in these countries (United Kingdom), and particularly in Ireland. He insisted on the necessity of the teachers constantly keeping before their minds the true end of science teaching – the careful working out of the experiments by their pupils, the careful noting down by the pupils in their book the stages of their work, and the knowledge to be deduced from the experiment.

Armstrong spoke on the "Teaching of Domestic Science", and it was reported that:

> On the heuristic methods the boys themselves experiment, and try to find out the use of the instruments and the truths of science from the performance of the experiments.[46]

He laid great emphasis on weighing and,

> ...would subject all things in science to weight, and weighing linear and volume measurements were no doubt good, but weighing things gave a clearer and more tangible idea of their nature than anything else.[47]

---

[43] Ibid., p. 67.
[44] Christian Brothers Educational Record 1902, p. 600.
[45] Ibid., p. 600.
[46] Ibid., p. 607.
[47] Ibid., p. 607.

He again emphasised that expensive equipment was not necessary and advocated the self-built approach from simple materials. In order to promulgate his method he insisted that boys and girls should begin their scientific quest at the age of twelve or thirteen and to prove his point brought a boy and girl onto the stage in order to '...explain to the audience some interesting experiments which they had carried on themselves by means of very simple and homely apparatus, which the Professor himself had contrived.' [48] His methods as demonstrated received a good reception from the delegates assembled, although some doubt was expressed on the difficulty of obtaining the time necessary to teach practical science in an already full timetable.

4.6 Building and equipment grants

With co-operation from the Intermediate Board, the Department began a scheme of building and equipment grants for the intermediate schools. The difficulty encountered initially in setting up science teaching in Ireland, was the need for laboratories and laboratory equipment. This was met by the co-operation of the schools, and of the Local Authorities.

Because the state of technical education was practically non-existent, the Department felt that the Secondary Schools should '...acquire the apparatus and equipment necessary for the new Programme.' [49]

At its fifth Board meeting the Technical Instruction Branch of the Department stated:

> That the Board are of opinion that Secondary Schools might be assisted out of the funds placed at the disposal of the Department for Technical Instruction under Section 16 (1), c.ii. of the Agriculture and Technical Instruction (Ireland) Act, 1899, to meet the initial cost of apparatus and equipment necessary for instruction in Science and Drawing under the New Regulations.[50]

From the beginning the Department prepared plans of laboratories, on various scales, for 10, 20, 30 pupils working together. These plans were useful guides for the schools. If the school authorities applied to the Department, then special plans were drawn up to suit that particular school circumstances. This appeared to be the most common arrangement. The Department would also prescribe the apparatus and equipment necessary for the school to be approved as qualified for teaching Experimental Science:

---

[48] Ibid., p. 607.
[49] D.A.T.I. 1st annual general report 1900, p. 67.
[50] Minutes of the 5th Board Meeting of the Technical Instruction Branch. May 1901, p. 18.

> Suggestions with regard to the equipment, and a list of indispensable apparatus for the first two years' work in Science, accompanied by a statement of the probable cost, were issued to the Managers of all Secondary Schools in Ireland.[51]

As can be seen, the Department was determined on not just providing the practical facilities and apparatus, but its philosophy on the methods of instruction had also to be accepted by the schools as part of the package.

> A suggested arrangement (with accompanying notes, hints, and advice with regard to equipment and necessary apparatus) has been supplied to the school. Where necessary, an officer of the Technical Instruction Branch of the Department visited the school and gave the Managers the benefit of his experience on the spot. The arrangements finally decided on have been approved.[52]

Loans were advanced by the Intermediate Education Board and grants made by the DATI to allow the schools to comply with the prescribed conditions. County Councils and the municipal bodies also lent their aid by allocating some of the funds, which would have been used for technical education towards the schools. By the end of 1901, '100 cases of provision of laboratories have been dealt with'.[53]

As a result of these endeavours, 214 schools by 1905 had enough appliances for the two-year Preliminary Course; and quite a substantial number of these schools had enough equipment for one or more of the Special Courses.

Dale and Stephens make reference to the intervention by the Department in their General Summary of Conclusions and Recommendations of their 1905 reports:

> The Department of Agriculture and Technical Instruction has assisted in the erection and equipment of laboratories in Intermediate Schools, and has reformed the teaching in Experimental Science.[54]

It is evident that very large sums of money were spent. For instance, between 1900 and 1910 more than £190, 000 was paid in attendance grants in respect of instruction in Science, Art, etc., in the Day Secondary Schools.[55] The modern equivalent of this expenditure would represent almost £15 million pounds.[56]

---

[51] D.A.T.I. 1st annual general report 1900, pp. 67-68.
[52] Ibid., p. 68.
[53] Ibid., p. 68.
[54] Dale & Stephens, p. 84.
[55] D.A.T.I. 12th annual general report 1912, appendix, p. 314.

Reports of expenditure for 1910 appear to indicate that the amount available per pupil for secondary education in Ireland was £2 15s, whereas the corresponding contribution in England and Wales was £5 per pupil.[57]

4.7 Teacher training

The problem of providing properly trained teachers generally in the country had already manifested itself before 1900, and efforts had been made to alleviate it. This had begun towards the end of the nineteenth century, with the Royal University of Ireland offering a diploma course in teaching for university graduates in 1898. In January of this year Trinity College became the first third level institution to offer a teacher training course in the form of the 'History and Practice of Education', with the chair being established in 1906. The three colleges of the National University of Ireland and Queens College in Belfast quickly followed and had established education departments by 1906 in the case of the former and 1914 in the case of the latter. The creation of a registry for secondary teachers soon followed, and this came into operation in 1914.[58] Inclusion required teachers to possess a recognised university degree and diploma in education. Two years teaching experience to a satisfactory level was also mandatory.

But for the newly established Department a major difficulty encountered in introducing this new system of practical science teaching was the lack of availability of properly trained teachers. Finding a solution to this problem was the sole responsibility of the Department, because teacher training did not fall into the remit of the Intermediate Board. Upward of 250 schools had to be provided for and the number of suitably qualified teachers initially was small. In their report of 1905, Dale and Stephens comment on this difficulty:

> A dearth of qualified teachers of Science and Art subjects is a difficulty inevitably arising out of the rapid introduction of those subjects since 1901 into almost all of the Intermediate schools. The dearth still exists, but its effects have been much mitigated by the action of the Department...[59]

What was this action? Essentially the plan they adopted was two-fold:

1. A temporary arrangement was made in order to get the system up and going immediately.
2. A permanent arrangement, which was to come into effect in 1908.

---

[56] Figures courtesy of the Central Statistics Office.
[57] *The Irish School Weekly*. Vol. LIII, No.4. May 6th 1911, p.118.
[58] The first secondary teacher's register was not in fact published until 1918.

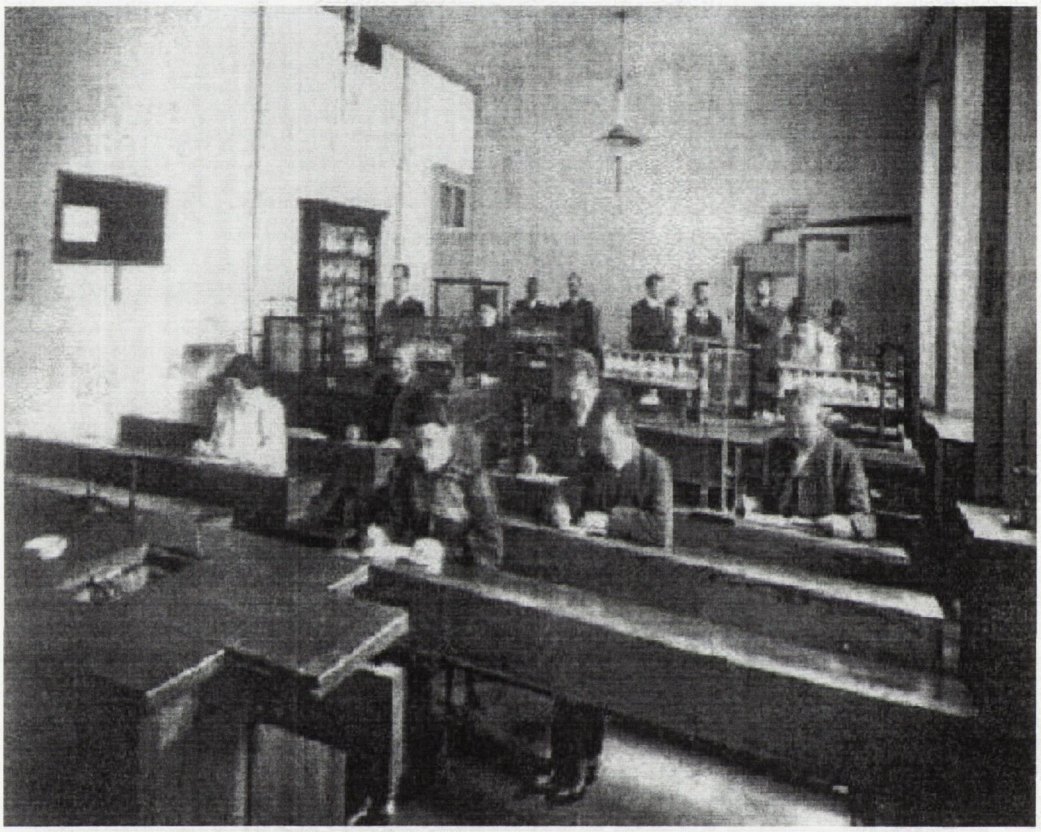

Plate 12. National school teachers attending summer course in elementary science at the Municipal Technical School Waterford, 1908.

The temporary arrangement consisted of starting Summer Classes for Secondary School Teachers (in 1901) which were held during the months of July and August each year at certain centres in Dublin, Cork and Belfast, and other large institutions elsewhere. Initially, these courses were aimed at teachers who '...had already received a training in Science to obtain the necessary knowledge and skill to give the first year's instruction in the new Programme of Introductory Physics or Drawing.'[60] By chance quite a considerable number of practising teachers fell into this category. The idea was that courses would follow in second and subsequent years to provide the teachers with further instruction.

The summer courses extended over a period of four weeks, during which the teachers were at work for five hours a day except on Saturday, when they finished at one o'clock. An examination was held at the completion of each course, which consisted of written, oral and practical sections. The practical examination was conducted by the Professor in charge of the course and the written examination marked by external examiners. The successful teacher received a provisional certificate, which allowed the teaching of that course in the secondary school. In total, five summer attendances were necessary in order for the teacher to receive the Irish Secondary Teachers' Science Certificate.

At the close of the first years courses, no less than 293 teachers, from 196 schools had attended. From the point of view of the Department this outward display of interest and enthusiasm boded well and in their Annual Report for 1900-01 this is acknowledged:

> They attended the courses with admirable punctuality and regularity; and in work, beyond the regular hours of the course, displayed a keenness and enthusiasm which were remarkable, and augur well for the future of Science and Art instruction.[61]

Plunkett also gave praise to this sacrifice made by teachers in order to secure the certification necessary to provide science instruction under the Department:

> There was only one way in which they could assist us to overcome the difficulty, and that involved a great sacrifice on their part, but a sacrifice which they willingly made.[62]

In 1902 the Department's Day Secondary School programme had been adopted by 152 secondary schools, and some of these schools would have required the services of more than one teacher of science or art. [63]

---

[59] Dale & Stephens, p. 44.
[60] D.A.T.I. 1st annual general report 1900, p. 68.
[61] Ibid., p. 69.

The number of pupils working under this programme was 6,412. In the face of such a sudden demand for science instruction the choice for the Department was clear, either opt for properly trained science teachers, which would have meant putting off the programme for a few years at least, or put into place 'emergency measures' in order to allow the programme to begin. The latter option was taken, and with the co-operation of the Intermediate Board, the Department began a scheme of carefully graded summer courses for teachers in both science and art. Some very distinguished scientists were co-opted to lecture to these teachers, notably Sir William Ramsay who taught in the Royal College of Science. According to Carton, the shortest course of instruction to be taken in summer courses for science and art was to be 500 hours, spread over five summer courses of 100 hours each. This was mainly to be laboratory work, because many of the older teachers had little or no laboratory experience. In the interval between the summer courses the teachers obtained experience through teaching to the pupils in their own schools the subjects they had just studied. [64] Such a course was established at the Christian Brothers' School in North Richmond Street.

> Science course in connection with Department of Agriculture and Technical Instruction conducted in Physical Lab. by Professor Ryan of the Catholic University assisted by Messrs. Ebril and McLaughlin. Eighteen brothers and two seculars twenty in all attended the course.[65]

Apart from North Richmond Street, other centres for these courses in 1903 were: the Royal College of Science, Queen's College, Belfast, Christian Brothers' Schools Our Lady's Mount, Cork, and St. Andrew's College, Dublin. The Department even arranged special courses in experimental science at convent centres, which were attended by 134 nuns.[66]

Such courses were held throughout Ireland right up to 1924, and lend testimony to the great dedication of the teachers involved, that even during their holidays they were prepared to give up time in order to advance science instruction in the schools.

Tables 4.5 and 4.6 show the results of the first three years of the course, which would have included the two-year preliminary and one-year special courses. This data was taken from the Report of the DATI for 1905-06

---

[62] Plunkett, p. 268.
[63] D.A.T.I. 1st annual general report 1900, p. 19.
[64] Carton, p. 82.
[65] Annals of the Christian Brothers for 1904, p. 324.

Table 4.5 Summer Classes for Teachers. Preliminary Course, 1901-03.[67]

	First Year of the course		Second Year of the course	
Year	No. of teachers who attended the Class	No. of teachers who obtained provisional Certificates	No. of teachers who attended the Class	No. of teachers who obtained provisional Certificates
1901	196	173	---	---
1902	166	114	160	132
1903	164	116	105	91
Total	526	403	265	223

Table 4.6 Special Courses, 1903.[68]

Subject	No. of teachers who attended the Class	No. of teachers who obtained provisional Certificates
Physics (1st Year)	48	44
Chemistry (1st Year)	69	62
Mechanical Science (1st Year)	6	3
Botany (1st Year)	14	10
Physiology and Hygiene (1stYear)	12	10
Total	149	129

From the results in these tables it is apparent that up to the summer of 1903, 403 teachers had obtained a provisional certificate in order to teach the First Year of the Preliminary Course, 223 to teach the Second Year, and 129 to teach the First Year of a Special Course. This meant that, with time, a large well-trained body of science teachers was being formed in Ireland. Teachers who during the summer attended a

[66] Carton, p. 82.
[67] D.A.T.I. 6th annual general report 1906, pp. 87-89.
[68] Ibid., pp. 87-89.

practical course of training and instruction were then examined, and returned to their school to teach that particular course they had qualified in.

This system existed until the end of July 1908, when properly qualified science teachers would only be recognized by the Department if they had either an Irish Secondary Teachers' Science Certificate or some equivalent Diploma or Degree. By 1908-09, 293 teachers had secured the Irish Secondary Teachers' Science Certificate and 240 of these were actively teaching in the schools under the Department's Regulations. By the summer of 1909, 243 of these certificates had been awarded.[69]

The Certificate was given to candidates who attended the course prescribed for such certificate, extending over three years, in the Royal College of Science, Dublin. This certification programme was begun almost immediately, resulting in the first batch of graduates under the employ of the County Committees by 1904.[70] Initially the certificate would be given to all science teachers who attended for five years the summer classes in science, obtaining each year a provisional certificate in that subject, and who taught over a period of three years science in a secondary school.

Teachers who did not hold the Department's Science Certificate could still be recognized as science teachers if they obtained an "Approved Equivalent", which could be a University Degree or the Diploma of a Technical College. The only stipulation was that the subject that teacher wished to teach had to be one of the subjects taken in the final examination for that Degree or Diploma.

As a result, by the end of 1908 the Department could quite justifiably feel confident that it had overcome the initial problem of a shortage of properly trained science teachers:

> By these means the Department have succeeded in meeting the greatly increased demand for teachers which the putting into operation of its schemes brought about.[71]

Table 4.7 shows the success of the Department in this regard. On average about £4,000 had been spent since its first year in operation up to its end.

---

[69] D.A.T.I. 9th annual general report 1909, p. 80.
[70] Plunkett, pp. 268-269.
[71] D.A.T.I. 9th annual general report 1909, p. 80.

4.7 Number of Students attending summer courses of instruction for teachers.[72]

Year	Number of students	Year	Number of students
1901	276	1906	789
1902	455	1907	737
1903	643	1908	689
1904	813	1909	622
1905	838	1910	621

4.8 Progress

The number of schools that participated under the Department's programme for the first year was 152, and the number of pupils who worked through the course, '...to the satisfaction of the Department's Inspectors'[73] was 6,412. A Consultative Committee of Heads of Secondary Schools was established to allow for it to liase between the Department and the Schools on the working of the Programme generally, this was an all-Ireland body and it was also multi-denominational. Some might even say that to get so many people from so many different religious backgrounds to co-operate to the extent that they did was a major achievement in itself, not to mention the fact that the workings of the Department appeared to cross many political boundaries. Resources were stretched to the limit as practical science instruction spread into the schools for the first time. 150 schools received laboratory equipment to stock the school laboratories, which had either been built or were in the process of development. Funding for this came from the Department, which was made through the local authorities from the first year's income of the endowment for technical instruction.

[72] D.A.T.I. 12th annual general report 1912, p. 315.
[73] D.A.T.I. 2nd annual general report 1902, p. 19.

Table 4.8 The number of Secondary Schools possessing Laboratories in the various Provinces:[74]

Province	School laboratories Prior to 1900	School laboratories in 1904
Ulster	- In	54
Munster	Total -	58
Leinster	6	88
Connaught		14
Total		214

When the first two years preliminary courses had been established and were running, courses for the third and fourth years of the programme then came under consideration. It was proposed that these more advanced courses would allow for some specialisation, for example in the teaching of a form of agricultural science. The first two years of the school science course were intended to be an elementary introduction to natural phenomena, to excite the pupil's interest and awaken in them the innate curiosity which all children possess. Years three and four were intended to be flexible enough to allow the pupil to pursue a particular aspect of science which would relate to his future career. The scheme was intended to be as adaptable as possible. Schools which had an intake representing the working class could follow a type of practical instruction which emphasised mechanical science and manual instruction. Rural schools could follow a more agricultural course, girls' schools could follow a syllabus which concentrated on Domestic Economy[75], and those schools whose pupils went onto either University or higher Technical College could focus on the study of science which suited this end.

On the ground however, matters were far from being easy. There were more problems that the Department had to overcome.

1. The Secondary Schools were without definite aims in the science and art instruction as they tried to give.

[74] Dale & Stephens, p. 29.

[75] Science instruction in girls' schools was beset with the problems of lack of both laboratories and qualified teachers. Domestic economy as a subject was offered as an alternative to science. Prejudice

2. As a rule, they had neither laboratory nor specialised art rooms.

3. There was a dearth of science teachers with any kind of experience of experimental work.

The first of these problems was tackled by publishing in April 1901 a programme for Day Secondary Schools. Included in this was a note of the fundamental principles involved in the teaching of science, and on the application of these principles to that work in Secondary Schools. Details of the first two years course were set out, and work for the third and fourth years outlined. Subjects of the special courses were:

Physics: Third Year. – Heat, Light, and Sound. Fourth Year. – Magnetism and Electricity.

Chemistry: Third Year. – Inorganic Chemistry. Fourth Year. – Inorganic Chemistry with some Elementary Organic Chemistry.

Mechanical Science, Natural Science and Drawing.

Another new development was that the syllabuses were actually worked through by the teachers, at the summer course during the month of July 1903.

> In Ireland there is but one syllabus of a subject for all schools, and teachers, before beginning to teach that particular syllabus in their schools, spend one hundred hours working through it under the guidance of a staff of highly experienced and expert scientists. The gain in invaluable. A fuller appreciation of the various problems is obtained, and inspiration is derived from close contact with a master of the subject. These, in addition, to some minor efforts, in the way of publication of leaflets of lists of suitable apparatus, and so on, were the means taken to give definiteness of aim and freshness of treatment to the teaching of science and art subjects in Secondary Schools.[76]

The problem of supplying laboratories and equipment was dealt with by using direct grants from the Department (out of the Science and Art Vote) and using indirect grants out of the Department's endowment through the various Technical Instruction Committees countrywide. In this way, by 1903, 184 Secondary School laboratories at a total cost of £35,000 were fitted, equipped and in use. The enormity of this achievement is appreciated when one compares the state of affairs prior to 1900, when there were at most six laboratories associated with Secondary Schools in the country. Now there were 190, accommodating

---

suggested that science was not necessary for girls, although physiology and hygiene courses proved popular.

[76] D.A.T.I. 3rd annual general report 1903, p. 45.

3,500 students working in them. School Science laboratories were now considered as vital as desks, blackboards and maps.

The third problem with regard to the supply of qualified teachers was the most severely felt. In the first few years, with the system growing exponentially, the one factor, apart from the supply of suitable facilities, was the provision of the right type of instructor. As in most systems, there appears to have been a scale of efficiency. At one end, the teacher with the minimum level of qualification (perhaps teaching in quite a mediocre way) to the other end, with extremely effective practical science being taught. It was hoped that in the years to come, the level of expertise could be raised, and the entire system achieve an equilibrium with respect to effective instruction as seen through the eyes of the Department's inspectorate.

Using the words of George Fletcher, who was then a Senior Inspector for Technical Instruction, and who was writing in regard to science instruction in the secondary schools of Leinster and Connaught:

> The transition from purely theoretical teaching to a system in which practical work is the principal consideration is a violent one; but there is some advantage in the suddenness with which the scheme has been adopted in the country, and while there is the difficulty of inexperience in practical laboratory methods on the part of many teachers, we are happily free from the difficulty of having to uproot vicious methods.[77]

A situation now existed whereby each secondary school was entitled to have 7/9^{ths} of the costs of fittings and apparatus supplied by the Department. Schools which were unable to avail of these grants for whatever reason could use the laboratories of the Technical Schools which were administered by local authorities or a neighbouring Secondary School. A system of substitute teachers was also started at this time; with over eighty contracted by local authorities, this was to allow for areas in which rapid development outstripped teacher availability.

By 1904 nearly 9,000 pupils were under instruction in experimental science, with physics and chemistry proving to be the most popular subjects. Part of the success which led to such a huge uptake, may be traced back to the flexibility the Department allowed to be built into the syllabuses provided by the various schools. The idea behind this was to allow for the teacher to develop a scheme of instruction that would provide the pupil with the necessary education needed for life after school.

---

[77] Ibid, pp. 52-53.

It was suggested in the 1903-04 Annual Report that the boys' schools fell into two main groups –

1. In which the pupils are being trained for a future professional or ecclesiastical career.

2. In which the pupils on leaving school pass into industrial employment of some kind or other.[78]

In the former situation chemistry or physics was proposed as the appropriate subject, and mechanical science for the latter. However, only four schools in the entire country were taking this subject – the report then went on to laud the establishment of Day Trade Preparatory Schools, which would deal with this particular situation.

In his last report as Senior Inspector, George Fletcher writes about the state of experimental science instruction in the schools at this time:

> During the session seventeen additional Secondary Schools commenced to work the Department's programme. Most of the temporary laboratories in the district have been replaced by suitable permanent laboratories. There are still nine small schools which use laboratories belonging to other schools, and which have not so far been able to undertake the expense of equipping a laboratory of their own.[79]

Under the Chairmanship of its Vice-President, Horace Plunkett, the Board of Technical Instruction met for the first time on 15th June, 1900 at the Offices of the Department, Upper Merrion Street, Dublin. Also present was Professor George F. Fitzgerald, Dr. W.J. M. Starkie, Mr. T.P. Gill (Secretary to the Department) and Captain T.B. Shaw (Assistant Secretary in respect of Technical Instruction). The first priority was to define its functions and attitude, particularly towards local authorities and to arrange its finances. At the third meeting, on 17th October, 1900, Captain Shaw reported on the steps that were being taken with reference to, '...the preparation of plans for Laboratories, &c., for Technical Schools.'[80] Mr. Robert Blair succeeded Captain T.B. Shaw as Assistant Secretary and was present at the fifth meeting on 7th May 1901. The minutes also make reference to the sad loss of Professor Fitzgerald, who had passed away on February 22nd. The Cork Industrial Exhibition which was to take place the next year was discussed and it was the opinion of the Board that this exhibition presented a unique opportunity to make the public aware of the proposed work of the Department.

---

[78] D.A.T.I. 4th annual general report 1904, p. 59.
[79] Ibid, p. 60.
[80] Minutes of the 3rd Meeting of the Board of Technical Instruction. October 1900, pp. 9-10.

It was for instance, the first Irish Exhibition inaugurated since the Department was established, and it afforded the excellent opportunity of furthering the objects of the Department and of stimulating interest in its work.[81]

It was also proposed that the Board adopt the Programme in Science and Drawing set forth in the 'Suggested Syllabus', prepared for Secondary Schools in Ireland by the Department. The Board also went further in saying 'That Natural Philosophy, Chemistry and Drawing be replaced in our Programme by one subject, viz., Experimental Science and Drawing', and that after the present year, until a year's notice, shall have been given by us, we shall not hold any examinations in this subject, but shall accept the inspection and, where necessary, the examination of the Department.[82]

Part of the strategy of the Department at this initial stage was to see that science teaching in both Primary and Secondary Schools was conducted in such a way that the pupils from these schools might be able to '...pass with advantage into the Technical Schools', that were being set up at that moment in time.

Mr. George Fletcher joined the Department in August 1901, and attended the sixth meeting on August 30th:

> The Vice-President suggested that it would be well if Mr George Fletcher, the Department's Senior Inspector for Technical Instruction, were invited to attend the meetings of the Board, as there were many important matters connected with the various Schemes of Technical Instruction with which he had to deal. The Board concurred in this suggestion. Mr.Fletcher subsequently attended, and was introduced to the members present.[83]

In an article entitled 'The new Intermediate system – Is it a reform?' in the *Irish School Monthly*, the new rules of the Intermediate Board were seen as still conforming to the examination test, with Science and Art singled out as the exceptions.

> They have been arranged by the new Department of Agriculture and Technical Instruction, and schools will get grants from the two Boards in these subjects. The arrangements in them seem to be excellent. There are strict regulations for the qualifications of teachers, the methods of teaching, and the science equipment of the schools, and no written examinations whatever are held. The grants in science and art from both the Intermediate and the D.A.T.I. will be given on the reports

[81] Ibid, p. 16.
[82] Minutes of the 5th Meeting of the Board of Technical Instruction. May 1901, p. 17,
[83] Minutes of the 6th Meeting of the Board of Technical Instruction. August 1901, p. 20.

> of highly qualified Inspectors. If a pupil is taking Honours in Science or Art he will be individually tested by the Inspectors. It is to be regretted that the Board did not endeavour to regulate on such a system the whole of their new scheme.[84]

In all examinations above the Preparatory, pupils had to choose a classical or a modern or scientific course. Six subjects were obligatory for a pass, and in the modern course that sixth subject was experimental science and drawing.

By 1903 the work of the Department in introducing its new programme into the secondary schools had reached such a peak that an additional inspector was deemed necessary:

> Mr. Gill stated that the Department proposed to ask the Treasury at the first opportunity to sanction the appointment of an additional Junior Science Inspector, as the work was rapidly increasing.[85]

This increased work-rate is seen in the amounts of grant monies paid out. Between the years 1903 – 1904, £32,500 was paid out. A year later this figure had risen to £33,900.[86]

However some views particularly on behalf of the nationalistic elements of the media were beginning to criticise the Department and its staff. Under the headline 'Is it another Anglicising Board?' in January 1903 the *Leader Newspaper* carried a letter from Monsignor D. Hallinan:

> Many people in Ireland have looked forward with high hopes to the benefits to be derived by the country from the new Department of Agriculture and Technical Instruction... We had hoped that this Board, at least, would be worked in accordance with Irish ideas, and for the benefit of Irish people. It seems that this is a mistake. The tide of emigration continues. Our fine young men and young women are rushing from the country, seeking situations abroad, and in the meantime this new Board is acting as a kind of bureau for bringing in outsiders to take up most of the positions worth having under its control, and which are the rightful inheritance of Irishmen and women.[87]

---

[84] *Irish School Monthly*. Vol. 1, No.11, July 1901, p. 250.
[85] Minutes of the 12th Meeting of the Board. July 1903, p. 6.
[86] Minutes of the 14th Meeting of the Board. March 1909, p. 155.
[87] The *Leader* newspaper, January 3rd 1910. Article written by D.Hallinan DD re: arguing for the establishment of a Domestic Economy training school in Limerick over Dublin, p.310.

Even though this letter was written in quite a vindictive manner, it did express a feeling among Irish people that the Department was yet another symbol of the establishment. It ran into yet more trouble over the instruction of Irish,

> ...our newest educational body seems to be disposed to discriminate against the native tongue... At Limerick, from which Monsignor Hallinan's complaint in regard to the training of Domestic Economy Instructresses emanated, and Irish class would not be tolerated under the Technical Scheme unless the expenses were covered by the fees of the pupils, or some extraneous subsidy.[88]

In England the heuristic method of science instruction was coming under increasing attack as a method of promoting science education:

> At the Manchester Science Conference the "Heuristic Method" of teaching science came in for some hard knocks. The "method" may generally be described as the art of making children discover facts for themselves. The objections were that this was useless in the higher stages, and that the nomenclature was childish. Dr. Armstrong defended it on the ground that it encouraged individuality and character on the part of the pupils.[89]

The year 1904 saw the loss of Robert Blair and his post filled by George Fletcher. Blair was heading to a new post as Director of Education under the London County Council; he would also be responsible for recruiting three more members of the Department and bringing them over to London to join him. Blair was perceived by some to be too dogmatic and inflexible:

> Mr. Blair was undoubtedly a man of great energy and of inflexible will. But he had scarcely enough experience of the peculiar circumstances that obtained in the schools of Ireland: and the country was not ripe for the application in their entirety of the regulations that had been found suitable for Scotland after ten years experience there. Hard and fast rules cannot be enforced while a new system is in its infancy; and the late Assistant-Secretary had only one policy – to put his foot down and to keep it down, whether right or wrong. [90]

Fletcher, however, was seen as a much more agreeable replacement:

---

[88] Editorial from the *Leader* newspaper, Apr.11th 1903, p. 108.
[89] *Irish School Monthly*, Vol. III, No.6. February 1903, p. 211.
[90] *Irish School Monthly*, Vol. V, No. 1. September 1904, p. 34.

> Mr Fletcher has a most intimate knowledge of the local conditions, and has personally visited almost every Secondary and Technical School in the country. He is fully conversant with local requirements, and, while we feel confident that he will administer his department with the sole object of securing the best results for the country, we are also confident that the experience he has acquired since coming to Ireland will enable him to avoid the mistakes of his predecessor.[91]

In the following year, it was proposed that the proceedings of each meeting of the Board be sent to the Press, in addition to the usual list of members present. This was probably done in an effort that the Department be seen by the public to be open and transparent in the way it was carrying out its day-to-day business.

In 1905 the Dale Stephens Report on Intermediate Education was published. Both of these English teachers had been commissioned by the Intermediate Board to examine and report on the system of Intermediate and Technical in Ireland, the latter so far as it was connected with the former, and report on whether any changes were required in the system. The following points were to be dealt with in the final report:

1. Co-ordination of Intermediate Education with Primary, Technical and University Education.
2. Staffing, equipment, sanitary conditions, &c., of schools receiving grants from the Intermediate Board.
3. (a) Allocation of the funds of the Intermediate Board.
   (b) Possibility of allocating the School grant in the form of grants to selected schools.
   (c) To what extent, if any, inspection might take the place of the examinations conducted by the Intermediate Board.
4. Possibility of establishing a profession of Intermediate Teachers analogous to that of Elementary Teachers:
   (a) Training of Intermediate Teachers.
   (b) Salaries.
   (c) Proper staffing of schools.
   (d) Registration of schools.

---

[91] *Irish School Monthly*, Vol. V, No.1. September 1904, p. 34.

It was an exhaustive study during which nearly 80 Intermediate schools were visited, of all types and denominations in different parts of the country, including schools in each of the six county boroughs.

> It is important to observe that down to the creation in 1900 of the Department of Agriculture and Technical Instruction the Board of Intermediate Education was the only public body in Ireland possessing large funds for the support of Intermediate Education as above defined. In 1903 the total amount paid in Prizes and Exhibitions was £11,356.10s 9d, in Results Fees £57,318 11s 0d.... It might therefore have been reasonably expected that the great majority of the institutions providing Intermediate Education in Ireland would avail themselves of the financial benefits of the system, and this had proved to be the case. In 1903, 262 schools – 147 boys' schools, 83 girls' schools, and 32 mixed schools – received grants from the Board, and the number of pupils in these schools amounted to 19,517 – 12,195 boys and 7,322 girls.[92]

The final report referred to the existing relations between the two Boards, the National and the Intermediate. It stated that they had found no relation between the two, apart from the fact that some members of the Board of National Education were also members of the Intermediate Board. Furthermore National schools were excluded from earning results fees and neither Board had any control over any of the schools in the other. National teachers, with exceptions, normally received their education via the National system followed by the Training Colleges, and did not pass through the Intermediate system. The syllabuses and regulations of each board were drawn up independently and there was no reference or consultation between Boards. In Dale and Stephens own words, '...the line of demarcation may in short be described as absolute...'[93]

Mention was also made in the final report of the connection between the Intermediate Education Board and science instruction in that the Board had been enabled,

> ...to advance money to managers of schools upon approved security, to enable them to purchase equipment and appliances for the teaching of practical science, and for similar purposes to be approved by the Board. Advantage of the power thus given has been taken to a considerable extent by the managers of Intermediate Schools, no less a sum than £16,025.18s 6d having been advanced to the managers of 31 schools within three years for the provision of Laboratories and

[92] Dale & Stephens, pp. 2 – 3.

Science Equipment; and the benefit has been undoubted.[94]

The changes which were proposed to the Intermediate system in 1905 were opposed in some quarters. It had only been five years since the new system had been introduced and it was felt that five years was too short a period in which to fully appraise the system. Chief among the perceived problems was the system of obtaining and holding onto financial aid in the form of grants. The system was considered to be far too onerous and placed the student under increasing academic pressure as he moved up through the school from year to year. Added to this was the introduction of an annual competition. Under the old system the results were published annually, this was seen as putting considerable strain on the schools. However, the new system changed this and effectively transferred the strain onto the individual pupils themselves. But the most important change proposed was that of a system of school and teacher approval. This area had been left alone when the new system was implemented; but five year on the call in some quarters was that the teachers should be '...properly qualified, both in regard to their own educational attainments, and in the art of imparting their knowledge.'[95]

The Board of Technical Instruction and its work on the science course in Intermediate schools was singled out by an article in the Irish School Monthly at the beginning of 1905 as displaying the possibilities in this area.

> But the Board of Technical Instruction has furnished an admirable example of what can be accomplished in this direction; for, after only three years work, they have effected this transformation, that no teacher, who is not equipped with their certificate, can teach a subject of science in an Intermediate school.[96]

The Department itself was not always held in high esteem, as some perceived it to be adopting a very bureaucratic approach in the implementation of its policy:

> ...in cases where minor breaches of the "rules" have occurred, the Department has been following the methods of the notorious Draco. Whether the offence was, of one of the many "forms" not being sent to the office on the date prescribed, or of a class being started a day late or of a register

---

[93] Ibid, p. 4.
[94] Ibid, p.24.
[95] *Irish School Monthly*. Vol V, No.5. Jan 1905, p. 154-5.
[96] Ibid., p. 155.

not being initialled, or some other such "dreadful" thing as will happen even in a well regulated school, the decree has been "off with his head".[97]

The system which the Department hoped to implement in order to bring the heuristic method in science to schools around the country was proving difficult in the rural areas of the country. A new Intermediate regulation prescribing four different courses of science proper to the four grades was introduced. This allowed a pupil over the age of twelve to present in the course proper to his grade even if he had not done the preliminary stages.

It is open to the Technical Department to continue to patronise their own particular scheme, by paying higher grants on students who follow the course in their order.[98]

The problem of funding science equipment and apparatus, particularly in the smaller schools in the country centres, was also proving problematic even at this early stage. In England under the Board of Education, two distinct schools were recognised, one type which conducted "science classes" and the other a "school of science" which was more complete and better organised. It was proposed that the schools of Ireland be divided into "Secondary Day Schools" and "Higher Grade Schools". The former would deal with science instruction in a less ambitious manner and encompass the rural parts of the country. The latter would conduct science instruction in a much more serious manner, have adequately equipped and staffed laboratories and be concentrated mainly in the urban areas. Pupils who wished to pursue a course of scientific instruction for five or six years leading up to University entrance would be accommodated there.

Meanwhile in the Department, Plunkett resigned his post in 1907 and was immediately replaced by T.W. Russell, who was more acceptable to the nationalist element, and who remained in the post until 1918. With the new rules for 1908, the system being implemented by the Intermediate Board was not seen to be ideal because it tended to cause pupils to specialise in only one science subject. This specialisation was attributable to the lack of time in an already busy school day. Now it was proposed that apart from English, two other languages were necessary.

By 1912 the amount of monies disbursed by the Department to the secondary schools had reached its highest yet, as the grants paid for the previous two years show. For in 1910, £27,467 was paid and this increased to £27,583 the next year. However, in 1912 this figure reached £28,000.[99]

---

[97] *Irish School Monthly*. Vol. IV, No.9. May 1904, p. 293.

At the 44th meeting of the Board on 30th March, 1915 it was stated that:

> Since the Intermediate Education Board relaxed their rule making Experimental Science a compulsory subject for their examinations, a number of schools had severed their connection with the Department. There had, however, been only a slight diminution in the total number of students receiving instruction in the subjects of the Department's Programme for Day Secondary Schools, while the amount of the grants earned had actually increased. The grants paid in the year preceding the appointment of the present Board, and for the three succeeding years, were as follows:[100]

Table 4.9 showing the number of schools working under the Department, 1912 – 1915, and the amount earned by them in grant payments.[101]

Year ended 31st March	Number of schools	Grant monies paid
1912	285	£27,955
1913	277	£27,705
1914	275	£28,616
1915	271	£28,971

Instead of levelling out the grant monies did in fact further increase to £29,000 by 1916, and the numbers of pupils registered for instruction in Experimental Science, Drawing, Manual Training and Domestic Economy in Day Secondary Schools also continued to increase to 15,309 in the year 1916-17. If the success of its work could be judged in terms of the number of pupils engaged in practical science then this particular period might be said to be halcyon days for the Department, and the Technical Instruction Branch in particular. Figures for the total payment to schools by the Intermediate Board for all subjects in 1918 amounted to almost £48,000 compared to grants that were paid to schools by the Department which amounted to £30,000 for science alone.[102]

---

[98] Ibid., p. 291.
[99] Minutes of the 36th Meeting of the Board of Technical Instruction. February 1912, p. 177.
[100] Minutes of the 44th Meeting of the Board of Technical Instruction. April 1915, p. 222.
[101] Ibid., p. 222.
[102] Department of Education. Council of Education Report. Dublin: Stationary Office, 1962, p. 184

However, the way in which science was being taught in the schools had changed, and what heurism existed was slowly being replaced with science work that was to be assessed not by inspection but by examination. The 1916 Report stated that '...the quality of the work done is very satisfactory and appears fully to justify the methods used since 1901'.[103] School managers moved to have a major change made to the system; the reason given by them for this was two-fold. It was felt that after a four-year science course there was scope for a '...greater uniformity of standard in the schools'.[104] They also felt a strong need to be able to grade their pupils according to the grades of the Intermediate Board's programme. Prior to this situation the Department had insisted that science be taught practically (a '...system under which every student (was) forced to familiarise himself with the procedure of investigation by experiment')[105], and assessed by inspection. Now a system was proposed which would include assessment according to written tests and which would be linked directly to the grade examinations of the Intermediate Board. No proper system of practical science taught heuristically could exist under such conditions. Even in the flagship school of Christ's Hospital where Armstrong, Heller and Browne had set heuristic methods in science in motion, heurism had faltered and failed due to the introduction of written examinations in order to assess the pupil's performance in science.

4.9 Examination papers set by the Department

Evidence for the change in the way science was being taught in the schools under the Department can be seen in the way the wording of examination questions was changed. Prior to 1900, the questions were based to a small extent on the pupil's memory of what had been witnessed in the demonstration rooms, but were mostly based on the facts that lay between the pages of a science textbook, of which there were many at the time. Now the questions used language which showed that the pupil's own experience in the laboratory was considered to be a very important part of the course they were studying. For example in the first year's course in experimental science for June 1903, there were ten questions on the paper and not more than six questions were to be attempted. At least five of the questions can be traced back to some form of practical work that the pupils experienced either first or second hand. For example, questions included: 'Give an

[103] D.A.T.I. 16th annual general report 1916, p.72.
[104] Wallace, 'Science teaching in Irish schools 1860-1970'. *Irish Journal of Education*, 1972, p.54.
[105] Dale & Stephens, p.29.

account of the experiments you would make to investigate how the rate of cooling of a body depends on its temperature and that of the surrounding bodies', 'You are finding the temperature of a small quantity of a liquid. What influence will the size and character of your thermometer have on the result?' and 'Carefully point out the sources of error in finding the specific heat of a substance. Mention what precautions may be taken and corrections made in order to secure an accurate result'. These questions all reflect the continuing emphasis on practical work, and the importance still being placed on the pupil being the investigator in the school laboratory. In experimental science again, this time for the second year's course in Chemistry June 1903. One of the examiners included E.M.Rich from the Department. The format was exactly the same as that of the First Year Course paper. However, unlike this paper the questions were more theoretical in nature. Only three of the questions could be related indirectly to practical work either by demonstration or by pupil experimentation. Of these three, it might have been able to 'get up' two of these from a good textbook.

Seven years later in experimental science, second year's course in June 1910, the number of questions had been reduced to eight and not more than six questions were to be attempted. Of the eight, five of the questions can be directly related to practical experience on the part of the pupil. For example three of the questions are: 'Describe exactly what happens when each of the following bodies is heated and then allowed to cool: - sulphur, ammonia solution, chalk, potassium permanganate, nitre', 'Sketch the apparatus required in the collection of the following gases: - ammonia, carbon dioxide, and hydrogen. Refer to any special precautions that you consider necessary', and 'You wish to determine as accurately as possible the quantity of chlorate of potash that would be sufficient to afford 100 litres of oxygen gas at N.T.P. How would you proceed to do this? Sketch the apparatus that you would employ'. In the same year, for experimental science – Chemistry (Third Year), of the eight questions (six to be answered); at least half of the paper was devoted to experimental methods. Three of the questions in particular had a very strong heuristic aspect to them. 'Assuming that you have shown hydrogen chloride to contain half its volume of hydrogen, what further experiments are necessary to establish the formula of the gas?', 'By what experiments was Cavendish led to the discovery of the composition of water? Describe in detail any experiment that you have made to ascertain the percentage composition of water. Make a careful sketch of the apparatus which you employed' and 'Give a list of the drying agents which are in common use in the

laboratory. Describe briefly the manner in which each is employed for its purpose, and devise experiments, which would demonstrate conclusively that the substances possess the property, which is ascribed to them'.[106]

4.10 The Digby Inquiry of 1907

By 1907 the mood towards the DATI, both public and political, had changed so much that an inquiry was set up to inquire and report into the provisions of the Agriculture and Technical Instruction (Ireland) Act, 1899, which established the Department, and whether the methods which the Department had followed in carrying out those provisions,

> ...have been shown by experience to be well suited to the conditions of Ireland; whether any, and, if so, what changes are desirable in those provisions and methods; and to report also... upon the funds at its disposal, and the modes of employing them; and upon its position in regard to other Departments, especially those charged with educational functions.[107]

The Committee was chaired by Sir Kenelm Edward Digby, and a prominent member was William Lawson Micks, a member of the Local Government Board for Ireland. Micks was to feature prominently in the subsequent examination of witnesses and he would state his views on the results of the inquiry in a separate form, thus divorcing himself from his fellow committee members.

During the course of this inquiry the founder of the Department, Horace Plunkett, and the assistant secretary of the Department, George Fletcher, were called to give evidence and spent several days doing so. In his evidence and being questioned by Micks, Fletcher revealed the extent of the Department's success in promulgating experimental science into the secondary schools. When asked about the state of secondary education, and in particular the state of science teaching in Intermediate schools as revealed in the Intermediate Education (Ireland) Commission Report of 1898, he spoke frankly:

> It is enough here to point out that the number of boys presented in science subjects for the intermediate examinations in 1891 was 2,885: the number had decreased to 673 by 1899. Perhaps this was not to be regretted, for the teaching was for the most part theoretical in character. In the

---

[106] Intermediate Board Examination Papers for 1901.

[107] Report of the Departmental Commission of Inquiry into the provision of the Agriculture and Technical Instruction Act 1899. DATI Inquiry Committee, (Digby Inquiry), p. 807.

> whole country there were not more than half a dozen laboratories in secondary schools. There was no inspection of Secondary schools other than that of science and art classes, and the results of teaching were assessed wholly by means of written examinations.[108]

When he spoke about the state of technical education in the country he was also frank. He declared that things were much the same as that for the Intermediate schools, and that very little technical instruction existed outside the larger urban centres. The only source of aid was from the Science and Art Grant administered by South Kensington. He then went on to explain the state of affairs using figures only recently available.

In the academic year 1900-01 there were 101 schools and classes working under the rules of the Science and Art Department, and sixty-one of these were classes in Secondary schools. The total grant for these, paid in the financial year 1901-02 was £5,185 3s 2d. and in addition there was a grant known as the "Equivalent" Grant, amounting to less than £3,500, and expended under the terms of the Technical Instruction Act of 1899.[109]

Pressed further on the vigorous policy of the Department towards secondary schools in the initial stages of its crusade he defended the stance of the Department towards the task, which lay before it. He cited loss to the country from the benefit of finance to the tune of £20,000 had not the Department acted in the way it did:

> I have a special object in mentioning this. There is a common impression in the country that we have been diverting funds intended for technical instruction, properly so-called, to teaching in secondary schools. This impression is an altogether mistaken one, as the Committee will perceive.[110]

He went into some detail regarding the situation in the country and the Department's strategy in the early years. It was generally felt that there was wide recognition that 'steps had to be taken' with respect to science instruction in the Irish secondary schools. Very few of them could be described as 'modern', laboratories were almost non-existent and the work was much more academic in character. He singled out and made reference to the Christian Brothers' schools, which by this time had extended the scope of their

---

[108] Ibid., p. 122.
[109] Ibid., p. 122.
[110] Ibid., p. 123.

operations. Consequently, many of them had come to work under the auspices of the Department. The boys, however, were being educated as the Department saw it, for the non-professional classes, and therefore it was felt that they had to be educated '...for the kind of work they have to do in after life'.[111] As regards the benefits to pupils in terms of career prospects, Micks enquired if many of them advanced to a 'higher station' of life later on. Fletcher replied that up to the present time most of the youth in the country were being educated mainly for the lower Civil Service posts, to the detriment of industrial training. For a sound system of technical education he felt that the work had to begin in both the primary and secondary schools.

> In drawing up our programme we had in full view the schemes which had been at work in Great Britain and elsewhere. My predecessor, Mr. Blair, had a wide experience in England and Scotland. I myself had wide experience in England, and we were fully aware, I think, of everything that had been done both in England and elsewhere in regard to science work in secondary schools.[112]

The Department of Science and Art came in for criticism when Fletcher said that it had,

> ...been found to exhibit a serious defect in England and Scotland, and more particularly in Ireland. This defect was that the system endeavoured to confer on students a knowledge of some specific and specialised branch of science, while the students were quite unprepared in respect of general knowledge to receive this instruction.[113]

When asked by Mr. Oglivie for clarification on the change which the Department was to make in 1900 of adapting the science and art instruction in evening schools to the conditions of the day schools, Fletcher replied that the onus had fallen on the Department to revise the regulations and specifically adapt them to the specific needs of the country. The Department desired that the teaching they sought to introduce should bear a due relation to the other main branches of a general education, and that it should take its place as an organic part of the secondary curriculum. Early specialisation was to be avoided. He then went into great detail in explaining these regulations. A much-needed grading was necessary in boys' schools. Soon after the Department's programme was published in 1901 a Consultative Committee for co-ordinating educational administration was appointed. Among its many remits was,

---

[111] Ibid, p. 123.
[112] Ibid, p. 124.
[113] Ibid, p. 124.

...to watch and pronounce on any defects in our educational system which the new efforts to deal practically with out industrial and commercial problems may disclose.[114]

One of its first tasks was to examine the question of co-ordinating the work of the Department with that of the Intermediate Board. Following a series of meetings, the Board agreed to adopt the Department's programme; subsequently the science programme, which had existed since 1878, was replaced. Not only that, but the inspectorate system which the Department suggested as a means of assessing "Pass" and "Honours" candidates was also accepted. As a result of this a large proportion of Irish secondary schools came under the Department's educational scheme. Fletcher proceeded to elaborate on the regulations pertaining to this scheme. It was based on the 'best modern experience', and provided for a two years preliminary course, which was common to all schools, with 'special courses' for third and fourth years in physics, chemistry, mechanical science, botany, geology, physiology and hygiene, domestic economy and drawing.[115] This last subject was exceptional in that it was the only subject made compulsory in the preliminary year. The aim of this preliminary course was to focus on 'fundamental questions', which led to the knowledge of certain 'fundamental principles', and there was very little leeway for a school in deciding how to do this. However, in the subsequent years no stringent conditions were imposed on schools. The Department felt very strongly that pupils could not take up the special branches until these fundamentals were dealt with. Schools were allowed to choose the special subject or subject for the third and fourth years.

No school could be recognised unless it made provision for the instruction of its pupils in a properly equipped laboratory. It was at this stage that Fletcher came closest to describing the heuristic methods demanded in science instruction under the Department. He reminded them that the Department regarded the training in scientific method via practical as being of great importance. He referred to the prefatory note, which the Department had circulated to all the schools in its first few months of operation. The particular part of the document he quoted from detailed the principal functions of a well-designed course for secondary schools.

These included: the education of the power of observation which involved exercise of judgement and the training of the senses. The training of reasoning and executive powers, which involved the pupils doing

[114] Plunkett, p. 238.

experimental work to cultivate manual dexterity, initiative and self-reliance. Finally, the imparting of the more important principles and facts of physical science. As far as the Department was concerned Fletcher felt that in order to realise these aims the course of instruction had to be,

> ...carefully planned and carefully taught. The method of teaching we regard as of greater importance than the mere imparting of knowledge, and the best results of the training are not so much as can be written by a written test. A knowledge of the facts of science, however important, is secondary to the training in "scientific method" which the course is designed to confer. Not that the scientific method is a method peculiar to science; it is the same as that employed in business.[116]

The reasoning behind the insistence that drawing be compulsory was that in travels to the continent, members of visiting commissions had observed that this was the case in the majority of the schools there. The subject was not just seen as an art subject merely, and it was tied in with experimental science owing to the fact that it was seen to be an extension of writing, as a means of expression, and '...of enormous importance in view of subsequent specialised technical instruction'. To emphasis this importance the Department refused to pay grants to a school for experimental science unless the school also taught the same pupils drawing. No school was recognised by the Department unless its pupils were receiving science instruction in a 'properly-equipped laboratory'.

Teacher training was also carefully monitored by the Department, and only properly trained and qualified teachers were eligible to give science instruction under its grant scheme. A school satisfying all of the Department's conditions obtained a grant, the amounts being assessed on two factors:

1. The amount and extent of the instruction.
2. Its quality.

In reality the grant was given on the basis of the total number of hours of instruction provided by the school. However, some allowance was built into the amount, as work which was judged by the inspector to be of 'conspicuous merit' with respect to instruction or organisation could mean an increment of one-tenth on this grant, whereas work judged to be 'defective' meant reductions of one or more tenths.

---

[115] Fletcher's evidence before the Digby Inquiry, p. 124.
[116] Ibid., p. 124.

The attendance of every pupil was registered. At the end of the year when the registers were submitted to the Department and the total number of hours of attendance of pupils was divided by forty. Then payment was made on the basis of these units, paying ten shillings for each unit of science in the first year, and other rates for other subjects. In extreme cases where the work was judged to be poor the grant was refused altogether, although the alternative of a reduction by more than two-tenths was preferred.

When Fletcher was questioned about the equipment and laboratory grants, his reply indicated the enormous work achieved by the Department in such a short passage of time:

> I have already explained that schools had no laboratories. The difficulty had to be met, and met immediately. The Department offered grants for equipment, requiring the preliminary approval of plans. The grant amounted to between one-third and one-half of the expenditure for fittings and apparatus. A special equipment grant was obtained from the Treasury. The total grants made from this source amounts to £18,244. The grant was made for five years only and is now at an end, but nearly every secondary school in Ireland, to the number of 265 had been enabled to comply with our rules.
>
> Micks questioned if this equipment grant was to be renewed, and Fletcher replied that it was most unlikely.
>
> (Mr Micks) *Is that equipment grant likely to be renewed? –*
>
> Most unlikely, because it was given for the purpose of equipping the secondary schools for a new programme, and although it is true that secondary schools need additional equipment from time to time, the grant was given for the purpose of equipping them in the first place.
>
> Under further questioning Fletcher was adamant that there might only be a few schools without equipment at this time, and he found it hard to name any schools that were not working under the Department's conditions.
>
> (Mr Ogilvie) *To come back again to that question of dictation and notes – there are, of course, numerous sections of work in science classes in which dictation of notes is a necessary and desirable thing, but the essence, as I take it, of the method that your grants are intended to encourage, includes this effort of the pupil to set down as well as to reason out, a proper description for himself; so if you found in any school that the notes recorded in the boys' book*

from the beginning of the session to the end were in a very large part dictated that would necessarily be a serious evasion of the method you intend to encourage?

Very. It would be a mark of bad teaching.

And if that were persisted in, I presume you would consider it so serious a thing that you would deal with it in the grant?

Certainly. There are many grades of sinfulness in this particular respect. First of all the teacher, with the view of giving directions to the boys may say, "In writing out your results you should adopt this form", and he puts down on the blackboard how to arrange it in columns. That is not only not objectionable, but it is desirable. That is teaching. There is another case in which he dictates not only the methods but the records. That is distinctly wicked. Next you have another stage, which is absolutely criminal, where the teacher gives the figures that the boy should have got as the result of his experiments. That is terrible.[117]

In an article published by *The Irish Educational Review* in October 1907, reference is made to this inquiry and the fact that had an independent committee met instead of an internal one, the result might have been more successful. Mr. Micks in producing a Minority Report was praised for attempting to get 'efficiency along true lines' when he pleaded for the separation of functions aiming at the work of practical development from functions that are purely educational. The article closes with the following comment:

> Co-ordination of effort not only sounds well, it is in reality necessary for true efficiency, but it does not follow that co-ordination is best secured by putting the entire management of several complex and diverse systems into one set of hands.[118]

4.11 Development of Intermediate school science from 1922 – 1924.

Teachers had been given freedom in the 1918 – 19 Session to draw up their own syllabuses of instruction for the Preparatory Grade, and whilst some of the syllabuses received by the Department were 'out-standing', most were made up from material connected to the elementary work of the Junior and Higher Grades. It was felt that many managers placed inexperienced science teachers in charge of Preparatory classes, and gave their more experienced colleagues the other classes, hence the poor quality of the work

[117] Ibid, p. 128.

schemes presented. The Department placed great importance on the Preparatory years of science, as these were the formative years during which the pupils could be trained in observation and experiment using the heuristic method. The Department now found itself involved in new training schemes, not in science however, but in a new subject that was to displace science – Irish. By October 1921 the Department of Agriculture and Technical Instruction was organizing, in conjunction with the County Council special courses for the training of Irish teachers in Dublin.[119] The Department's science work continued and the following table shows the number of schools working under the Department. The numbers of pupils and the amount of the grants earned, indicates that the work of the Department did not slow during a most troubled period of Irish history. (Note: These figures are for the Irish Free State and exclude Northern Ireland).

Table 4.10 showing the state of the Department's science work in the schools from 1921 – 1922.[120]

Year.	No. of Schools.	No. of pupils who worked through the courses, and upon account of whom grants were payable.					Amount of Grants earned.
		1st Year	2nd Year	3rd Year	4th Year	Totals (Individual pupils)	£ s d
1921– 22	179	3,449	5,261	2,080	694	11,484	24,208 13 1
1922 - 23	176	3,240	5,047	2,146	680	11,113	22,756 0 3

This compares with 154 schools and grants totalling £9,575 10s 8d for the Department's inaugural year, 1901- 02, which included Northern Ireland.[121] The number of pupils who worked under the Department for the year 1922 – 23 had increased almost five-fold since its first year.

The transition from the old system to the new one appears to have gone smoothly for in February 1922 the Minister of Education, Eoin McNeill, stated that he,

---

[118] *Irish Educational Review*, Vol. I No.1. Oct.1907, p. 59.
[119] *The Irish School Monthly.* Vol. XLX, No. 8, p. 177.
[120] D.A.T.I. 22nd annual general report 1922-23, p. 76.
[121] Ibid., p.76.

...desires that, pending a full measure of legislation by the Parliament of Northern Ireland, there should be as little disturbance as possible in the work of the schools.[122]

Grants to schools in Northern Ireland continued to be paid by the Ministry, whilst the DATI continued to advertise its summer courses of instruction for teachers.

The financial state of the DATI was reported by the *Irish School Monthly* to be '...better than that of most other countries',[123] and the breakdown for the monthly statement for November 1922 was as follows:

Deposits and cash balances in Irish Joint Stock Banks on 30th June last amounted to about £196,395, those in Post Office Savings Bank totalled about £13,550; and those in Trustee Savings Banks £3,678. The amount of Government stock held in Ireland was £108,312. This would appear to indicate that the financial management of the Department had been extremely prudent and above board, and nowhere in the research of this thesis were any major criticisms found regarding the handling of the Department's funds. The only criticisms that have been discovered in this matter refer to the tardiness with which the Department issued its grant monies to the respective schools, and this was put down to bureaucracy. In February 1923, Marlborough Street Training College was abolished and the science laboratory that had been constructed there was made available to the Central Model School, Marlborough Street.[124] Two months later the Department once again advertised its summer courses as it had since 1901, however this time it was intended to train science teachers in nature study.

This subject was being introduced into the preparatory course of the Department's programme for day secondary schools. Teachers who were already qualified to give instruction in elementary science under the Department, and were teaching in schools where it was proposed to introduce nature study for the 1923 – 24 session would be allocated places first. The course was to consist of lectures, practical work and excursions for fieldwork.[125] George Fletcher speaking at this summer course on July 14th 1923 said: 'The instruction in Science had been found to be too bookish and a stimulus would be provided by the introduction of Nature Study'.[126] This remark would appear to indicate that there had been a slow erosion of the Department's heuristic policy of practical science in the schools, and that the study of science was

[122] *The Irish School Monthly*. Vol. LXXI, No. 5, p.107.
[123] *The Irish School Monthly*. Vol. LXXII, No. 51, p. 124.
[124] *Irish School Monthly*. Vol. LXXII, No. 7, p. 159.
[125] *Irish School Monthly*. Vol. LXXIII, No. 16, p. 375.
[126] *Irish School Monthly*. Vol. LXXIV, No. 28, p. 673.

returning to the form it had existed in prior to 1900. That same month T. P. Gill, secretary of the Department retired. He was very highly respected by the teaching organisations and held in high esteem by them.

> A saying of Mr. Gill's in giving evidence before a civil service commission some years ago, is worthy of repetition. It was that the teacher was the most vulnerable member of society.[127]

The next and last annual report to be published was not until 1926 and covered the years 1923 – 26; this was the twenty-fourth general report of the Department of Agriculture and Technical Instruction. By now the business and functions of the Technical Instruction Committee had been transferred to the newly created Department of Education as of June 1924. The report opened with a reference to the improved political stability of the country. Making reference to the fact that much of the Department's work had been affected by the troubles. The lack of funding appeared to be the single most problem cited which affected the Department's work nationally. Gill although retired was using every available opportunity to promote this message. In a section entitled 'Mainly Personal' in the Irish School Monthly he is quoted as saying:

> If the country lifted its head out of the present trouble and went forward every class of people would understand that the truest national economy and the safest investment of the State was the money applied to education.[128]

With regard to the development of science instruction in the secondary schools which was reported only four lines described the three years of progress. This is another indication that the Department's work in this area had slowed, particularly in the promotion of the practical side of science instruction.

'In Science, much sound cultural work was done by certain teachers, but, on the whole, there was a decided tendency to regard this subject as a mere factor in securing a "Pass" in the written examination'.[129] This was the last report on science instruction to be published as all such reports including examiners' reports ceased in 1924, and the only indication as to the type of science instruction under the new Department of Education was the publication of the annual syllabus.

To compound matters poor school attendances at all three levels, National, Secondary and Technical were still a source of problems for the development of the Department's work in the schools. The majority of

---

[127] *Irish School Monthly*. Vol. LXXIV, No. 17, p. 411.
[128] *Irish School Monthly*. Vol. LXXIV, No. 24, p. 576.
[129] Ibid, p. 133.

pupils were leaving school after 4th Standard in the National school, and this number was estimated to be almost 50,000 in 1923. On July 21st 1923 Sir Robert Blair retired as Chief Officer of the London County Council Education Department.

Slowly science began to disappear from the National Schools, for by 1924 Standards I and II did not do any form of science at all. For Standard III Nature Study was an optional subject along with either Grammar or History. Nature Study or History had to be chosen by pupils of IV Standard, and for Standard V the optional subjects were:

History, Drawing (only in schools with less than 3 teachers), Elementary Physical Science or Nature Study, Algebra, Geometry and Mensuration, French, Latin or Irish. One of these subjects had to be taken in every school with three or more teachers.

In May 1923 the Department held an examination in the principles, methods and history of education, with special reference to science teaching. It was open to persons who were provisionally recognized as teachers of experimental science and there was no fee for admission to the examination. The syllabus included the following:

> The general nature of the Inductive and Deductive processes. The methodology of instruction in Science as determined by the laws of development of knowledge; the functions and relations of laboratory work and class teaching. The use of notebooks and textbooks in Science teaching; methods of recording and treating observational data. Correlation of Science teaching with instruction in English and Drawing.[130]

Two of the books which were on the recommended reading list included: Westaway: *Scientific Method*, and Armstrong's: *The Teaching of Scientific Method*. It would appear that even in its death throes the Department had not given up on Armstrong's heuristic methods.

---

[130] *Irish School Monthly*. Vol. XXIV, No. 20, p. 476.

Chapter 5

The Department of Agriculture and Technical Instruction and Technical Education from 1900 – 1924

5.1 Introduction

The policy of the Science and Art Department towards Ireland which existed at the beginning of the twentieth century, when compared to the remainder of the British Isles, provides strong evidence of the British Government's continuing apathy towards the development of technical education here. No national policy for technical education was in place, and even had there been one there was no agency in existence to implement it. For almost the entire duration of the nineteenth century very few opportunities were available for Irishmen and Irishwomen to train in any form of industrial occupation. The institutions that did exist were few, and tended to cater for only a limited number of students; they also tended to be sited in the major cities like Belfast and Dublin. The Mechanics Institute which was founded in Dublin in 1838, '...provided working class students with a variety of commercial and scientific courses in return for a modest subscription of ten shillings a year.'[1]

This Institute was the forerunner of the modern day technical college in that it provided a practical form of education in many different trades, and allowed those who possessed a talent for this type of work an opportunity to further it career wise.

> For many years, such institutions as these maintained in many a small town, as well as in every great city, evening classes where the foreman and the intelligent mechanic could improve their general education, and classes for science and art, where thousands of men and youths obtained the practical knowledge of geometry, drawing, machinery and mechanics which enabled them to take a higher position in their respective trades. These institutes frequently provided facilities such as laboratories for the study of more purely scientific subjects, especially chemistry and physics, to which was due the rise of many from the ranks of the artisans to lucrative and responsible posts.[2]

On the other hand, the College of Science which had been founded in 1867 and was organised by the

---

[1] Atkinson, Norman. *Irish Education – a history of educational institutions.* Dublin: Allen Figgis, 1969, p. 108.

[2] 'Technical instruction in Ireland'. *New Ireland Review*, Vol.XII, Nov.1899, pp. 171 – 187.

Department of Science and Art in South Kensington, provided advanced courses in agricultural and engineering subjects more immediately connected with industry. The origins of the Dublin Institute of Technology can be traced to the Irish Artisans' Exhibition, held in 1885 in premises located on the site of the present National Concert Hall in Earlsfort Terrace.[3] The purpose of this exhibition was not only to encourage and stimulate Irish industry but also to promote technical education. Thoughts turned towards setting up a technical school in order to allow artisans compete more equally with competitors in other countries. The Samuelson Commission which sat from 1881 to 1884, stated in its final report '...that municipally aided technical schools, on the successful continental model, be established throughout the United Kingdom'.[4] In 1887 the Kevin Street Technical School, financed jointly by public subscriptions and grant-aided by Dublin Corporation, opened its doors for evening classes only, with W. Vickers-Dixon as principal. Vickers-Dixon later became a prominent influence on the administration of a technical system of education in Ireland. However, the countrywide lack of development during the period 1838 to 1896 is reflected in the report of the Recess Committee, which was detailed in Chapter Four. Over a ten year period from 1889 to 1899 the grants had dwindled from £8,481 to £3,840, whilst the amount contributed from the Imperial Exchequer under the Technical Instruction Acts of 1889 and 1891 amounted to only £3,044.[5] The number of students presenting for science in the Intermediate Examinations mirrored this trend also: dropping from 2,885 in 1891 to 673 in 1899, whilst the total number of boys presenting for examination in other subjects rose from 3,856 to 5,726 in the same years. This is referred to in the first annual general report of the Department in 1901 when it is stated that:

> Instruction in Science and Art in Ireland has of late years fallen to a very low ebb. Ten years ago, in 1891, the Science and Art grants in Ireland amounted to £8,481, a sum which, though small, was twice the figure to which the grants have since declined. In 1891 the number of boys presented for Science in the Intermediate Examinations was 2,885; the number in 1899 was 673, less than one-fourth. In 1891 the total number of boys presented at these examinations was 3,856, whilst in 1899 it was 5,726.[6]

---

[3] Duff, Hegarty and Hussey. *The Story of the Dublin Institute of Technology.* Dublin: Blackhall Printing, 2000, p. 3.
[4] Ibid., p. 4.
[5] Report of the Recess Committee on the establishment of a Department of Agriculture and Industries for Ireland. Dublin: Browne & Nolan, 1896, p. 88.
[6] Department of Agriculture and Technical Instruction. 1st annual general report 1900. Dublin: HMSO 1901, p. 64.

With a lowering of numbers each year the future looked grim with respect to science instruction in the secondary schools of the country. In a matter of two years, between 1893 and 1895 there was a significant fall in both the numbers of pupils taking science and in the number of schools offering it as a subject.

> In 1893 there were 9,157 science students in 236 schools or classes in connection with the Science and Art Department in Ireland; in 1895 there were only 6,547 science students and only 182 classes. In fact it has been shown by evidence given before the Commission on Intermediate Education that in a few years the teaching of the natural and experimental sciences will have died out almost completely in Irish schools unless steps are taken to prevent this.[7]

The Board of Education's policy towards Ireland during these years indicate a distinct lack of understanding towards the problem in the country. Very little effort was made by it to initiate any programme which would provide a system of practical technical education. Reports for the first year of the new century make reference to a lack of technical students outside the major cities that might have any experience in work of an industrial nature:

> In the majority of the provincial towns of Ireland, beyond the artisans connected with the building trades, there are seldom workers enough engaged in any industry to which technical instruction could properly be applied to furnish pupils for a class at a technical school.[8]

It was also felt that should a system of technical instruction be established in Ireland, there would simply not be enough pupils in the country to fill the classrooms. This had been the pattern in other continental countries. Ireland's tradition up until now had been agriculture rather than industrial, '...agriculture is a great and living industry, universally pursued in Ireland '[9]

As a consequence, the task facing the Department was huge. A system of technical education had to be constructed almost from scratch, properly trained teachers had to be brought into the system with great urgency, adequate facilities to be found or built, and the proper apparatus provided in order to achieve instruction of a practical nature. The population of the entire country had to be convinced that this innovation could make a real difference to their lives and that attendance at whatever courses were offered was vital for their future prospects. To compound matters, circumstances within the country

---

[7] *New Ireland Review*. Vol.XII, Nov.1899, pp. 171 – 187.
[8] Ibid., p. 24.
[9] Ibid., p. 23.

were not congenial towards an innovation such as this. Emigration at this time was one of the only means for those looking to further themselves through industrial employment. This also led to a draining of the country's supply of potential technical students.

There were also very few established industries in the country, and it was acknowledged that any initiative would be difficult with such a limited base on which to build:

> To establish a system of technical instruction which shall dovetail into and supplement the work of existing workshops and factories is an easy matter compared with establishing a system in a country in which there is a general absence of manufactures.[10]

Perhaps this was the 'culture' to which so many distinguished speakers had referred to in late 1902. Many educationalists argued as to what was meant by the meaning of this word:

> Professor Dewar told us at Belfast that the English people were seriously behind the rest of the civilized world in "culture"; and Mr. Plunkett followed him up in Dublin by saying that technical education cannot be carried out without "culture"... But Professor Armstrong is of opinion that the same "culture" is to be discovered by the pupil who spends his time "at the work-bench, tool in hand".[11]

To compound the difficulty which the Department faced in introducing an efficient system of technical education was the fact that the county and urban councils through which the Department hoped to introduce its schemes nationwide were themselves new to their duties. Good relationships between both agencies would be crucial to the success of the venture. The challenge would begin in the primary sector with the introduction of a more practical science programme in the National Schools. This would also embrace the secondary sector with the introduction of a similar method of science teaching organised by the Department with the consent of the Intermediate Board.

5.2 Historical background

There were several events that occurred during the latter part of the nineteenth century which precipitated the introduction of an organised system of technical training in Ireland. Both the formation of the Technical Education Association of Ireland in 1893, and the Recess Committee in 1896 under Plunkett and Gill, pushed the cause of an Irish Department to the fore of educational reform in Ireland.

---

[10] Ibid., p.55.
[11] *Irish School Monthly*, Vol.III, No.2. October 1902, p. 71.

The final report of the Belmore Commission in 1898 began a move towards a more practical form of education, the immediate effect of which was the initiative proposed for the National Schools. In secondary education the report of the Commission on Intermediate Education (Palles 1899) initiated new programmes, and the Local Government Act of 1898 allowed for a more organised system of local authority structure, which in turn opened the way for establishing and funding the Local Education Committees. This funding of technical education via levies on the local rates (taxes), under the Agriculture and Technical Instruction Act of 1889, enabled local authorities to supplement central government funding.[12]

However, it was the final report of the Recess Committee that brought about the greatest change, with the passing of the Department of Agriculture and Technical Instruction (Ireland) Act of 1899, and ultimately led to the establishment of the Department of Agriculture and Technical Instruction (D.A.T.I.). Clune states the reasons for the foundation of the DATI as originating from two sources:

> 1. The growth of a new spirit of co-operation between Unionists and Nationalists in Ireland around 1895, evidenced in the passing of the Irish Local Government Act of 1898, followed by the establishment of the D.A.T.I.
>
> 2. The strong and determined personality of, coupled with earnest work by, its first vice-president Horace Plunkett.[13]

Its founder and vice-president also saw the Department as very much a Department of the Irish people as distinct from the Science and Art Department, and he said as much when speaking at the Cork Exhibition in 1902. 'The other respect in which our Department is unique is that it is in the truest sense of the word a people's Department.'[14] It would appear that a concerted effort was made by the officials concerned to distance themselves from South Kensington in order to create and maintain the 'Irishness' of the Department. Certainly the Irish public welcomed this new development in Irish education as evidenced in a newspaper report of the time:

> These are new and pregnant educational ideals, not so much in themselves as coming from an Irish Government Office. A Department whose guiding spirits keep them steadily in view cannot go far wrong and deserves to succeed.[15]

---

[12] Duff, Hegarty and Hussey, p.5

[13] Clune, M. *Horace Plunkett, the origins and development of the D.A.T.I. and the political context 1895 – 1907*, 1978, p. x.

[14] D.A.T.I. Journal, p. 692

[15] *The New Department,* editorial article in the *Leader*, Dec.7th 1901, p. 255.

5.3 The **organisation of the Department**

The administrative structure of the Department when it began working on 1st April 1901 showed a remarkable resemblance to the proposals contained in the final report of the Recess Committee of 1896.

> Proposed scheme of Practical Education.
>
> We propose that this state of things should be remedied – (1) by a reform in the teaching in the Primary Schools; (2) by the creation of a new type of Secondary Schools in two categories, to be called Practical Schools of Agriculture, and Practical Schools of Industry and Commerce; (3) by the establishment of local Art Schools; (4) by the promotion of Evening Continuation Schools and classes for youths and artisans engaged at work during the day: these to be in connection with the Practical Schools, the Art Schools, or the higher Technical Colleges in the towns or cities; (5) by the establishment of higher Technical Colleges for Agriculture, Industry, and Industrial Art, and by the endowment of Chairs of Agriculture and applied Science at Universities.
>
> All this system, except the Primary Schools and the University Professorships, should be under the care of the new Department, which should, for the purpose, take over a portion of its agricultural section from the National Board of Education; absorb the entire educational functions of the Science and Art Department, so far as they refer to Ireland; and be placed in control of a special grant of its own for Practical Education.[16]

The emphasis was on a scheme of education which had never been practised in this country before, and one which would replace the more theoretical and examination based system of the Intermediate Board. Apart from the ordinary functions of the newly established Department such as veterinary, fishery, statistical and educational work that had previously been carried by five or six state departments, a number were comparatively new; for example, the development of 'Agriculture and other Industries and Technical Instruction' was a new departure. A capital sum of £200,000, which had an annual endowment of £166,000, was to be the source of finance toward setting up and maintaining the Department. Salaries and allowances for the staff came directly from the Treasury. The staff structure allowed for a President and Vice-President, both assisted by a Secretary, two Assistant Secretaries, one

[16] Report of the Recess Committee, pp. 90-91.

for Agriculture the other for Technical Instruction together with a number of Inspectors, Instructors, Officers and Servants.[17]

In order to keep in touch with the public opinion of the classes that its work would concern, and without whose active co-operation no lasting good could be effected, a Council of Agriculture was established which comprised two boards; one concerned with Agriculture the other with Technical Instruction. This structure appeared to have been modelled on continental systems. This modelling was due to the suggestions of the various working committees which were set up at the behest of the Recess Committee and whose members had travelled throughout Europe observing and reporting back on some continental systems.

A board of technical instruction, which comprised 21 members was set up. Local committees (under the guidance of the technical instruction branch) prepared schemes of technical instruction, which had to be approved by the Department. These schemes were reviewed annually. Local monies had to be raised before the Department contributed towards these schemes from central funds. The Department went to great lengths to avoid offending 'existing agencies', and put the improvement of the plight of secondary school science high on its agenda. There was also a pronounced effort on behalf of the Department to allow maximum flexibility in framing these local schemes in order to allow for the needs of the area to be met in the provision of technical courses there. It would appear that these initial efforts were successful beyond even Plunkett and his officers' expectations. Proof of its immediate effect is evidenced by the fact that in 1901 there were only six secondary schools with laboratories, whilst at the end of 1902, 101 permanent and 49 provisional laboratories had been established at a cost to the Department of £30,000.

5.4 The Department's educational policy and strategy

The framing of the Department's educational policy and its implementation was the remit of the Consultative Committee of Education. Speaking at the 1st Meeting of the Council of Agriculture on 29th May 1900, Plunkett said of its educational functions that,

> ... education is largely a matter for experts, and the educational policy of the Department will be largely guided by the Consultative Committee of Education, which is so constituted as, in

[17] Gill, T. P. *Character and Educational Efficiency in Ireland*, address to the 1908 British Association Meeting in Dublin, pp. 161-162

> my opinion, to be the best possible adviser upon our educational policy, and upon the complex problem with which that policy will have to deal.[18]

The first major contribution of this Committee was made during the setting up of the Department's Programme, when it liased with the Board of Intermediate Education. The outcome of this meeting was that the Intermediate Board acceded and adopted the Programme in lieu of their own regulations for the teaching of Natural Philosophy and Chemistry, and the Department's inspection in lieu of their own annual efficiency test of the teaching and the knowledge of the pupils.[19] Apart from this it would appear from the minutes of the Board of Technical Instruction in July 1915, that subsequently this committee had in fact very little to do in helping shape education policy:

> Reverend Dr. Evans called attention to the fact that the Consultative Committee had not met for some time. He considered that the Committee might, with advantage, meet at regular intervals as, even although there were no special questions to be submitted for decision, the meetings would afford convenient opportunities for an interchange of views between the representatives of the several Educational Authorities on topics at the moment of interest in connection with educational work. The Vice-President stated that none of the bodies represented had asked for a meeting to be called, and meetings of this Committee were convened only when some specific question had to be considered. He would, however, confer with Mr. Gill about a subject suitable for discussion by the Committee and if any case was made for holding a meeting he would have one summoned.[20]

In this instance the question must be – who in the Department was directing the educational policy with respect to the development of technical education in the country? No direct evidence has been found to answer this, although it is the opinion of this researcher that it was more than likely Robert Blair himself who was responsible for setting up the Programme. Reports taken from the minutes of the Board of Technical Instruction indicate that whenever a scheme of technical education needed presenting or explaining it was Blair's role to do this. Certainly he began to attend the meetings of the Board from May 1901, and on repeated occasions which are recorded in the minutes, addressed the Board on matters of major Departmental educational policy. He received all the credit from Fletcher on being the person responsible for setting up the schemes of the Department:

---

[18] Plunkett, H. Address delivered at the Council of Agriculture, 29th May 1900, pp. 6-7.
[19] Minutes of the Board of Technical Instruction. July 1916, pp. 93-94.
[20] Minutes of the 45th Meeting of the Board of Technical Instruction. July 1915, p. 4.

> In drawing up our programme we had in full view the schemes which had been at work in Great Britain and elsewhere. My predecessor, Mr. Blair, had a wide experience in England and Scotland. I myself had wide experience in England, and we were fully aware, I think, of everything that had been done both in England and elsewhere in regard to science work in secondary schools.[21]

If this was the case, there are strong reasons why he might have favoured a more heuristic approach. By the 15th Meeting in September 1904, Blair had left the Department, and his position as Assistant Secretary for Technical Instruction was taken by George Fletcher, who had been a senior inspector prior to this.

The educational policy of the Department emphasised the importance of a practical oriented system of education and a strategy which involved a three-pronged approach incorporating all three levels of the Irish educational system, 'The primary school, the secondary school, and the university are thus regarded as having their part to do for what is commonly called technical education...' [22] For example, out of the first year's grant the Technical Instruction Committee handed out to various secondary schools the sum of £1,600 provided towards the cost of equipment and apparatus,

> ...in order to enable them to serve the purposes of co-ordination with the system of technical instruction already described.[23]

The 'New Programme' attempted to revise the system on which the Science and Art grant had previously been administered in Ireland. Although science instruction was important, concern was also expressed with the administration of this grant from the point of view of a general education. The first annual report makes this quite clear.

> They desire it to be understood that they regard a liberal introduction to general culture as the essential foundation for all sound forms of systematic specialised instruction whatsoever, and that, in their opinion, Science and Art instruction cannot be a substitute for humane letters in such a general course. It can, however, they believe, be made a powerful ally.[24]

The report goes on to elaborate on the benefits of a properly organised course in laboratory science instruction:

---

[21] 1907 Digby Inquiry report, George Fletcher's evidence Cd.3573-3574, xvii p. 124.
[22] Hyland, A & Milne, K. *Irish Educational Documents*. Dublin: C.I.C.E, 1992, p. 280.
[23] D.A.T.I. 1st annual general report 1900, p. 58.
[24] Ibid., p. 65.

> Apart from its utility in teaching facts, Science instruction, if it be given through the laboratory (where the teacher does not dogmatise but stimulates and directs inquiry), rather than through the lecture-room, and if it be accompanied by a certain amount of instruction in drawing and manual work, becomes a valuable mode of intellectual training. It gives full opportunities for creating interest on the part of the pupil; it draws out his powers of observation, puts him in the attitude of a seeker after knowledge, and gives him accurate and orderly habits of thought. Having done its part, side by side with literary instruction, in a course of general education, Science and Art instruction will have prepared the pupils who have received it, when the age for specialisation comes, for those practical and technical courses towards which it is so important in Ireland to direct much of the teaching power of the country, and which it is the particular duty of this Department to organise.[25]

Furthermore, the emphasis on the work being practical is also contained in the earliest reports:

> When the secondary school, on, at least, one of its "sides", is permeated with the practical spirit, and deliberately related to the real economic and social needs of the country, it becomes possible to produce leaders of industry; and when properly-trained leaders of industry are available for a country reforms in all the grades of practical education inevitably follow.[26]

The initial aim of the Department was to centralise technical education, and so the Royal College of Science was made the chief technical college for Ireland. Appropriate plans were made to 'upgrade' this facility in order to fulfil its new role. Other established centres like the Metropolitan School of Art and the Science and Art Museum were also included in the scheme. From the outset the Department saw clearly that the main objective of technical instruction was, '...to give a training in principles which govern industrial processes, and which determine the conditions of commerce and influence its flow.'[27] Consequently, the form of technical education assumed two forms. One involved instruction of a general nature including,

(a) The teaching of practical science,

(b) Practice in exercises requiring skill of hand and eye, such as the various forms of drawing and

---

[25] Ibid., p. 65.
[26] Ibid., p. 22.
[27] Ibid., p. 53.

designing and manual instruction in wood, metal, leather, and other kinds of material.[28]

Five years earlier, Armstrong had penned the following words:

> The knowledge of method and the discipline afforded by laboratory studies are factors of primary importance which meet with no consideration in a lecture course.[29]

It would appear that the Department had something similar in mind, for the old system in which science had been taught under the 1878 Intermediate Education Act was to be replaced by a radically different one.

> The introduction of the new programme demanded, in the view of the Department, a new approach to science teaching in Ireland. The traditional book-centred method was to be replaced by a practically oriented one.[30]

The new approach involved increased instruction in specific industries. For instance, it was proposed that under agriculture, experiments would be performed and the results obtained would be directly applicable to the work of the farmer. In the engineering section it was proposed that materials be tested on a commercial scale, '...and the methods of testing the efficiency of machinery and designing new forms practised in the school work-shops.'[31] In the rural setting, the plan was twofold – to assist '...local effort in inquiries designed on the one hand to spread a knowledge of markets for existing industries, and of the readiest means of reaching them', and to determine whether or not the specific locality lent itself towards the '...introduction of new and profitable industries'.[32]

One of the major problems also recognised by the Department was that in other countries where such schemes of technical education had been established and developed, there had been a fairly effective system of science and art instruction in place for many years previously. In Ireland, both would have to have a common genesis. Furthermore, the 'Councils of Ireland (County and Urban)' had only been recently established, and were in their first period of office. The fact that Ireland had little or no previous industrial history only served to further complicate the problem.

An indication of the well-researched groundwork being done by the Department is reflected in its publication in June of 1900 of 'Suggestions for the guidance of local authorities and others in preparing schemes of technical instruction for approval by the Department' – a pamphlet designed to assist the

---

[28] Ibid., p. 53.
[29] H.E. Armstrong, 'How Science must be studied to be useful'. *The Technical World*, 1896, p. x.
[30] Hyland & Milne, p. 284.
[31] D.A.T.I. 1st annual general report 1900, p. 54.
[32] Ibid., p. 54.

local authorities by means of suggested actions. This pamphlet detailed the monies set aside by the Agriculture and Technical Instruction (Ireland) Act. It also outlined the way in which the Department proposed to assist the local authorities:

> It will be the duty of the Department to assist in every way possible, by correspondence and personal consultation, the local authorities and other persons preparing and organising schemes of Technical Instruction. The Inspectors of the Department will visit localities, where necessary, for this purpose.[33]

Details of the terms under which grants were available were also itemised and included the following:

- Tenure of buildings
- Inspection
- Registers
- Qualifications of teachers
- Examinations
- Estimates and accounts to be furnished

Within the pages of this pamphlet it was proposed that every county borough should have at least one technical school, which should comprise properly equipped laboratories and lecture rooms for Chemistry and Physics. Provision was also to be made for instruction in the sciences underlying the practice of Agriculture, and for researches and experiments which cannot conveniently be carried out in the field. Duly qualified teachers were considered to be those who were qualified under the Science and Art Department to give instruction in any subject of science. Those holding certificates of the City and Guilds Institute in technical subjects were also considered to be suitably qualified.

The Department followed its 'Suggestions' document by a memorandum, which detailed the '...power of these bodies, and the procedure to be followed'[34].

The Department met most of the local authorities in order to clarify the meaning of the Act establishing the Department, its funding and its proposed action. A survey of every locality was also performed, followed by the creation of a specific scheme for

the area. The amount of time consumed by such preliminary resource work was considerable:

---

[33] *Suggestions*, pamphlet issued by the Department. Dublin: HMSO, 1900, p. iv.
[34] D.A.T.I. 1st annual general report 1900, p. 55.

> An idea of the extent to which this is the case may be gathered from the fact that one inspector from the Technical Instruction Branch, between September 1900 and March 1901, attended sixty-two conferences, and visited 152 institutions in connection with local schemes.[35]

Yet it was the opinion of the Department that this was absolutely necessary in order to implement its scheme effectively. In fact the two features of any heuristic scheme, which would be considered to be an anathema to it, were textbooks and formal examinations. In the case of the former they were downplayed considerably, and in the case of the latter, removed entirely:

> The committing of facts to memory, however important or useful is not Science teaching: and it is hoped, therefore, that during at least the first two years of the course the text-book will occupy a very small (if any) share in the work of instruction. The object in view is the introduction of the scientific method of Science teaching as a means of mental discipline; and it is because the methods and spirit of the teaching cannot be measured by the ordinary form of written examination, that the annual written tests have been abandoned in favour of inspection.[36]

Armstrong himself had written on the problem of attempting to teach science heuristically and the difficulty of assessing progress made,

> ...if teachers can be kept free from the clutches of the examination demon or even if the demon will but mend his ways and become an honourable, useful, retiring member of society, there is no reason why rational courses of instruction in all subjects should not be open to the public to an extent to meet all requirements.[37]

The Department's idea of dispensing with formal examination in favour of inspection was in part to free co-operating schools from the need to follow strictly prescribed syllabuses. This would therefore allow them the freedom to devise their own syllabus, which would be adapted to suit local needs. This led to considerable diversity amongst the many technical schools in Ireland. This policy was dropped in 1912 and the Department reverted to an examination system as a result of its programmes becoming out of harmony with the examinations of the Board of Education. The four-year course in Applied Chemistry became one subject, which was then examined by the Department. Two examinations were

---

[35] Ibid., p. 55.
[36] Hyland & Milne, p. 286.
[37] Armstrong. *How Science must be studied to be useful,* p. 50.

held in each of the four years. It was made quite clear that not only theory but also practical work would be examined:

> It is intended that the courses of instruction of which these Examinations will provide a test, should include not only theoretical, but practical and laboratory work. The laboratory work should be based on and co-ordinated with the subject matter of the class-work. In the Practical Examination credit will be given for records of work done by candidates, and their laboratory note books must be retained and made available for examination.[38]

This new examination system proved very successful and the number of candidates presenting was indicative of the interest in achieving some degree of certification. The following table details the number of 'exercises' or courses which were attended in a five year period from 1913 – 1918 and shows that the popularity of the science subjects failed to be affected by the introduction of this examination system.

Table 5.1 Numbers of exercises worked each year since establishment of the examinations in 1913 was submitted.[39]

Year	No. of Exercises worked
1913	4,298
1914	4,428
1915	3,969
1916	3,667
1917	4,561
1918	4,753

5.5 The allocation of monies

Four years prior to the establishment of the Department, the grant earned from the Science and Art Department for technical education amounted to '...£4,213 in 1896'[40]. In fact this figure seldom varied from this amount in the five years up to 1900. With the passing of the Local Taxation (Customs and Excise) Act in England, money was made available towards education in Ireland. However, instead of

---

[38] Fletcher, G. *The Department's new scheme of examinations for technical schools.* D. A. T. I. Journal, Vol. XII, October 1911 – July 1912. Dublin: Browne & Nolan, p. 675.

[39] Minutes of 54th Meeting of the Board of Technical Instruction, November 1918, p. 30.

[40] Fleming, G. F. 'The case of Ireland against the Science and Art Department'. *Irish Ecclesiastical Record*, Vol. XV. Dublin: Browne & Nolan, 1904, p. 132.

providing the country with an improved technical education system the bulk of it (£78,000) went to the Commissioners of National Education, with the remainder going to Intermediate Education, being allocated to the Intermediate Education Board. Under the Technical Instruction Act of 1889 some money was raised towards the promotion of technical instruction, although it was only very meagre. An 'equivalent grant' system arose whereby the Science and Art Department matched penny for penny any monies raised locally, although this practice was at best sporadic. In fact both the rate and the grant raised in this way together only managed to amount to £7,000. The incongruity of the situation may be seen in table 5.2,

Table 5.2 Amounts of grants allocated to Ireland as compared to the United Kingdom for the years 1893-1895.[41]

Ireland							United Kingdom
	Science			Art			
Year	Total number of schools	Pupils presented	Results paid	Pupils presented	Results paid	Total results paid in Ireland	Total results paid in the United Kingdom
1893	236	9,157	£5,607	4,443	£1,716	£7,325	£182,532
1894	201	7,388	£4,175	4,156	£1,754	£5,930	£197,136
1895	182	6,547	£3,514	3,885	£1,294	£4,809	£202,263

The above figures prompted a science inspector to the Science and Art Department to write:

> Under the existing circumstances, I do not think it likely that the teaching of Science is likely to improve in the schools...No doubt, the educational systems at present in force might be very easily modified so as to place Science and Art instruction on a sound basis, or, at any rate so as to give instruction in these subjects a fair chance.[42]

As stated at the beginning of this section by the time the Department of Agriculture and Technical Instruction came into being, the grant earned under the Science and Art Department was some £4,000 or £5,000 per annum.[43] Things were to change however, and in 1900 funds were available from a number of sources. One of these sources came about with the formation of the county councils in 1898.

---

[41] Fleming, p. 131.
[42] 44th Report of the Science and Art Department, p. 64.
[43] Fletcher, G. *The Organisation and Position of Technical Education in Ireland.* Paper read at the Belfast Summer Meeting of the Association of Technical Institutions. London: Knapp, Drewett & Sons, Ltd., 1907, p. 1.

These local organisations could raise a rate in the pound from the local population and monies used to promote technical education. With no policy towards technical education before 1900, it was left to the Recess Committee to suggest ways in which this could be put right. Both Plunkett and Gill who were so central to this committee were now charged with developing a scheme by which the Department could carry out a more definite and effective policy. With the transfer of the Science and Art vote, and an annual endowment of £55,000, the Department now had a degree of power in order to implement the policy, although the transfer of the vote did not occur until the autumn of 1900. The total investment by Parliament in the new Department can only be seen as huge when compared with the prior level of investment. With an annual income in its first year of £166,000 (net funding), a capital sum of £187,000 and all its salaries and administrative expenses paid for, the Department had the financial means to make Plunkett's vision as close as possible a reality.[44]

Technical education was to be overseen by the Board of Technical Instruction, comprising 21 members. In order to consolidate the three areas of education in Ireland, two members represented the Intermediate and National school systems. This Board had control of the endowment for technical instruction, and allocated the funds between the various local authorities. Such was Plunkett's determination that this scheme would work that it took the first two years of the Department's existence to prepare, inquire and organise before it began to implement its schemes.

According to Fletcher the work of the department during these formative years was one of organisation and planning,

> ...so during the first year or so of the Department's existence, its work was work of quiet preparation, inquiry, and internal construction. The statutory Committee of the Local Authorities, moreover, had to be appointed, and schemes to be framed, and this was mainly the work of the first two years.[45]

Robert Blair joined the Department early in 1902, and was immediately given the brief of organising the work of technical education. It was seen as imperative by the Department that Intermediate education be organised along lines which would favour the success of any scheme of technical education. 'By an arrangement with the Intermediate Education Board, the organization, inspection, and examination of science and art work has been practically delegated to the Department.'[46]

---

[44] Clune, p. 349.
[45] Fletcher. *The Organisation and Position of Technical Education in Ireland,* p. 3.
[46] *Irish Educational Review,* Vol. I, No.12, September 1908 p. 753.

Under Blair's capable guidance, a four-year experimental science, drawing and manual work programme was set up together with a scheme of grants. These grants could only be obtained if the school fulfilled certain criteria laid down by the Department. The most important of these were that the school should be provided with '...an adequate laboratory and equipment; that the teacher should be qualified and that the instruction should be regular and systematic and efficient'.[47] According to Fletcher, allocation of the grant depended upon the amount of work done and its efficiency. The former could be discerned from registers and the latter from the reports of inspectors. Importantly, examinations were abolished, and this was a sign that more practical methods of assessment were being employed. The examination-system of Intermediate education, which fitted hand-in-glove with the payment by results system, was gone. During this same period, the Department worked closely with the technical committees of urban district councils, and these local committees were invited to construct schemes that the Department would consider suitable to their district. The manifestation of this preparatory work were the technical schools which began to offer courses to the populations of the smaller and larger towns of Ireland. From Fletcher's point of view their success would appear to be significant:

> Freed from any restrictions except such as would secure sound teaching of subjects of a technical character, classes filled rapidly, and the work succeeded beyond the expectations of the most sanguine.[48]

The manner in which local authorities were enabled under the 1898 Local Government Act to levy a rate in the pound toward technical education was another positive move which favoured the development of technical instruction. However, the low rates levied compared with those of England made this practically useless in some of the poorer areas of Ireland. For instance, as much as 8d, 9d or even 10d which was raised in England and Scotland compared with the highest of 6d in Ireland (Co.Dublin), 2.5d in Cork, 1d in Waterford, and 0.25d in Kerry and Wicklow to 1/40th of a penny in Donegal. According to the Irish Ecclesiastical Record of 1904, empowered local authorities to raise 2d in the pound on the rateable value. That is 1d under the Act of 1889, and another 1d under the Act of 1899. The Irish Act of 1899 directed that all these monies were to be applied only with the approval of the new Irish Department.[49] While the secondary schools were administered directly by the

---

[47] Fletcher. *The Organisation and Position of Technical Education in Ireland,* p. 4.
[48] Ibid, p. 5.
[49] *Irish Ecclesiastical Record.* Vol.XV, 1904, pp. 135-136.

Department, funds for technical education were administered through County, County Borough, and Urban District Councils.[50]

In 1908 Gill referred to the problem of lack of funds for the Department in order to allow examinations to be conducted under its inspectors. As the examination of a more practical type of course would have to be done this way, the lack of funding would be a critical issue. Introducing any form of heuristic methodology into the schools and colleges, particularly when none whatsoever had existed before would have demanded a considerable financial outlay. Large expenditure on behalf of the technical instruction branch would thus provide evidence of this innovation in the laboratories of the schools and colleges.

5.6 Initial progress

Initially the work of the Technical Instruction Branch focussed on three areas:

1. The implementation of a programme of Experimental Science, Drawing, Manual Instruction and Domestic Economy (intended for the Girls' schools) in the Secondary Schools of the country.
2. The implementation of schemes of Technical Instruction in the cities, towns, and rural districts, suited and adapted to their diverse needs.
3. The training of teachers for Secondary and Technical Schools, as well as for rural districts, to carry out this work.

The Day Secondary Schools were seen as the principal benefactors of grants and the focus of the Department was on a form of schemes of instruction which were directed at Experimental Science, Drawing, Manual Instruction and Domestic Economy. Consequently there was much more progress made in this sector than in any other. For the Department to build an effective system of technical education a foundation had to be laid. It was felt that a programme built on the solid principles of science and art courses in the secondary schools would provide this.[51] It was proposed to concentrate more fully on the system of technical education which had been put in place in the first few years of the Department's existence and for the time being consolidate the progress made here.

---

[50] Fletcher, G. *A decade of technical instruction in Ireland.* Address before The Irish Technical Instruction Association at the Manchester congress, May 1911 p. 307.

[51] D.A.T.I. 13th annual general report 1913, p. 99.

It would be wrong to suggest that the early days of the new Department were solely filled with success. The reality was far from the ideal; for barely three weeks after its formation, it had its first real confrontation. Representatives of the newly constituted Department met with a deputation representing the Technical Education Committee for the City of Dublin at the Department's offices in Merrion Square. The Vice-president of the Department, Horace Plunkett led the group, which also comprised T.P. Gill (Secretary), Captain Shaw (Assistant Secretary in respect of Technical Education) and W.P. Coyne. Members of the Technical Education Committee comprised, amongst others, Professor G.F. Fitzgerald (Trinity College Dublin) and W. Vickers Dixon (Secretary), both of whom would eventually sit on the Board of Technical Instruction. The outcome of this meeting, which had been instigated by the Technical Education Committee, had profound repercussions on the relationship between both committees over a decade. Even though the dispute between the two bodies appeared on the surface to involve the appointment of a 'suitable principal for the Kevin Street school', this was not the case; the real reason boiled down to a power struggle: '...the struggle was one of power between the central department and the strongest local authority.'[52] It was not to be the only case that the Department would encounter, and it tested the relationship between the Department as a central body and one of the strongest local authorities in the country. However, in reality it was a power struggle which did very little to further the aims of the Department with respect to technical education during its lifetime. The dispute lasted for approximately ten years, and would appear to have affected, to a degree, the development of technical instruction in Dublin itself:

> During that period the advancement of technical instruction in Dublin city was impeded while the Department and auditors of the Local Government Board withheld approval and funds, implicitly demonstrating to the local technical instruction committee the futility of its opposition.[53]

5.7 The Cork Exhibition of 1902

One of the first public demonstrations by the Department in the promotion of its aims was at the Cork Exhibition of 1902. From December 1899 a scheme of "pioneer lectures" was organised and a prospectus sent to every local authority,

---

[52] Parkes, S. M. 'George Fletcher and Technical Education in Ireland, 1900-1927'. *Irish Educational Studies*, Vol. 9. No.1. 1990, pp 13-39. (Reprinted in *Irish Educational Decisionmaker*, No. 4, Autumn 1991, p. 45.

> ...to illustrate the need and use of scientific instruction in agriculture and industries, and to explain to local authorities and the public generally, and especially to the working classes, the manner in which the Department can aid in supplying this need.[54]

In Plunkett's own words the purpose of the Department was '...to lay the foundation of industry by the establishment of a system of technical and science instruction'. Making reference in the same address to the difficulty he saw in the advancement of its educational methodology, he said:

> It is incidental to the stage of initiation in this matter that the people who have not witnessed this kind of training in operation, nor its benefits, should for some time fail to grasp its practical utility. Moreover, the beginnings of this education are rather trying to the student, and seem, perhaps, rather meaningless. The drawing of straight lines, the careful measuring and weighing of things, the neatness, accuracy, and thoroughness which are the first essentials, are all a little tedious to acquire.[55]

He considered participation at the Exhibition, even though it involved considerable sacrifice in terms of man-hours and finance, as a means of publicly declaring these methods and schemes of the Department. The Leader newspaper was of the opinion that the Department had saved the Exhibition. It had provided it with money; it gave it its most interesting and valuable section; it had also brought serious and studious Irish visitors to it from all parts of Ireland. Outside the Department the Exhibition was badly conceived and indifferently executed. The Department had participated at the Exhibition and '...sent up agricultural and technical fire-works to arrest the attention of the passers-by', a sound policy according to the newspaper. It went on to quote Plunkett, and his ideas regarding the aims of the Department in attending:

> The object of the Department, through the Exhibition, was, in matters of agricultural and technical education and industrial development, to show some of the things that might be done. Their duty now, and that of the local bodies with whom they work, is to do some of these things. The work of illustration by means of an Exhibition has, so far as the Department are concerned, been accomplished for the time being...[56]

---

[53] Cooke, J. *The Dispute between the D.A.T.I. and the City of Dublin T.I.C., 1901-12*, p. 47.
[54] D.A.T.I. 1st annual general report 1900, pp. 587-588.
[55] Plunkett, H. *The Cork Exhibition and after,* address delivered to the Cork Literary & Scientific Society, January 1903, p. 525.
[56] *The Department and the Cork Exhibition*, article from the *Leader*. November 1902, pp. 153-154.

Central however to this particular endeavour was Br. Burke, then heading science instruction at the C.B.S. North Monastery in Cork. Br. Burke's co-operation with the Department is well documented and it began a short yet very strong relationship which would last up to his death in 1904. Testimony to this was the huge Departmental representation of its highest officers at his almost state-like funeral in Cork. E. M. Rich was involved with the Br. Burke Memorial Committee in the funeral arrangements, and a deputation from the Department comprising Gill, Blair, Fletcher and Rich marched in procession behind the hearse.[57] From the 1860s Br. Burke had been developing his own form of heurism in the science classrooms, and it is possible that he was much influenced by the theories of Pestalozzi.[58] According to Kelleher it would appear that the Department was keen to implement a system of science education similar to the one devised and carried out by Br. Burke:

> The new Department was willing to create mirror-images of Br.Burke's system in the North Monastery in all the Irish second-level schools, if it was possible.[59]

In April of 1901 Robert Blair, who had only just joined the Department as a technical inspector, was sent to Cork to meet with Br. Burke and see for himself the system he was employing in the classroom. 'He inspected all the arrangements and 'expressed himself as both astonished and highly pleased' at what he had seen.' [60] Barely three months later Blair was back in Cork to meet Br. Burke and the superior of the Christian Brothers, this time accompanied by Plunkett and Gill. There they witnessed the instruction at first hand.

When the organisation of the Cork Exhibition was in its developmental phase, the then mayor of Cork went to the Department and obtained a grant of £5,000 towards the cost of hosting it. According to Kelleher, the Exhibition Committee provided an area for Br. Burke to organise a school display. However, when the Department realised that Br. Burke was involved they persuaded him to join with them in demonstrating the Department's new experimental science course. This was readily agreed to by Br. Burke as the Department's science instruction was being promoted as being heuristic, in that emphasis was placed on the practical work being carried out by the pupils in properly equipped school laboratories.

---

[57] Kelleher, D. V. *Br. James Dominic Burke a pioneer in Irish Education.* Ph. D. thesis N. U. I. Maynooth, 1977, pp. 386-87.
[58] Kelleher, D. V. *Br James Dominic Burke a pioneer in Irish Education.* Irish Academic Press 1988, p. 70.
[59] Ibid., p. 140.
[60] Ibid., p. 141.

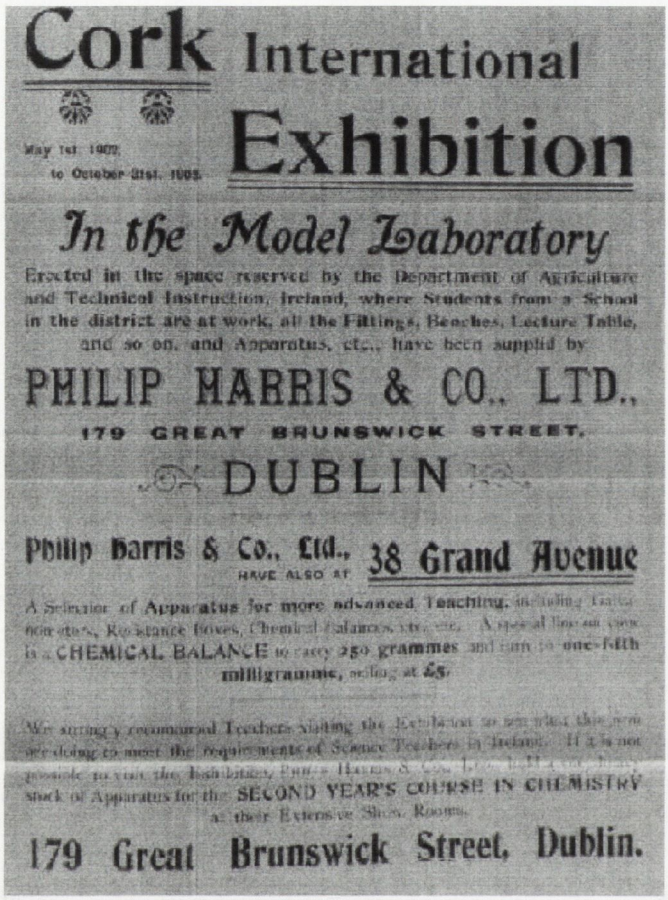

Plate 13. Advertisement for the DATI's 'model laboratory' at the Cork Exhibition of 1902.

> The new Department had no connection with the national schools as they had their own board and it was resolved to have the technical side of secondary education, namely drawing, physical science, chemistry and manual work '...as largely illustrated as possible'. Br. Burke and his classes showed the teachers, students and educationalists how the new programmes were to be carried out.[61]

The esteem with which the Department held Br. Burke was evident when speaking in his address to the Council of Agriculture in 1904 Plunkett made reference to the recent death of Br. Burke;

> '...this great educationist is well known to have been one of the pioneers of science education in Ireland. His was one of the three or four schools which possessed a laboratory before the Department came into existence, and it was the first school to welcome the Department's co-operation in practical education. At the Cork Exhibition many thought that by far the most interesting exhibit was that conducted by Brother Burke and his pupils with the sole object of assisting the Department to popularise certain educational methods in which he made us feel that we were largely following the lead which he had given us'.[62]

Upwards of £25,000 was disbursed by the Department towards achieving this at the Exhibition. The fact that almost 100,000 representatives of '...the classes for whose training and enlightenment we were most concerned, came in organised parties, under the auspices of the Department, from all parts of Ireland'[63], would appear to justify this expense. By 1903 Plunkett felt confident that the Department would no longer have to argue the this type of education had to precede or at least go hand in hand with industrial development,

> ...it has enabled the country to understand the purpose, aims, and methods of the Department, and thus advance its work more effectively and quickly than any other means could have done. Not the least useful consequence of this object-lesson on a large scale is that, while stimulating interest and enterprise in the work of developing our industrial resources, and of establishing an enlightened system of practical education, it will, by making better understood the difficulties and the nature of such a task, help the people to realise that it is one which

[61] Ibid., p. 143.
[62] Plunkett, H. Address to the Council of Agriculture, 1904, p. 607.
[63] Ibid., p. 608.

> cannot be accomplished in a moment, or without toil, but which will call, on their part, for patience, thought, and sustained resolution.[64]

Clune argues that the strategy of the Department to initiate rather than facilitate, which the Science and Art Department had done previously, set the new Department apart from anything the country had yet seen.

5.8 The provision of suitable teacher training

One of the most pressing problems the Department encountered was the lack of teachers trained in the art of technical instruction. This was due to the fact that technical education in Ireland prior to this was so underdeveloped. Two options were available, to import these instructors from outside the country or to devise some means of training teachers at home. The Department chose the latter option by establishing a course of training over two months, July and August of 1901. This continued annually until the demise of the Board of Technical Instruction in 1922.

By 1902 the Royal College of Science had began to instruct its students in 'matters industrial'. To this end, scholarships were offered to enable teachers of science and technical subjects to be trained, and students of the college '...to obtain instruction in the industrial application of Science'.[65] It would appear that the construction of a new college was pivotal in the success of this scheme. The premises then occupied by the college was considered to be 'notoriously inadequate'; however the reorganisation was embarked upon. The initial aim of the Department was to elevate the Royal College of Science in stature:

> Through the close connection between the Department and the Secondary Schools, on the one hand, and chiefly by means of Scholarships, and the short summer courses for teachers on the other, the Royal College of Science has become much more widely known, and its work is, at length, being appreciated.[66]

The building of a '...new and extensive elementary laboratory' for the Albert Agricultural College was begun, and was completed in 1903. Throughout most of the country there appeared to be, in general, a great demand for the type of instruction on offer. The only factors which threatened the progress early

---

[64] D.A.T.I. 2nd annual general report 1902, pp. 13-14.
[65] Ibid., p. 22.
[66] Ibid., p. 15.

on were teacher shortage and a lack of funds. By 1903 the Department's Annual Report indicates that the situation with regard to the shortage of qualified teachers had eased:

> The teacher difficulty has thus to some extent been diminished in intensity, but, in its different aspects, educational and practical, this question will continue for some time to come to be one of the chief pre-occupations of the Department.[67]

The figures, shown in table 5.3 for those attending the summer courses annually reflect the keenness with which practising teachers felt to become a part of this innovation. The figures demonstrate the trend of increased numbers up to 1905-06 in order to satisfy demand, followed by a levelling off as this demand was met.

Table 5.3 Number of students attending summer courses of instruction for teachers.[68]

Year	Number of students	Year	Number of students
1901	276	1906	789
1902	455	1907	737
1903	643	1908	689
1904	813	1909	622
1905	838	1910	621

5.9 Continued progress of technical education

As already stated in section 5.5, the £55,000 which the Treasury granted to the Department was divided into two portions. One portion was divided, in proportion to their respective populations, among the six county boroughs. This was to be used by them on the various schemes of technical instruction approved by the Department. The other portion was allocated for the purposes of technical instruction in other parts of the country. The Department together with the Board of Technical Instruction agreed to this allocation: £25,000 was set aside for technical instruction in the county boroughs, and £30,000 for technical instruction outside these boroughs and the collection of information which would be helpful in setting up the schemes. £3,000 of the latter amount was allocated towards such schemes as senior scholarships, examinations and the training of teachers. Monies allocated towards non-county

[67] D.A.T.I. 3rd annual general report 1903, p. 12.
[68] Fletcher, G. *A Decade of Technical Instruction in Ireland.* Department of Agriculture and Technical Instruction Journal, Vol. XII. Dublin: Browne & Nolan, 1911-12.

schemes unspent at the end of the first year was to be used in the form of grants for apparatus and equipment. This was to emphasise co-ordination between the existing education system and the new system of technical instruction. Because the transfer of the Science and Art Grant was not made until 1st April, 1901, it was necessary to provide the much needed funds at such a critical stage.[69] This transfer of the Science and Art Grant placed considerable responsibility on the Department, as the annual expenditure under the previous grant system had been much less in financial terms.

During the financial year ended the 31st March, 1901, the grants for science and art purposes in Ireland were as under:-

For science and art schools and classes, ... £3,840

For elementary drawing, ... £1,090

And the grants in aid of technical instruction

Under the Act of 1889 amounted to, ... £3,044 [70]

The Department was guided by the principle that the Science and Art Grant together with the £55,000 allocated by the treasury and other monies which might accrue from other sources such as the Agricultural Board, would be used for the advancement of a system of technical instruction in the country. Added to this was the power of raising a rate of one penny in the pound that was conferred on the local authorities in 1898[71]. The county, county borough and urban district councils were assigned the task of administering the Department's grants for the benefit of technical instruction.[72] The main aim of this instruction was '...to give a training in those principles which govern industrial processes, and which determine the conditions of commerce and influence its flow.'[73] In order to accomplish this, the instruction assumed two main forms. Instruction of a general nature and instruction that had a more direct bearing on specific industries the former which included the teaching of practical science. The form of this instruction was to be educational '...it concerns itself with the development of practical intelligence, of the intelligent disposition'[74]. The Secondary schools were also seen as the chief contributors towards the efficient working of a national system of technical education.

A real problem which existed in Ireland at this particular time in its history, was the fact that outside the main cities there was very little industrial infrastructure in place:

---

[69] D.A.T.I. 1st annual general report 1900, pp. 51-53
[70] Ibid., p.52.
[71] Fletcher, G. *A decade of technical instruction in Ireland,* p. 307
[72] Ibid., p. 307
[73] D.A.T.I. 1st annual general report 1900, p. 53

> It is no reproach to those who are engaged in the work of education in Ireland that there was no system of technical education worthy the name up to the beginning of the present century... outside the large cities there was little except the Science and Art classes held in a number of centres under the South Kensington authorities.[75]

Consequently the Department approached the setting up of technical schemes in these areas with great deliberation:

> It will be seen that this is a large and complex problem, and that the preliminary steps towards solving it must be slow and carefully measured, if permanent, and not a specious and ephemeral success, is to be secured.[76]

In both England and Scotland where a better system of science and art instruction had been administered for many years prior to the setting up of a system of technical instruction, and where industrial development had been more widespread, progress had been slow. The Department's cautious approach was based on the premise that it was not just attempting to establish a system of technical instruction which would dovetail into and supplement the work of existing workshops and factories, but was '...establishing a system in a country in which there is a general absence of manufacturers.'[77] Added to the problem was the fact that both the county and urban councils were also quite new to their tasks, having only just completed their first year in office.

It was essential that the Department gained the support of the local authorities in order to implement its policy countrywide. As detailed in section 5.4 a pamphlet was printed and distributed entitled 'Suggestions', and this was followed by a memorandum which detailed their power and the procedure which the Department would like followed. Meetings were held between these authorities and representatives of the Department which provided further explanation such as funding and other related matters. In most of the cases the Department suggested schemes which it considered after surveying local conditions and facilities, and these with some slight modifications were accepted by the local authorities in question. Much of the first year of the Department's work was therefore involved in these meetings and negotiations. The six county boroughs were given priority and it was there, apart from Dublin, that most of the advances were made in the first few years of the scheme. Belfast formed a Technical Instruction Committee very soon after the establishment of the Department. Fifteen of the

---

[74] Ibid., p. 55.
[75] Fletcher, G. *A decade of technical instruction in Ireland,* p. 304
[76] D.A.T.I. 1st annual general report 1900, p. 54

twenty-one members were members of the Corporation. In addition two consultative committees were formed, one of manufacturers the other, educationists. Their role was to advise the Technical Instruction Committee. As a result of several conferences between the Department and the Technical Instruction Committee, a scheme was proposed and approved. Part of the scheme included the construction of a Central Municipal Technical Institute at an estimated cost of £71,000.[78] This money was raised on loan by the Corporation, and constituted part of the local contributions to the scheme. Before the building was even begun, a principal was sought. Mr. Forth who had been principal assistant in the Manchester Technical Institute was appointed, with the Department's approval. Belfast was in a better position than most of the other five boroughs, as some infrastructure of industry existed. Consequently the main emphasis of the scheme was directed towards the needs of the industries and trades of the city which existed, with some time devoted to instruction and knowledge which might result in the creation of new industries. Courses in Science and Technology to both sexes were provided with evening courses also on offer. Subjects provided included Mathematics, Mechanical Engineering, Applied Chemistry, and Naval Architecture. To provide a suitable intake of pupils, the committee,

> ...gradually induced and enabled the various teaching institutions of the borough to take their proper place in the general scheme. The coming session will see an organised system of instruction at work in various schools in different parts of the city.[79]

The committee also allocated £1,900 of the first year's grant to day secondary schools in order to purchase equipment and apparatus to alleviate any difficulties they might have in following the Department's new regulations and programme.

In Cork a similar pattern of organisation unfolded and a central Municipal Technical School was proposed. Like the work in Belfast, co-ordination was sought between the existing institutions and the committee. Cork had an added advantage in that it possessed the Crawford Municipal Technical Schools; these schools had been presented as a gift to the city of Cork by Mr. W. H. Crawford in 1884, and science and technology rooms were available in some of them.

It was up to the Technical Instruction Committee to look into the best ways in which further accommodation might be provided for the proposed central Technical Institute. As in Belfast the

---

[77] Ibid., p. 55
[78] Ibid., p. 56.
[79] Ibid., pp. 56-57

Municipal Council appointed a Head Science Master. The same procedure that was employed for Mr. Forth's appointment was followed here, and the result was the employment of Mr. O'Keeffe. This man was a technology teacher and had worked in Finsbury Technical College, London. Although it has not been possible to ascertain a direct link with Armstrong, it is almost certain that their paths would have crossed. Both Forth's and O'Keeffe's appointments were approved by the Department, which kept a close eye on the events as they developed according to its scheme. £1,600 from the first year's grant was disbursed to different secondary schools in the area with the same aim as that in Belfast.

The same could not be said for the borough of Limerick, where more hesitant deliberations meant that no proper scheme was approved by the Department in the first year. The scheme proposed for Waterford City involved building a central Municipal Technical School and the allocation of grants to four secondary schools in the city for purchasing apparatus and equipment. Until such time as the new technical school was built, temporary arrangements were made to occupy the School of Art.

The construction of a technical institute was foremost on the minds of the member of the County Borough of Waterford Technical Instruction Institute. A site was purchased in May 1904. The monies required to buy the site came from two sources, grant money the committee already had and a loan from the National Bank.[80] By the following February plans for the new building were agreed upon and the initial cost was put at £4,000.

The large urban centres were the next priority of the Department. On its advice deputations were sent to visit definite locations in England and Scotland with a view to observing schemes of technical instruction in operation there. Several trips were made by the various committees, and technical schools in many varied parts of both England and Scotland were visited. In some centres, as for the county boroughs, where specific buildings were lacking, temporary arrangements were made to house technical classes. For example, in Wexford such classes commenced in September 1901 in the Town Hall. The scheme for Athlone provided an interesting insight into alternative ways of raising rates in order to fund proceedings. A local whiskey manufacturer supplemented the grant made by the Urban District Council by £500, with an annual sum of £150. The scheme provided for day and evening instruction in Science, Drawing and manual work in the existing schools. The local Marist Fathers assisted in establishing a technical school where woodcarving, furniture making and other industrial subjects were taught.

---

[80] D.A.T.I. Journal Vol. VIII, 1907-08, p. 13

In the counties, which in many cases also came under the Agricultural Board, the monies available from the Board of Technical Instruction were less. Nonetheless the Department was more concerned that both these agencies would work in close co-ordination with one another. Whilst this slowed progress generally, some regions made great strides. In Nenagh and Thurles the Christian Brothers' Schools introduced '...the teaching of Practical Science, Drawing, and Manual Instruction, and of Technical Subjects suited to the local trade.'[81]

By 1904 good technical instruction was available in the Urban Technical Schools which had been set up. This occurred in spite of the eagerness shown in striking a rate and the provision of suitable locations. The figures detailed in the Department's 1904 – 05 Annual Report for payments made by the Department to Local Technical Instruction Committees apart from the County Boroughs show this.

Table 5.4 Payments made by the Department to Local Technical Institution Committees, 1901 to 1905.[82]

Year	Payments made by the Department
1901-02	£6,537
1902-03	£20,860
1903-04	£26,593
1904-05	£29,389

From this year onwards the progress reported in the Department's annual report was described as one might describe a schoolboy's adequate progress, that is, 'satisfactory':

> There are now few places large enough to maintain a technical school in which one has not yet been established, and in the case of the urban centres development must now consist in the provision of suitable permanent buildings, in rendering the instruction increasingly efficient, in bringing it more completely in relation with industrial needs, in interesting, as far as may be, employers of labour with the work of the school, and in prolonging the period during which students remain at the schools.[83]

In the country areas the availability of suitable premises was a concern that was expressed as a desire to establish permanent centres and an extension of the courses of instruction. Another was the lack of

[81] D.A.T.I. 1st annual general report 1900, p. 62.
[82] D.A.T.I. 5th annual general report 1905, p. 56.
[83] D.A.T.I. 6th annual general report 1906, p. 65.

teachers, with funding problems preventing more from being employed. It would appear from some of these reports that the rapid advance made by the Department had been too rapid and the supply lines had become stretched beyond elastic limit:

> The scope of the instruction has unfortunately, been limited by the want of an adequate building. The absence of laboratories and workshops has severely restricted the teaching of Science and Technology.[84]

The situation in Limerick reflected the problems created due to the increased numbers of students registering for technical classes:

> The increasing demand for instruction induced the Committee to provide additional accommodation for classes by taking over another house adjoining the Central School, but classes are still distributed over five buildings in different parts of the city. Many of the rooms are unsuitable...[85]

Speaking in Manchester at the Irish Technical Instruction Association Congress in 1911, George Fletcher looked back at the first ten years of technical instruction in the country. He said:

> Every county in Ireland has now a scheme of Technical Instruction adapted more and more to its needs in successive years, while almost every town has its technical school where the attendance of students and efficiency of instruction will be found to bear comparison with more favoured countries.[86]

He did, however, make reference to the shortage of funds available for the provision of buildings:

> I do not know why it was that while the Act of 1899 provided an annual sum for maintaining or helping to maintain a system of technical education, no financial provision was made for providing buildings in which such a system could be carried out. This defect was not felt for several years.[87]

All manner of buildings were brought into use in the initial years; for example, fever hospitals, disused jails and disused chapels were employed, and the organisation of technical instruction under local authorities proceeded apace:

---

[84] Ibid., p. 68.
[85] Ibid., p. 69.
[86] Fletcher, G. *A decade of technical of technical instruction in Ireland,* p. 304.
[87] Ibid., p. 307.

> The progress of schemes of technical instruction under local authorities... has continued satisfactory. There are now few places large enough to maintain a technical school in which one has not yet been established...[88]

Whilst this statement in the 1905-06 DATI Report may appear to herald triumph, the reality was not as simple. In the urban areas suitable permanent locations were not easily obtained and the provision of suitably qualified teachers problematic. In county areas suitable premises were in even shorter supply, and coupled with the teacher shortage owing to lack of funds, the extension of the certain courses was greatly restricted. In spite of these problems the numbers attending technical classes showed a steady increase.

The Department's scheme of technical instruction in the North was making progress, and the figures make this point admirably as can be seen from table 5.5 that gives the numbers attending technical schools there.

Table 5.5 Numbers attending technical schools in the environs around Belfast 1905[89]

Town	Local Population	No. attending technical school
Ballymena	11,000	488
Coleraine	7,000	324
Dungannon	3,700	188
Larne	7,000	236
Lurgan	12,000	454
Portadown	10,000	246

Fletcher was keen to stress that the Department's concern was not about increasing numbers but rather providing quality schemes of education. With regard to the rural schemes the figures he gave reflect impressive progress:

> There are at work under local schemes in Ireland about 100 fully trained teachers of domestic economy, chiefly engaged in connection with itinerant courses. There are also some 80 manual instructors.[90]

---

[88] D.A.T.I. 6th annual general report 1906, p. 65.
[89] D.A.T.I. Journal
[90] Fletcher, G. *A decade of technical instruction in Ireland,* p. 310.

Interestingly, he also made reference to a success story in County Kilkenny where a course of work in woodwork, was followed by special summer courses for young tradesmen. A guild was formed which resulted in a furniture company being set up. This story was mirrored in Naas, with the establishment of a carpet factory, and in many other centres. Any opportunity to exhibit the work of technical instruction was taken. The Irish International Exhibition contained a Home Industries Section which provided more evidence of the progress that was been made.

Speaking in 1907 at the Association of Technical Institutions, Belfast Summer Meeting in July under the title *The Organisation and Position of Technical Education in Ireland*, George Fletcher outlined the progress made by the Department. He made special reference to the South Kensington branch of the Board of Education and the fact that their regulations were 'not suited to Irish conditions'.[91] The scheme which the Department had initiated was grant based, the amount decided by the Department on the basis of the work carried out, details of which Fletcher himself reiterated:

> The grant is based upon the amount and character of the work done and in respect of pupils having such a general elementary education as would enable them to take advantage of the instruction.[92]

Experimental science was one of the many subjects offered. To encourage continuity of work, an increment grant was offered for continued attendance. Efficiency, or even lack of it, on the part of the school meant that this grant could be increased or decreased based upon an inspector's report.

The figures contained in tables 5.6 and 5.7 for these early years reflect strongly the quick uptake of the Department's programme. Table 5.6 detailing the numbers of men and women attending technical schools for 1908-09.

Table 5.6 Total number of students under the scheme 1908-09[93]

	Leinster	Munster	Ulster	Connaught	Totals
Total number of students.	10,581	11,804	15,155	4,126	41,666
Corresponding numbers for 1907-08	11,419	11,782	13,954	4,087	41,242

[91] Fletcher, G. *The organisation and position of technical instruction in Ireland,* p. 5.
[92] Ibid., p. 5.
[93] Fletcher, G. A *decade of technical instruction in Ireland,* p. 314.

Table 5.7 Number of students attending schools and classes working in connection with the D.A.T.I[94]

Session	Day Secondary Schools	Technical Schools and Classes
1900-01	Figure not available	Figure not available
1901-02	6,615	Figure not available
1902-03	7,279	29,513
1903-04	10,350	39,398
1904-05	12,178	40,345
1905-06	14,018	43,520
1906-07	14,163	44,458
1907-08	14,724	41,242
1908-09	15,034	41,666
1909-10	15,003	42,909

Table 5.8 Amount of Attendance Grants paid in respect of instruction in Science, Art etc.,[95]

Session	Day Secondary Schools	Technical Schools	Total
1900-01	£2,366	£2,819	£5,185
1901-02	£9,575	£3,026	£12,601
1902-03	£12,808	£3,171	£15,979
1903-04	£16,144	£3,812	£19,957
1904-05	£19,417	£4,256	£23,674
1905-06	£21,992	£4,423	£26,415
1906-07	£25,163*	£12,057*	£37,221*
1907-08	£26,725	£15,040	£41,765
1908-09	£27,468	£18,224	£45,692
1909-10	£27,584	£21,527	£49,110
1910-11	£28,000 (projected)	£27,000 (projected)	£55,000 (projected)

* This increase was due to the revised system of payments. Figures are rounded to the nearest pound.

[94] Appendix to the 1911 – 12 D.A.T.I. Journal, p. 314.
[95] Ibid., p. 314.

The numbers of students show a steady increase each year up to 1906-07 when a levelling out occurred, as demand was satisfied, figures for this are shown in table 5.3, in section 5.8. The scale of investment in the Day Secondary Schools also shows how important the Department saw the role of proper practical science instruction at this level.

5.10 Progress from 1910-1920

By 1910 the number of schools participating under the Department's scheme had reached a plateau.

It was now recognised that for greater efficiency in the Special Course, greater success had to be achieved in the Introductory Course. Time spent by the teacher on going over the basics in Arithmetic and English was eating into the time allocated for practical science work. Regular and prolonged attendance at technical classes had always been a problem, one which threatened the continuity of schemes, and so, as already mentioned on page 122, the Department responded by introducing the administration of another grant called the "increment grant". Entrance examinations were also established which permitted a judgement to be made of the abilities of the pupils. The teaching of the 'advanced courses' was running into difficulty with respect to the standard of teachers available, and it became clear that more highly qualified persons would be required for the scheme to continue satisfactorily. Grants available to schools offering such courses were higher in monetary value than the more regular courses. By 1913 the DATI had instituted its own examinations. Table 5.9 provides detail on the progress of science instruction in the secondary schools over two separate periods, 1907 – 08 and 1910 – 11.

Table 5.9 Growth of the work in Secondary Schools 1907-08 and 1910-11[96] (Grant monies rounded to nearest pound)

Province and year	No. of schools	No. of pupils who have worked through the course of instruction					Total amount of Grants earned
		Prelim course 1st Yr.	Prelim course 2nd Yr.	Special course 3rd Yr.	Special course 4th Yr.	Totals	Pounds
Leinster							
1907 – 08	111	2,406	1,721	799	246	5,136	9,951
1910 – 11	108	2,541	1,661	1,077	235	5,411	10,575
Munster							
1907 - 08	82	1,905	1,285	619	128	3,924	7,286
1910 – 11	82	1,794	1,194	711	149	3,821	7,186
Ulster							
1907 – 08	77	1,520	1,103	491	119	3,211	7,676
1910 – 11	79	1,476	1,191	569	140	3,362	8,406
Connaught	19						
1907 - 08		382	276	150	38	844	1,810
1910 - 11	16	360	243	142	30	773	1,786
Totals							
1907 - 08	289	6,213	4,385	2,059	531	13,115	26,725
1910 – 11	285	6,171	4,289	2,499	554	13,367	27,955

From 1912 onwards, with the establishment of a scheme of instruction in Experimental Science, the Department could now turn its attentions to similar endeavours in Technical Education.

In the technical schools progress was made by establishing a "Course" system. Under this new system courses of instruction would extend over a four-year period in a limited number of branches of technical knowledge. Initially it was proposed that examinations would be provided in the following

[96] D.A.T.I. 12th annual general report 1912, p. 105.

fields: - Applied Chemistry, Art, Building Trades, Commerce, Domestic Economy, Electrical and Mechanical Engineering.

The various Technical Instruction Committees of the Urban Centres, in full co-operation with the Department, began to frame courses which were suited to their localities. By 1912, 91 of the 96 Urban Districts had schemes of instruction in operation. No fewer than 45,341 pupils were enrolled under these schemes and it was felt that this represented a watershed in terms of pupil numbers. In fact, one of the criteria employed to gauge the success of these schemes was the establishment of permanent buildings by the local authorities. The Department realised the importance of cultivating a closer and more vital relationship between the Technical Schools and employers of labour. Certainly the climate was changing in this regard. During the early years the technical schools and their associated schemes of work were viewed with a degree of apathy, but as Technical Instruction began to establish itself strongly throughout the country, employers began to reconsider their initial scepticism.

> A marked change has in recent years appeared in the attitude of employers towards the work of the Technical schools. This change manifests itself in the encouragement now given to the work. In some cases employers pay the fees of their employees, in others they grant facilities for attendance at day classes, in others they increase the wages or shorten the period of apprenticeship in recognition of regular attendance and proved progress.[97]

The challenge for the Department was now to provide the best form of Technical Education possible, and this endeavour fell into two main areas. One, the work of Technical Schools and the other, "Itinerant" and other modes of instruction in rural areas. In the Technical Schools a new system of examinations was established, and whilst they had no bearing on the awarding of grants, the uptake was considerable. These examinations were intended to compliment the course system. However, the work in the rural areas tended to include the following subjects: Domestic Economy including Cookery, Laundry-work, Home Sewing, House-wifery, and Hygiene and Home Nursing; Manual Instruction in Wood (including Drawing) Lace and Crochet Making, Sprigging and Embroidery, Machine Knitting, and other forms of home industry. Science subjects did not feature. The success of Technical Schools in small rural centres never achieved the status compared with other areas, and taxed the minds of the most determined officers of the Department throughout its working period.[98]

---

[97] D.A.T.I. 13th annual general report 1913, p. 117.
[98] Ibid., pp. 102-102.

It was now realised initially that filling classes was not a huge problem, maintaining the numbers over the years was. Up to 75% of those enrolling in year one were leaving before year four. Part of the problem as it was perceived by the Department was '...due to the absence of the industrial atmosphere that characterises and encourages the efforts of technical educators in other countries. A youth not unnaturally seeks to know how he can apply the knowledge he acquires in the Technical School.'[99] Other reasons given for absenteeism in the country and urban schemes were,

> ...since April comes at the end of the session, and the lengthening days prove attractive to town students for outdoor games and recreation, while July is a busy month in the fields, and the rural students are too busily employed in haymaking and other farming operations to give time for technical instruction.[100]

The connection between the national schools and the technical schools, which was hoped to be a strong source of potential talent, was suffering from a number of defects that hindered the progress the technical schools had hoped to make. As those interested in extending and developing technical instruction in the country soon discovered, a major flaw in the system existed. Those pupils who were going straight from the national schools into technical education at age fourteen had a deficiency; this was the fact that, whilst they emerged from their primary education fairly well in most subjects, they showed a poor grasp of the most elementary instruction in the three Rs. Some even criticised the small amount of elementary science they had been exposed to. The immediate effect of this was evidenced in the fact that hundreds of pupils who '...presented themselves at the doors of the technical institutions were unable to read and write and work simple sums in arithmetic'.[101] In short, they had not been adequately prepared by the National schools for the next stage of their development, that of technical training. This left the technical instructors with more work to do – to fill the gaps that the national teachers had failed to do. In short, precious time which was necessary to engage the students in heuristic methods of science in the technical schools was lost teaching the rudiments of elementary science and mathematics.[102] The Irish School Monthly was critical of the elementary science programme whose organisation was under that of William Mayhowe Heller:

> It is now two years and a half since the training of teachers in elementary science was commenced by Mr. Heller and his assistants, and it appears from what we can see at present

---

[99] D.A.T.I. 14th annual general report 1914, p. 107.
[100] Ibid., p. 113.
[101] *Irish Educational Review*. Vol. VII, No.1, 1913, p. 631,

that very few pupils of ordinary national schools will acquire that experience of scientific methods which the technical schools are intended to develop.[103]

Many students found themselves at the age of 15 or 16 back in the very same menial jobs they thought they had left behind years ago. One of the questions appeared to be, what to do with the pupil between the age of fourteen on leaving the national school system and the age at which they could advance to technical instruction?[104] The establishment of higher grade schools was proposed as a means of allowing the pupils to remain on in elementary education until fourteen or fifteen thus bridging the gap between the national and technical schools. These would be run by the local committees that were seen to be doing a good job in providing technical education around the country.

Another factor which was impeding progress was that of irregular attendance at national school level. In 1913 out of 699,000 pupils on the rolls, 200,000 or 29% were absent on a daily basis nationally.[105] The Department felt the effect of the outbreak of The Great War in many ways. For example, a substantial number of its central staff and some of the teaching staffs of local institutions left their positions to 'serve with the Colours'. On the other hand, the attendance of students at the Technical Schools and Classes under the Department showed very little variation during the war, mainly due to the fact that most of them were not of military age. Of the student population of 45,930, more than half was female. The same could be said of the Intermediate schools. By far the most serious effect of the War was the almost total curtailment of building projects which were sorely needed. This situation did not improve for the remainder of the Department's life, for the cost of building soared following armistice, and even structural improvement proved difficult to finance. (Evidence for this can be found in Chapter 7 that describes the progress of science instruction at King's Hospital School). However, the numbers enrolled remained high, as the following figures attest: 14,095 students were enrolled for the year 1915-16 with more than £29,000 disbursed by the Department, and this was improved upon for 1916-17 with 14,167 students and nearly £30,000 paid out[106].

A revised programme was introduced by the Department in March 1918. It came about at the request of school managers who wished to see a greater uniformity in the results achieved in the schools generally

---

[102] *Irish Educational Review*. Vol. III, No.9, May 1903, p. 296.
[103] *Irish School Monthly*. Vol. III, No.9, May 1903, p. 296.
[104] *Irish Educational Review*. Vol. VII, No.1, 1903, p. 631.
[105] Ibid., p. 632.
[106] D.A.T.I. 18th annual general report 1918, p. 100

after a four years' course in Science, and also to enable them to classify their pupils in accordance with the grades of the Intermediate Education Board's Programme. This involved,

(i) the elimination of Experimental Science as an obligatory subject in the First Year;

(ii) the abolition of Special Courses, and the substitution of general courses in Physical Science and Natural Science;

(iii) the correlation of the courses with the grades of the Intermediate Programme.

The idea behind this revision was to, '...obviate the undesirable breaking-up of classes caused by a want of correspondence between the Grades of the Intermediate Education Board and the Years of Courses of the Department's Programme.'[107]

Another problem which was hoped to be alleviated by the introduction of this revised programme was the fact that for years the introduction of a successful course in manual instruction had eluded the Department. This particular subject had quite considerable bearing on preparing students for an industrial career, and therefore considerable disquiet was expressed by the authorities with respect to the poor uptake. Now Experimental Science was no longer obligatory in the first year (preparatory grade) and its place was taken by either manual instruction or domestic economy. The science syllabus was now open to modification by the individual teacher, and emphasis was placed upon originality and the creation of interest amongst the students working under it.

A further development was the introduction of the day trade preparatory schools in 1909. These were seen as a link between the national school and employment, as the education they provided lay between general and industrial. In the year 1918-19 the Department paid grants amounting to £69,304 for 37,241 pupils in technical schools and classes.[108] Despite all its apparent gains, the plight of technical education was sealed by a number of factors amongst which was the public perception that it was far inferior to white collar training and that some craft workers opposed the development of craft teaching in the fear that such an extension might affect employment prospects.[109] Yet despite all this technical education made considerable progress and an infrastructure was laid which was capable of great development.[110]

---

[107] Ibid., p. 100.
[108] Coolahan, J. *Irish Education – Its History and Structure.* Naas, Co. Kildare: Leinster Leader, 1981, p. 91.
[109] Ibid., p. 92.
[110] Ibid., p. 92.

At a special meeting of the Board of Technical Instruction at the offices of the Department in Upper Merrion Street, on 18th December 1919, after T.P. Gill had explained the terms of the new Irish Education Bill as it affected the position of technical education, the Board drew up a statement to submit to the Government. It contained the following paragraph:

> We observe with the greatest regret and alarm that the Bill proposes to remove Technical Instruction from the care of the Department of Agriculture and Technical Instruction, of the Board of Technical Instruction, which it abolishes, throughout the country, through which latter bodies the local administration of the schemes approved by the Department and by this Board is effected. The Board are of opinion that the Department of Agriculture and Technical Instruction, in so far as it has carried on the work of technical instruction, had been the most successful Department ever set up in Ireland.[111]

5.11 Progress after 1920

The Government of Ireland in 1920 effectively dismembered the DATI. The Board of Technical Education was abolished and technical education in the Irish Free State came under the control of the Department of Agriculture in 1922. (The Department of Education eventually took over technical education in the country when it was established in 1924.)

It would appear from the annual reports that experimental science was beginning to wane. The freedom which was given to enable syllabus-creation by teachers involved in Science instruction for the first or Preparatory grade year, and which the Department thought would stimulate interest and enthusiasm in the pupils, with no fear of an examination, did not produce the results expected. In only a few instances were syllabuses created which justified the scheme; in the majority of cases teachers showed a marked lack of imagination themselves. Only those teachers who had a wider experience and training were able to rise to the challenge. Consequently, the scheme was a failure, and as the years ran out there was not enough time to improve upon it. In the last few annual reports of the Department the number of references to science instruction diminishes.

Describing the work of the Department in a speech in March 1921, Hugh Barrie, Vice-President of the Council of Agriculture, gave a very brief synopsis of the workings of the Department. This was at the last meeting prior to the coming into operation of the Government of Ireland Act of 1920, and both Gill

---

[111] Minutes of the 58th (Special) Meeting of the Board of Technical Instruction. December 1919, p. 176.

and Fletcher were present. Barrie outlined the difficulties that were being experienced in technical schools maintaining their high attendance rates due to the 'existing circumstances'. The result of the lower attendance meant that the finances of technical instruction were affected greatly. He reiterated the areas in which the Department still functioned: the summer courses for the training of both secondary and technical school teachers, the scholarship schemes, the co-operation which still existed between both the Intermediate Education Board and the National Education Board. The rural science scheme which was at this stage proceeding well amongst the National schools was due mainly to the support of the Department, and the connection with the Royal College of Science appeared to be as strong as ever, evident in its rolls. Representing Leinster on the Council, and a founder member of the Department, Mr. William Field reflected the mood of the proceedings when he proposed a toast:

> We express the earnest hope that under the new state of affairs the friendly unity of this Council, which unity has been so marked a feature of all the Department's system, may be, by some means, preserved.[112]

In the 1922-23 report there is no mention of science in relation to the secondary schools. The Government of Ireland Act had removed the control of technical education in Northern Ireland to the new government established there under the Act. It would appear that the original work which had been established by the Department of Agriculture and Technical Instruction continued for, an examination was held on 17th June, 1922 in the 'Principles, Methods, and History of Education', for '...persons who have been provisionally recognised as Teachers of Experimental Science'.[113] The syllabus of examination contained the following:

> The general nature of the Inductive and Deductive processes... the functions and relations of laboratory work and class teaching... use of note-books and text-books in Science teaching: methods of recording and treating observational data... the construction of apparatus... Laboratory organisation and management.[114]

There was a Dail debate on technical education in December 1923 during which it was proposed that technical and vocational training be withdrawn from the Ministry of Education and have it placed under the Ministry of Industry and Commerce. During the debate several points were raised about the state of technical education in the country. Major Brian Cooper said that,

---

[112] Minutes of the 38th meeting of the Council of Agriculture. May 1921, p. 20.
[113] Department of Agriculture and Technical Instruction for Ireland, Form S. 255, p. 1.
[114] Ibid., p. 1.

> ...in spite of the devoted work done by very able men, technical education was not in a satisfactory state in this country. It was started on the wrong lines and tended to produce a smattering of knowledge.[115]

Mr. Good in replying stated that the reasons that those engaged in technical education assign for its failure,

> ... for it has been a failure in Ireland, is the low standard of primary education in Ireland. Owing to this low standard of primary education, boys and girls coming from primary schools are unable to pass the simple qualifying examination for entrance into technical schools.[116]

The overall result of this was that whilst the technical schools were more than adequate not only in the cities but also elsewhere in the country, they were virtually empty. This was used as an argument for bringing technical education back under one authority along with the other educational sectors. In opposing this Mr. O'Connell put forward the argument that the lack of co-ordination between the various departments had caused this lack of success on the part of the technical schools.

> It is generally admitted, and anyone who has a practical knowledge of educational matters knows, that education in this country is at a low ebb. One of the principal reasons for that was the want of co-ordination in the past between the various education departments. Education was run in a series of water-tight departments with no relation whatever between one department and another. The result was that there was overlapping, waste of effort, and, on the whole, an absence of the results that should have been obtained under a properly co-ordinated system.[117]

As was the case with national and intermediate education, technical instruction became a branch of the Department of Education on its establishment in 1924, and from June of that year central funds for technical education were to be voted by the Oireachtas.[118] The new Department also took control of the Metropolitan School of Art and the Royal College of Science, though the latter was transferred to UCD in 1926. Monies disbursed to the technical instruction committees in the Irish Free State for the school year 1925-26 amounted to £236,476 (the state contribution was £161,442 and rates and other contributions came to £75,034).[119]

---

[115] *The Irish School Weekly*. Vol. LXXIV, No. 50. December 15th 1923, p. 1300.
[116] Ibid., p. 1300.
[117] Ibid., p. 1300.
[118] Coolahan, p. 92.
[119] Ibid., p. 93.

In the twenty fourth General Report of the D.A.T.I. which covered the period 1923-1926 there were only four lines given to the progress of science instruction in the secondary schools:

> In Science, much sound cultural work was done by certain teachers, but, on the whole, there was a decided tendency to regard this subject as a mere factor in securing a "Pass" in the written examination.[120]

In a mere 25 years the wheel had come full circle, and the innovation brought about by the Department's intervention in bringing practical science education into almost every secondary school in Ireland came to an end.

[120] D.A.T.I. 22nd annual general report 1923-26, p. 133.

Chapter 6

The Department of Agriculture and Technical Instruction's heuristic policy towards Intermediate and Technical school science instruction

6.1 Introduction

On the 12th September 1902 the Vice-President of the Department of Agriculture and Technical Instruction, Sir Horace Plunkett, was due to deliver a paper in Belfast to the newly formed Section L, (Educational Science) of the British Association entitled: *Technical Instruction in relation to Industrial Development in Ireland.* Owing to a mix-up of appointments he was unable to speak, and so it fell to the Secretary of the Department, Mr T.P. Gill to deputise for him. Gill, not having much notice to prepare, changed the title of the paper to *Science in Secondary Schools – The Department's Programme*, which he addressed to this section and its president, Professor Henry Edward Armstrong, a name that, as discussed in Chapter 1, was inextricably linked to the heuristic method of science instruction then in vogue in Britain. Section L had been formed in the previous year, mainly due to the driving force of its new president. Proof of Armstrong's stature as a major educationalist at this time is reflected in the fact that he was unanimously elected as its first president.

Why Gill chose to change the original title of the paper from the subject of technical education to encompass the Department's work with the secondary schools cannot be established, the connection between the secondary schools and technical education had already been acknowledged by the Department. Quoting from the Department's educational policy Gill said:

> The primary school, the secondary school, the university, the lower and the higher technical schools must, in our view, all co-operate.[1]

Just the previous day Armstrong himself had addressed the conference, and doubtless there were many representatives of the newly formed Department sitting before him.

---

[1] Gill, T. P. *Science in Secondary Schools: The Department's Programme.* Paper read on 12th September, 1902, at the Meeting of the British Association in Belfast, p. 3.

Now in Belfast he seemed to have chosen to address some of his remarks to these members directly, and intimated the challenges which lay ahead, chief among them the natural aptitude of the Irish towards use of the imaginative powers with respect to education:

> The Irish people have rich powers of imagination such as no other section of the nation possesses: it is only necessary that these powers be trained to considered and balanced action to make the Irish capable of deeds before which the splendid achievements of the past will appear as nothing.[2]

Plunkett used this same sentiment when speaking at the Cork Exhibition in the same year, and after Armstrong had spoken in Belfast:

> Our people are gifted with an imagination and a subtlety of thought which somehow seems instinctively to recoil from the practical. Perhaps then - I throw this out as a deeply interesting Irish problem most relevant to the educational purpose of the Department's section at the Exhibition – the joint efforts of the people's Department and the popular local bodies to develop education on its practical side....[3]

It is quite possible that Plunkett and Armstrong exchanged views on this particular aspect when they met in Belfast. William Mayhowe Heller read a paper entitled: *The Introduction of Practical Instruction into Irish National Schools*. Heller, in his summary also made reference to the necessary connection between primary and technical education in Ireland:

> Practical instruction in the National school is to-day in Ireland, among many educational problems of importance, probably the one of most urgent importance, is that upon its successful introduction depends the future of technical instruction.[4]

Heller's remarks, which mirrored Gill's above, indicated that the Department implemented a common plan aimed at the introduction of technical instruction into the secondary schools. That the Department was intent to do away with 'bookish ways' and replace the teaching of science with a more practical base was asserted by Horace Plunkett in 1902. He stressed the importance of education being practical, when he said:

---

[2] Report of the 1902 Belfast Meeting (72nd) of the British Association. London: John Murray, p. 842.
[3] D.A.T.I. Journal, Vol. X, p. 693.
[4] Report of the 1902 Belfast Meeting, p. 846.

> ...no matter where I start, I always come back to education as the condition precedent of all progress in Ireland. How that word education broadens out when one applies it to the living problems of practical life![5]

In describing the work of the pupils in the model-classrooms set up for the Cork Exhibition, Plunkett also reveals his attitude towards a certain heuristic type of education:

> These lads may be seen unravelling the elementary mysteries of science, preparing to take part with trained hands and observant eyes in the work of a New Ireland.[6]

Towards the end of his paper Gill made probably the strongest reference that any senior official had made up to that time with respect to a connection between the Department's educational schemes and Armstrong's heuristic methodology:

> One word before I close upon the method of teaching this subject – the so-called heuristic method, of which the President of this section is so distinguished an advocate. That, too, I believe, has been attacked – attacked as if it were an innovation or fad... My hope is that the schools, once they get the method into their work at all, will apply it all round so far as possible, even to the making of Latin verse.[7]

In this last sentence, Gill re-echoed Armstrong's very sentiments that the heuristic methodology did not belong to the preserve of science alone but could be applied to any subject if used in the proper context. In his biography of Armstrong, the historian W.H. Brock referred to this aspect of heurism when writing about its progress in the newly built Christ's Hospital in Horsham, (of which Armstrong was then a governor, and continued to be so for forty years):

> The teaching of science in the school was placed on an equal level with religious and literary studies, inevitably it was Armstrong who devised the science syllabus. Later a 'virus heuristicum Armstrongii' spread to other subjects like geography, languages and history.[8]

In his speech Gill emphasised the importance of the Department's view of this system of instruction; a leaning which would be used by opponents of the Department as a stick to beat it with in later years. However, other than Gill's reference to Armstrong's heuristic methodology in the above paper, in only

---

[5] D.A.T.I. Journal, Vol. X, p. 693.
[6] Ibid., p. 695.
[7] Gill, T. P. *Science in Secondary Schools – The Department's Programme*, p. 9.
[8] Brock, W. H. *H. E. Armstrong and the teaching of science, 1880-1930.* London: Cambridge University Press, 1973, p. 31.

one other instance was any direct use made of the word 'heuristic' in any official Department document, and that was in the Department's Prefatory note which laid out its educational policy.

This is in stark contrast to material concerning the system employed by the National Board in elementary science instruction. It would appear that there was a conscious effort on the part of the newly-formed institution to disassociate itself directly with this particular term, even though the schemes proposed and carried out by the technical instruction branch carried all the hallmarks of this so-called 'heurism'. One reference that does come close to defining the Department's approach in its educational policy and heurism, is contained in the minutes of the 6th meeting of the Board of Technical Instruction in August 1901:

> It might be said that the science teaching which the Department favoured was the application of the research method to elementary science instruction.[9]

This was a radical change towards science instruction, and one which outside Br. Burke's science classroom, had never been seen in this country.

In Armstrong's eyes science instruction based on the research mode was close to the core of heurism. He drew attention to his belief that young pupils were always in questioning mode – and that one of the main defects of the school system was that this 'natural spirit of inquiry' was suppressed rather than cultivated and directed. He saw the teacher as

> ... researcher, constantly studying his pupils' idiosyncrasies and devising suitable methods of instruction. Nothing is at a standstill – the young child is constantly exploring, i.e. engaged in research: the habit is only gradually lost at school under our highly developed modern soul-killing system of perpetual lesson learning.[10]

Armstrong was totally opposed to the 'bookish' method of science instruction which had existed under the 'payment by results' scheme, and which had flourished under the Intermediate system of education since 1878.

In contrast, opponents of the Department and its decisions did not shirk from labelling its methodology as heuristic. It is quite possible that the new Department was seeking to dissociate itself from what was being carried out in the science classrooms under the British system. The use of a heuristic

---

[9] Minutes of the 6th Meeting of the Board of Technical Instruction. August 1901, p. 21.

[10] Armstrong, H. E. *The Teaching of Scientific Method and other Papers on Education*. London: Macmillan & Co. Ltd., 1910, p. 7.

methodology in science instruction had many opponents there, and the name was tainted by controversy at this time. Another possibility is that it was endeavouring to project an image to the Irish people which would remove it from being regarded as an extension of the Science and Art Department, whose work it now had a mandate to carry out. It is possible that Plunkett and Gill wanted this new Department to be seen as distinctly Irish, and not just another arm of the British Empire in Ireland. It is certainly unusual during a period of great educational reform in the sciences, and with such a vocal representative as Armstrong, that words specifically associated with matters 'heuristic' were avoided. Gill went on in his Belfast paper to warn against the danger of taking this system of scientific method to extremes, and advocated a balance which another learned educationalist, Br. Burke, had established forty years earlier in Cork. Br. Burke had championed the heuristic method, albeit with modifications, many years prior to the Department's founding, In fact it is my contention that the Department deliberately set out initially to create an adapted form of heurism in science teaching, combining the best of both Armstrong's and Burke's methodologies.

Armstrong's campaign in which he advocated the heuristic method became for many teachers the only way in which a pupil could learn science. The problem was that the method when applied in its strictest sense was time consuming and this was quite a disadvantage in the competition for prizes and exhibitions. Burke could have, like so many, returned to the tried and tested system of memory work and ignored the practical side of the subject. Instead he found common ground between laboratory methods and the necessary bookwork. Consequently according to Kelleher, the Christian Brothers '...avoided the trap of too great a concentration on heurism.'[11] It would also appear that the Brothers, in particular, were ahead of many in their development of a system of science instruction:

> And later in the nineteenth century, when Germany began to lead other European countries in scientific and technical instruction, the Irish Brothers studied their methods. In so doing they were well in advance of other schools in Ireland and Great Britain.[12]

In fact before the Brothers began to print their own science textbooks, they were translating many of those of the European De La Salle Brothers. In this way they were very much focussed on continental methods of science instruction. Many of the Cork Brothers were active members of the Cork Scientific

---

[11] Kelleher, Daniel V. *Br James Dominic Burke*. Dublin: Irish Academic Press 1988, pp. 107-108.
[12] Pamphlet written by Dr. Adrian Mallon, Belfast: Shanaway Litho printers, 1990 p. 3.

and Literary Society, which was a debating society founded in 1816. One of its aims was to attempt to keep pace with the latest scientific and literary works. Consequently, it invited guest speakers comprising distinguished scientists and scholars to speak about their work and research.

One of these was the English chemist Sir Humphry Davy, discoverer of the Group I and II elements and inventor of the safety lamp for miners. The context in which this was taking place was at a time when most Catholics would leave school and move into employment as working-class tradesmen, factory workers, clerks, shopworkers, labourers or as skilled and semi-skilled craftsmen.

Brother Burke's philosophy is summarised by Mallon in this way:

> He argued that understanding the scientific principles behind any process was an enormous advantage in doing one's job better and making improvements. As a result of Brother Burke's efforts, pupils were instructed and entertained by experiment and fine collections of scientific technology and mathematical instruments and models. In this type of instruction the Brothers were pioneers in Ireland and well in advance of most British schools.[13]

It was a form of education that did not go unnoticed by the new Department when it began to establish a scheme of technical instruction in the early part of the twentieth century. When the Department saw the opportunity of placing its proposed methodology before the Irish public, they chose the Cork Exhibition of 1902, and Br. Burke's workshop practices in the classroom particularly were used as a means of getting its message across. Later Br. Burke would himself testify before the Intermediate Commission on his choice of methodology, which was, according to Kelleher,

> ...a 'realistic' or 'realist' method. Work done in the workshops was 'real' and of genuine value, as was the whole process from drawing to the final construction and testing.[14]

6.2 Armstrong's writings and the Department's heuristic policy

What evidence is there in Armstrong's writings or speeches that heurism came to Ireland during this period of crucial educational reform? The fact is that Armstrong made very few references to the implementation of a major change in the structure and methodology of science teaching in Ireland. Apart from the Belfast meeting of the British Association of 1902, the only other time he appeared to

[13] Ibid., p. 6.
[14] Kelleher, p. 212.

have visited Ireland was for the Dublin meeting of the British Association in 1908. Armstrong not only met with high-ranking members of the Department in Dublin, he also participated on educational committees with some of them. Addressing the Educational Science section as its president in Belfast, Armstrong made a direct reference to the educational reform movement then taking place under the new Department of Agriculture and Technical Instruction:

> Ireland is fortunate at the present time in that far-reaching changes are being introduced into its educational system. A body of men are engaged in this work who are, I believe, in every way specially qualified to promote reforms and earnestly desirous of developing a sound policy.[15]

Armstrong was more than likely equating 'sound policy' with heuristic methods in this statement. Just what the impact of these words were on those top members of the Department present can only be guessed at. It is fair to say that by endorsing their credentials, Armstrong was lending his full support to this endeavour. That so many were present implies that the Department sanctioned his views in turn.

He also had great praise for those engaged in heuristic science instruction – the teachers themselves:

> Nothing could be more gratifying than Mr. Heller's statement in the Report for 1900, 'that the Irish teachers as a whole seem to possess a great natural taste and aptitude for science and the method of experimental inquiry.' May they seek to set the example which is sorely needed to teachers in other parts of the Kingdom.[16]

This last reference was because Armstrong always saw the lack of properly trained teachers as the weakest link in his method, and blamed this on its eventual demise. Within the next few days Armstrong travelled to Cork during the course of the conference to meet with Br. Burke at the Cork Exhibition, and see for himself Ireland's form of heuristic education. Whatever he saw there moved him to return to the meeting to encourage its participants to 'go see for themselves'.

Six years later in Dublin under the presidency of Professor L.C. Miall, Armstrong delivered a paper entitled, *The Outlook: a Grand Experiment in Education.*

Other members who were to read papers comprised Robert Blair (who had worked with the Department and left in 1904 to become executive officer of the London County Council Education Department), George Fletcher (then assistant secretary with the Department) and T.P. Gill (secretary of

---

[15] Report of the 1902 Belfast Meeting of the British Association, pp. 841-842.

the Department). These members of the Department not only met Armstrong, but also sat on committees with him. For instance, the committee reporting on *Studies most suitable for Elementary Schools*, comprised: William Mayhowe Heller (Secretary), Sir W. de W. Abney, Professor Henry Edward Armstrong and George Fletcher. The sub-committee on Elementary Experimental Science comprised four members, two of whom were Heller and Armstrong, and the committee investigating *Changes affecting Secondary Education* had on it Armstrong and Plunkett. It is my contention that Armstrong would not have figured so prominently on these prestigious committees had not Irish science educationalists adopted his own brand of heuristic instruction in their policies.

One of the groups which met during the week of the 1908 British Association conference in Dublin, discussed the curricula of secondary schools, Armstrong sat on this committee, which was called the Gregory Committee after its chairman Professor R. A. Gregory. A sub-committee had been set up during the year to inquire,

> ...into the actual practice adopted and the ideal plan of studies advocated by science-masters in selected public schools of various types...[17]

This sub-committee looked at many aspects of the brief given to it, however the most interesting returns were under the section entitled *On Present Methods of Teaching*. For example, one submission reported: 'Almost everyone appears to have tried the heuristic method of teaching, particularly in connection with the chemical side of problems in the laboratory...'[18] Most of the replies contain many different views, in fact it is safe to say that the teachers surveyed were divided about the effectiveness of the heuristic method – some teachers felt that the method had failed them altogether, whilst others felt that the method worked.

The following points summarise the findings of the Gregory Committee:

1. In the junior classes the approach towards science education should be via 'subject-method', progressing to the 'judicious addition of the "problem-method" in the subsequent study'.
2. That there was little or no room for formal external examinations under the heuristic approach.

---

[16] Ibid., p. 842.

[17] Report of the 1908 Dublin Meeting (78th) of the British Association. London: John Murray, 1909 p. 526.

[18] Report of the Gregory Committee contained in the Report of the 1908 Dublin Meeting of the British Association, p. 531.

The sub-committee described this sentiment with respect to the teaching of science in a practical manner most succinctly:

> The curse of science work is examinations, especially the compelling of boys to pass in Elementary Science...the boys are capable of doing higher work, but they must now grind along the weary round of describing elementary experiments, of learning to recognise that the same question may be asked in ten different ways, and of devising laborious experiments to prove something which is perfectly obvious.[19]

The above quotation from the sub-committee discriminates succinctly between the heuristic methodology and the examination culture under the Intermediate Board. At the 1908 Dublin meeting of the British Association, T.P. Gill also made reference to the way in which the Intermediate system imposed a system of written examinations and '...fatally governed the whole character of the Irish Intermediate system for nearly two generations'.[20] The opinions and recommendations which follow bear this out also, chief among them being:

> The attention universally given to laboratory practice and to the development in the boys of the powers of *doing* and *describing* deserves nothing but praise.... The resulting variety and elasticity in their methods is, in our judgement, a good feature, which we wish to preserve.[21]

Professor Miall in his presidential address at the opening of this meeting included a separate section in his lecture under the title 'Heuristic Methods'. He makes a direct reference to the work of Armstrong's colleague Heller, and is striking in its resemblance to Fitzgerald's letter to Heller in 1897:

> It is now a good many years since I saw Mr Heller give several lessons on this plan in elementary schools in London, and was then permanently convinced of the real value of the heuristic method. I only wish that we had a score of such, each worked out as carefully as Dr Armstrong's model.[22]

Writing in *The Technical World* in 1896, Armstrong expanded his views on how science had to be studied in order to be useful. Once again, he quoted both Spencer and Huxley in setting up the argument for a more heuristic approach towards the study of science, 'The great end of life is not knowledge but action'. He stated that the students instructed in heuristic method,

---

[19] Report of the Gregory Committee, p. 533.
[20] Report of the 1908 Dublin meeting of the British Association, p. 933.
[21] Report of the Gregory Committee, p. 533.

> ...will not only gain knowledge of facts but also of method - of scientific method -, which is of far more importance. That they will learn to work with a purpose and to devise experiments calculated to afford definite information as to certain clearly defined issues; to work cautiously and exactly; to observe carefully as well as to make use of their observations; and to be logical and guarded in their judgements.[23]

This association with Spencer and Huxley[24] appears in many writers on the topic of heurism. In concluding, Armstrong re-echoed the sentiment that in order to instruct pupils in the scientific method by heuristic means, there was no room for formal written examinations:

> Now that we have Polytechnics here, there and everywhere, no difficulty can arise in gaining access to a laboratory; and if teachers can be kept free from the clutches of the examination demon... there is no reason why rational courses of instruction in all subjects should not be open to the public to an extent to meet all requirements.[25]

6.3 The Departmental officers involved in implementing its educational policy

Blair and Fletcher were both inspectors at one time with the Board of Education in London. According to Parkes:

> Blair had known Fletcher in the inspectorate of the Science and Art Department, where he himself had worked. One of the other inspectors appointed to Dublin was Edmund Rich who had been a pupil of Blair's at Aske's Hatcham School and had been a science instructor with the Staffordshire County Council.[26]

When Robert Blair was interviewed by the Belmore Commission at 77th Meeting in Oct 21st 1897 at School Board Offices in Edinburgh, he was then Inspector of Schools under the Science and Art Department. It is more than possible that this interview was significant in that it brought him to the attention of those intent on establishing a system of technical education in Ireland.

---

[22] Report of the 1908 Dublin meeting of the British Association, p. 926.
[23] H.E.Armstrong quoting Huxley in *How Science must be studied to be useful,* p. 42.
[24] Thomas Huxley had been appointed to the Royal Commission on the Royal College of Science for Ireland in 1866, and so would have had some knowledge of both the state of science education and the various institutions employed in practising it in the country.[24]
[25] H.E. Armstrong, How science must be studied..., p. 50.
[26] Parkes, S. M. 'George Fletcher and Technical Education in Ireland, 1900-1927'. *Irish Educational Studies*, Vol. 9. No.1. 1990, pp 13-39. (Reprinted in *Irish Educational Decisionmaker*, No. 4, Autumn 1991, p. 43.

This would not have been an unusual occurrence as the Chief Organiser of Experimental Science in the National Schools, William Mayhowe Heller, was brought to Ireland following similar interviews with the Belmore Commission. The circumstances of Blair's appointment to the Department, and who was responsible for bringing him over from Britain are not known.

What is known however is that the development of the Department's policy in both Intermediate and Technical education was almost solely in the hands of Robert Blair. Blair joined the Department on 1st April 1901 and left on 31st July 1904. His loss to the Department should not be underestimated and his rapid rise to dictate London's educational policy as its first educational officer under London County Council until 1924 is testimony to his talent. He had previously served as science inspector under the Board of Education South Kensington from March 1894 until his appointment by the Department. His salary in London had been £200; however, it rose to £1,000 with his appointment as Assistant Secretary for Technical Instruction in Ireland. The minimum he could have expected was £850. Consequently, he was earning only £200 less than Plunkett who was Vice-President – this maybe an indication of the importance the Department placed on Blair. His role in organising the Intermediate schools and the implementation of technical instruction was crucial to the success of the venture. George Fletcher became Blair's successor, and with the system so ably set up and running, it was left to Fletcher to continue Blair's work in a two-fold way, that is consolidation and expansion. Fletcher proved more than capable, and the fact that so much was accomplished in the years following Blair's departure gives an insight into the determination of Fletcher to succeed in his new position.

In 1894 Fletcher was inspector under the Board of Education, South Kensington. He was appointed as Senior Inspector for Technical Instruction on 1st April 1901 with a salary of £800. He served in this capacity until July 1904 when he became Assistant Secretary – with a salary of £1,000, which rose to £1,200 in November 1913. As a point of interest, Fletcher was Head of the Technical School in Birmingham, which was noted along with The Central and Finsbury Technical School, for its 'Technical and manual instruction....'[27]

He had seen the need for practical work to be done in school science laboratories, and that heuristic methods had a role in this regard. The link between himself and Armstrong initially was more academic than personal. Parkes wrote of this period:

> Fletcher's major interest in the early years was undoubtedly the development of science teaching in the second level schools. He was much influenced by the work of H.E. Armstrong, Professor of Chemistry at Finsbury Technical College, London, who was the major advocate of the heuristic method in science teaching. Practical and experimental work was essential for school science, and school laboratories must be provided. One of Armstrong's former students, W. Mayhowe Heller had been appointed in 1900 as organiser of science by the National Board to develop elementary school science in the new Revised Programme for National Schools, and Fletcher fully supported this work.[28]

E.M. Rich had been a pupil of Armstrong's at the Central, and Armstrong was also a good family friend and had known Rich since he was a boy. In March 1902 he was engaged as Temporary Assistant Science Inspector with a salary of £250, and three years later was Assistant Science Inspector, salary £400. Blair eventually brought Rich back to London to work with him in March of 1905.

William Mayhowe Heller (Head Organiser of science instruction in the National Schools), was both a past pupil of Armstrong's at the Central, and had also worked with him both in the teacher training school in Berner Street and in both designing the science workshops and implementing heuristic methods of instruction at the new Christ's Hospital School in Horsham. He eventually joined the Department as a science inspector on the demise of elementary science instruction in the National Schools.

In June of 1903, Mr Alfred Mosely CMG invited Horace Plunkett to nominate two members to sit on a commission of inquiry to investigate the methods of education in parts of the United States with special regard to their bearing on commercial and industrial efficiency. Plunkett nominated the Rev. T. A. Finlay S. J. who was then a member of the Board of Technical Instruction and Robert Blair who was assistant secretary in respect of technical instruction. They sailed for the United States on 3rd October and returned in time for Christmas. Blair had some interesting remarks to make upon his return, namely his reference to the heuristic ideas which appeared to be lacking in the instruction he witnessed:

> The character of the instruction in science and manual training may be fairly well estimated if it is understood that the teachers being in accredited high schools, have to keep an eye on the

---

[27] *Science and Art and Technical Education Journal*, London: Chapman & Hall, November 1891 p. 173.

[28] Parkes, p. 43.

> scientific colleges and institutions of technology. "Heuristic" ideas have not penetrated into them...The American buildings and equipment are, for science teaching in advance of those of British secondary schools, but in ideals and generally in methods of science teaching, the British secondary, imperfect though they are, are I believe, unequalled. But American high schools are free! We want the funds which the Americans have, and we want the sentiment of democracy that education is that possession of the aristocracy which democracy most needs and can most readily obtain.[29]

The City and Guilds London Technical Institute and the City and Guilds Finsbury Technical College also in London, supplied many of the technical staff of the DATI. For example Mr. W. Vickers Dixon was a registered teacher at Finsbury, and was a technical expert in science and technological subjects, such as light and heat as well as the new field of electrical lighting. In 1901 he was appointed an inspector for technical instruction. Mr. E. A. O'Keeffe who was also a technological teacher of 15 years' experience at the City and Guilds Finsbury Technical College in London was appointed organising secretary of the scheme, which had been submitted in 1901.[30]

One of the big criticisms made about the Department was the preponderance of staff that had been recruited from both Scotland and England. Several articles appeared in such newspapers as the Freeman making this point:

> The English and Scotch officials of the Board, already numerous enough, will naturally try to secure more positions for their co-nationalists, and we, Irish people, are expected to look on with perfect complacency at this new process of Anglicisation....[31]

The Department responded quickly making the point that for it to work efficiently, then the best staff was required, and that these people could only be found on the mainland.

6.4 The educational policy of the new Department toward science – a heuristic trend

Time and time again in the references made by members of the Department in their writings on education, mention is made of both Herbert Spencer and Thomas Huxley. These were also educationalists admired by Henry Edward Armstrong in whose writings one finds quotations from both

---

[29] D.A.T.I. miscellaneous bulletin. Dublin: HMSO Alex. Thom & Co.Ltd., 1903, pp. 30-31.
[30] Cooke, J. *The Dispute between the D.A.T.I. and the City of Dublin T.I.C., 1901-12*, pp. 48-49.
[31] Hallinan, D. 'Is it another Anglicising Board?' The *Leader* newspaper, January 3rd 1903, p. 310.

men liberally sprinkled. The Department laid out its scheme of definite aims early on in its existence and in the Prefatory note to the Department's programme for Day secondary schools the following references are made to the principal functions of a well designed course:

(1) The education of the power of observation, involving the exercise of judgement and the training of the senses.

(2) The training of the reasoning powers.

(3) The training of the executive powers. The experimental work performed by the pupils themselves involves the cultivation of manual dexterity, initiative, and self-reliance.

(4) The imparting of some of the more important principles and facts of physical science.

These were compared to the practice in the past of didactic instruction of some of the ascertained facts of Science, and the recall of those facts, which were usually decided by means of a written examination. It continued by stating that any course of science instruction which ignored the importance of a training in scientific method would lose a large part of its educational value. Merely learning the facts of science, without doing any practical work, was considered secondary in value to the training of the faculties by following the heuristic method.

> This method, which has been called the 'Research' or 'Heuristic' method, involves the exercise of the highest powers of a teacher. It is less a method than a guiding principle. It requires that he should do less for his pupils than was common where a knowledge of facts was the sole aim, but the little required must be intensely purposeful.[32]

This is the one and only time that the Department refers to the scientific method as the heuristic method. The reasons given for following this course of action was based on Armstrong's reasoning, that of using science instruction as a means of cultivating discipline and mental training in the pupils by the following of definite lines of investigation in the laboratory. Fletcher goes on to describe the reason behind this heurism in true Armstrong-fashion:

> In fact, the teacher should avoid telling his pupils anything which they may fairly be expected to find out for themselves, and one of his highest functions is that of bringing home clearly to

[32] Prefatory note to the Department's programme for Day Secondary Schools. D.A.T.I. Journal, Volume I. Dublin: HMSO. p. 656.

them the nature of the problem to be solved and the method by which it may be investigated. In certain cases it may be found desirable to establish a fact by the method of verification.[33]

What does seem clear is that, in the four year experimental science course, the Department went out of its way to promote the policy of the pupil doing the experiment himself during the first two years of the course After this period much more flexibility was built into the work of the pupil, with the possibility of more exposure to demonstration experiments. This was more akin to the methodology of Br. Burke:

> There is absolutely no rule in the matter. We encourage the teacher to demonstrate in certain experiments. These are better taught by a demonstration on a lecture table. Let us take one instance which will serve very well – the composition of water by synthesis. In that case I think the lesson to be derived would be derived less soundly by the student if he performed the experiment than from a demonstration to the whole class. But in saying that, I do not wish to imply that that is the general principle in regard to the work. The first and second years' courses, and indeed the full course of instruction, is best carried out where the student performs the experiments. It is not desired that the student should determine every physical constant, but that, having found out by a number of selected examples, the method employed, he may then intelligently receive the teaching and learn from the work of others.[34]

The Department seemed to have adopted a policy that an appreciation of scientific method towards experimentation could be established in the minds of the pupils during the first two years of the course, with the third and fourth years allowing more flexibility, with the school permitted to substitute its own scheme, yet still remaining under the watchful gaze of the inspectors. All these means had an end – that of training the future industrial worker in scientific method:

> There is very great advantage in allowing these courses (Day classes for apprentices in the technical schools) to come after the youths have already spent some time in apprenticeship and are, therefore, in a position to appreciate the importance of the application of scientific methods to their craft.[35]

George Fletcher delivered a lecture in July of 1906 during one of the Department's summer courses for teachers in which he elaborated on some of the philosophies under which they were operating. Chief

---

[33] Ibid, p. 656.

[34] Report of the Departmental Commission of Inquiry into the Provision of the Agricultural and Technical Instruction Act 1899. The Digby Inquiry of 1907. From evidence presented, pp. 946-947.

amongst these was the method of instruction, and the form of this had to be practical. Essentially the teacher had to do less and the pupils more, for the faculty of observation to be trained and developed. He referred to the idea that the mind of the pupil had to be in a receptive state:

> In approaching the treatment of the scientific problem with pupils, the first, and perhaps the greatest difficulty, is to get them to realise the nature of a problem. Once this is done the rest becomes comparatively easy. Once you get the student's mind into the interrogative mood then the solution of the problem becomes easy.[36]

The major difficulty facing the newly established Department was elaborated on by Gill in September 1902, at the meeting of the British Association in Belfast when he stated

> ...there is one difficulty which besets the educational reformer everywhere, from which our path in Ireland will not be free. I mean impatience to see results...Here we are called on to organise, to create, a system almost out of whole cloth – a system of instruction for which there are no regularly trained teachers, for which the other educational systems of the country had made no preparation, and a system, moreover, the chief result anticipated from which is the stimulation of industries in the least industrial country in Europe.[37]

Armstrong was in agreement with this sentiment and also alluded to this problem at the same conference when he said:

> Of course the development of a true policy must come about slowly, and we must not be too impatient of results, but give every encouragement and all possible support to those engaged in the work.[38]

That the Department had from the outset encountered good will is clear, but now two years on, the demand for results was being heard from certain quarters.

All had not gone well in the Department's first few years. It was in dispute with the Technical Instruction Committee of Dublin Corporation and the newspapers were beginning to put pressure on the Department with regard to producing some tangible results, results obvious to the public. *The Leader* newspaper in December 1901 had extolled the 'New Department' on the ideals expressed on technical instruction in its first Annual General Report:

---

[35] D.A.T.I. 18th annual general report. Dublin: HMSO, 1919, p. 93
[36] Fletcher, G. *The place of science in a general education*, D.A.T.I. Journal Vol. VI. 1906, p. 651.
[37] Report of the 1902 Belfast Meeting of the British Association, p. 840

> These are new and pregnant educational ideals, not so much in themselves as coming from an Irish Government Office. A Department whose guiding spirits keep them steadily in view cannot go far wrong and deserves to succeed.[39]

This 'honeymoon' period did not last long.

6.5 The Department's scheme in developing a practical form of instruction

As mentioned in the previous chapter the Department focussed the first decade of its existence on the development of a sound system of science instruction in the field of secondary education. And it is here that some of the strongest evidence for the implementation of a heuristic methodology exists (or the teaching of 'scientific method' as the Department called it).

The first two years of the Department's administration was given over to '...work of quiet preparation, inquiry, and internal construction'.[40] There was much to organise and the establishment of the local authorities in 1899 was seen as providing the financial lifeblood of the new Department. Consequently, the statutory committee of the local authorities had to be set up. All the many schemes, which the Department hoped to implement, had also to be framed. Those in control saw that science instruction in the secondary schools got priority. George Fletcher, assistant secretary in the Department, alluded to its policy when looking back in 1907 he said: '...all sound technical education, being a specialised form of education, must depend for its success and efficiency on the work done in the primary and secondary schools of the country'.[41] The Department had no control over the national schools, but in any case, William Mayhowe Heller was busy implementing the recommendations of the Belmore Commission.

The fact that the Department had been given complete autonomy with respect to the grants supplied by the Science and Art Department of South Kensington gave it the authority it needed. Of the Department's annual income of £166,000, the sum of £55,000 was allocated to technical instruction. As stated in section 2.4, the state of science instruction in the secondary schools was such that by 1900 it was almost non-existent, with figures revealing that no more than five or six secondary schools in the country possessed what might be called laboratories. Science instruction was didactic and relied almost

---

[38] Ibid., p. 842.
[39] Article on the 'New Department', in the *Leader* newspaper, Dec.7th 1901, p. 255.
[40] Fletcher, G. Addressing the Association of Technical Institutions, Belfast Summer Meeting, July 12th –14th, 1907, p. 3.
[41] Ibid., p. 3.

completely on the many textbooks that proliferated around this time. Robert Blair who was given charge of the work of technical education, helped to formulate the new programme for the secondary schools. The programme which he developed was based on a four-year course in experimental science, drawing and manual work. The first two years, ('Preliminary course'), was compulsory in all schools taking the course which was followed by a two-years 'Special course', the subjects of which were optional.

In an article published by the *Irish School Monthly* in 1901 reference is made to the new regulations and proposed syllabi of the courses of science instruction as viewed from the Department's perspective. It compared the elementary course for secondary schools with that of the national schools and deduced that it was '...practically the same as column 1 of the Science Programme for National Schools, with the addition of practical laboratory work on "Heat" and the deductions therefrom.' In a reference to the new secondary programme the article makes a reference to the influence of Armstrong's method: 'The course right through is very practical, and due encouragement is given to the Heuristic method.'[42]

A scheme of grants was devised, which required that the participating school should be

> ...provided with an adequate laboratory and equipment; that the teacher should be qualified, that the instruction should be regular and systematic and efficient.[43]

The Christian Brothers were one of the first religious groups to see the opportunity that this afforded their mission of science instruction throughout Ireland, and it was written at the time that they

> ...intend having a Laboratory in every one of their schools in Ireland, and no pains will be spared by them to carry out the spirit of the new teaching in Experimental Science.[44]

Grants could then be paid on the basis of the amount of work done and on its 'efficiency'. The former could be discerned from the registers, the latter from inspection. The system of using inspectors to assess progress rather than formal examinations as a basis of awarding grants was an innovation also peculiar to this country, although examinations continued to be held under the Board of Intermediate Education. Furthermore, no grants were paid unless the teachers concerned were recognised by the Department as qualified. This meant that the respective teachers had to attend the summer courses held each year, the instruction at which promulgated a practical approach towards science instruction. Such

---

[42] *Irish School Monthly*. Vol.I, No.9. May 1901, p. 312.
[43] Ibid, p. 4.
[44] *Irish School Monthly*. Vol. II, No.1. September 1901, p. 29.

a scheme would not have been possible under a rigid examination system such as that under the payments by results system used in Ireland from 1878 to 1900. Within the confines of the school timetable the absence of such a rigid examination system would also have allowed the implementation and development of a more heuristic approach to the teaching of science.

Science instruction based on the heuristic methodology would have run into difficulties when an examination system needed to be devised. Consequently under the scheme, examinations were '...at a stroke abolished as a means of ascertaining efficiency of teaching'. In England the 1901 British Association's meeting in Glasgow was opened by Professor Rucker. In his opening speech he made reference to the newly elected Chairman of its Educational Section, Sir John Gorst:

> The necessity of a sound system of primary education was far above all monetary consideration. The study of Modern Languages, Technical Instruction on a sound basis, the Heuristic Method of Teaching, and the abolition of examinations were all found in Sir John's programme.[45]

This was reported in the Irish educational journal the *Irish School Monthly* with reference to this Educational Section, '...which was formed last year by the exertions of Professor Armstrong, whose name is now so familiar to Irish Teachers.'

A further aspect of this inspectorial system was that it allowed for more flexibility in a diversification of schemes in the various local authority areas. Fletcher speaking in 1907 made reference to this when he said:

> This abolition of examinations has resulted in freeing technical education from grooves and in giving freedom to local authorities and schools to initiate schemes especially suited to their own localities.[46]

A good deal of the Department's success in these areas is attributable to great flexibility in allowing schemes to be drawn up and in overseeing their implementation. The inspectors played a crucial role in this regard, forming a bridge between the local authorities, the schools and the Department. This role was a unique one in the British Isles at that time. Whilst the examinations became less important in the eyes of the Department as a means of assessing grants, the schools and colleges operating under the rules of the Department maintained the examination system. Pupils were encouraged to sit

---

[45] *Irish School Monthly*, Vol. II, No.2. October 1901, p. 59.

examinations for the Board of Education, the City and Guilds of London Institute, the Royal Society of Arts and other examining bodies. This enabled the schools and colleges to maintain a system of pupil assessment and the Department used this as a means of recognising those successful candidates (at a higher level) as teachers under the Department's schemes of technical instruction.[47]

Writing in the *Irish Educational Review* in September 1908 Father Andrew Murphy described the early days of the Department's work and its heuristic policy, comparing the changes made to the old Intermediate system:

> Actual experiment has replaced bookwork, and the scientific method of arriving at a knowledge of natural laws has been substituted for almost worthless memory work, which, at its best, resulted only in requiring a certain amount of interesting and curious information, but always sacrificed the far greater advantages of the educative process.[48]

What he said next encapsulated the problem of over-emphasis on the heuristic method, something which Brother Burke had identified and allowed him to perfect a more balanced approach long before the Department had been established:

> The need for strong measures in the beginning to check and destroy the tendency to book-teaching in science led to exclusively heuristic teaching, and though the recent syllabuses lay stress on the importance of a reasonable amount of theoretical teaching, it is to be feared that the drastic enforcement of heuristic methods at first continues to deprive the teaching of a most valuable and important feature. Heuristic methods alone will take the pupil but a very little way in the time at his disposal, and the knowledge acquired is apt to be somewhat scrappy, and not very closely knit. A judicious blend of didactic and heuristic methods would give the pupil a full, symmetrical, and thoroughly connected view of a branch of science, and would preserve him from the dangerous fallacy of thinking that his few experiments afford sufficient grounds for the very sweeping generalizations he is induced to draw from them.[49]

By 1912 the Department decided to implement an examination system for the technical schools and classes. This was due mainly to the fact that the examinations of the Board of Education were no longer

---

[46] Fletcher, G. *The organisation and position of technical education,* 1907, pp. 11-12.
[47] Fletcher, G. *The Department's new scheme of examinations for technical schools*, D.A.T.I. Journal. Vol. X, p. 675,
[48] *Irish Educational Review*. Vol. I, No.12. September 1908, p. 753.
[49] Ibid, p.754.

in harmony with those of the Department. Consequently, a new programme of examinations was drawn up. It is quite clear from the minutes of the Board that the emphasis on practical instruction was still very strong and healthy: 'It was intended that the courses of instruction of which the examinations would provide a test should include not only theoretical instruction, but also laboratory and practical work.'[50] The laboratory work should be based on the theory, and credit would be given in the practical examinations towards the work done in the pupil's laboratory notebooks. The course itself should include subject matter which was related to the pupil's own experience, and every effort should be in connecting the application of laboratory methods to that of industrial practice. These same criteria were used in assessing teachers following their attendance at the summer courses.

A crisis of a sort arose in July of 1916, when the Intermediate Board put into action a new rule which meant that pass students working under the Programme, and who, until now, had been assessed by Departmental inspectors, would also have to undergo a written examination. Gill was emphatic on the point that this change contradicted the practical nature of the Programme:

> It should be remembered that the subject was Experimental Science, and in regard to the teaching of this subject the Department attached less weight to the acquisition of facts than to the educative process involved in the Experimental work. The Department's system required the students to carry out certain experiments themselves. The proposed Examination of the Intermediate Education Board would conduce merely to the acquisition of a certain number of facts relating to the subject matter of the experiments.[51]

Some members of the Board felt that this revision would completely undermine the strategy of the Department with respect to the development of technical education in the country. T. P. Gill was certain that this step might be reconsidered in time and that it would be seen to have been a mistake. The Board was committed to making this scheme work and that,

> ...science was one of the best foundations for Technical Instruction; in fact, that Secondary Schools should be impregnated with science. The effects of this work had begun to be felt, and it was very unfortunate that a plan should now be proposed which amounted to a

[50] Minutes of the 37th Meeting of the Board of Technical Instruction. May 1912, p. 5.
[51] Minutes of the 49th Meeting of the Board of Technical Instruction. July 1916, p. 94.

discouragement of science. The Scheme required special equipment, specially qualified teachers, and a system of minute inspection.[52]

This revision was eventually implemented and thus began the slow process of erosion of fifteen years of practical science instruction, one which the Department saw as the lynchpin of its Programme regarding technical instruction.

6.6 The Department and heurism in the Secondary Schools, 1900 -1920

When the Department published its educational policy in its 1900-01 Annual Report it was clear how it saw its role with respect to the secondary schools of Ireland:

> The Department enters the secondary schools of the country as the administrator of the Science and Art Grant, principally from the point of view of general education, which is the first concern of the secondary school, and secondarily from the point of view of those specialised applications of education to which the secondary school should lead. With these objects in mind it has entirely changed the system on which the Science and Art grants have hitherto been administered.... The new Programme of Experimental Science, Drawing, Domestic Economy, and Manual Instruction, which the Department has issued, is intended to provide, in the first two years, the secondary school with that minimum of scientific discipline and training of the hand and eye which educationists now generally hold should be a part of any broadly-conceived scheme of general education.[53]

Experimental Science was defined in the Departmental regulations as

> ...such a system of instruction in Physical and Natural Science as will involve the greater part of the work being done by the pupils themselves in an approved laboratory[54].

The Department adopted a form of heuristic instruction with respect to both secondary and to a degree technical education, with the broader educative principles in mind:

> This form of technical instruction is educational; it concerns itself with the development of practical intelligence, of the intelligent disposition, and of manipulative skill; and while it has

---

[52] Ibid., p. 94.
[53] D.A.T.I. 1st annual general report 1900, p. 22.
[54] D.A.T.I. 9th annual general report 1909, p. 263.

no direct bearing upon one specific industry or commercial undertaking, it must be regarded as an essential preliminary for all.[55]

Most of the evidence of heurism in the secondary school laboratories comes from the Annual Reports of the inspectors. These reports provide a glimpse of the initial problems being encountered by the Department. Writing in 1902, George Fletcher who was in his last year as Senior Inspector said:

> The following points have been impressed upon Inspectors in the course of their visit to the schools of the district: -
>
> (a) An improvement in the cleanliness and order of laboratories.
>
> (b) Weakness in manipulative skill, due in a large measure to the fact that teachers do too much for the pupils, and provide ready-made simple pieces of apparatus, which the pupils should be allowed to make for themselves.
>
> (c) Excessive time spent on dictation of notebook records, or on writing out records of experiments. There is some danger that the educative value of an experiment may sometimes be lost in the desire to make a presentable record of the results obtained, which comes to be regarded as an end in itself.
>
> (d) The necessity for frequent revision and discussion of the meaning of the results obtained.[56]

In those instances where co-operating teachers attended the annual summer courses, in which the Department used the opportunity to train them in scientific method, the inspectors wrote positively when reporting on their visits to the schools in which these teachers taught. E. M. Rich, who was also a member of the Inspectorate, wrote on this matter in 1903:

> In those schools where teachers had taken a summer course in special chemistry, it was most gratifying to note that the practical work in introductory chemistry showed a distinct advance.[57]

By insisting on attendance at these courses, and following up with regular inspectors' visits the Department ensured that practical science instruction became normal practice. For example, the 1904 – 05 Annual Report states that:

---

[55] Ibid, p. 53.
[56] D.A.T.I. 4th annual general report 1904, p. 60.
[57] Ibid, p. 62.

> The system established by the Department involved several features – new so far as Ireland is concerned. Systematic practical instruction in laboratories became a *sine qua non,* grants were paid on the results of inspection only, and no grants were paid except the teacher was recognised by the Department as qualified.[58]

Whilst the Annual Reports make dramatic claims as to the success of the scheme, and the figures appear to support these claims, in the school classroom matters were moving with much more deliberation:

> Progress has been made in Science teaching, though the standard reached in the Third and Fourth Years' Physics and Chemistry was as a whole, only satisfactory, the chief defects being a weakness in manipulation and a mechanical treatment of the experiments. This no doubt is largely due to the newness of the work to the teachers, who were over-anxious and attempted too much.[59]

The old methods employed by teachers operating under the regulations of the Intermediate Board were proving difficult to eradicate, and whilst completely new structures had been put in place,

> ...text book teaching and the working of numerical examples still receive an undue proportion of time, and there is the tendency to regard the number of facts learnt as the criterion of the teaching rather than how these facts have been learnt.[60]

The situation was no better the following year when the Department published its 9th Annual Report containing the following comment: 'The spirit of investigation is not always sufficiently cultivated, and there is sometimes a tendency to give first and second year pupils too much help in writing up notes.'[61] Time allocated to science instruction on the school timetable (minimum 3 hours per week) was not sufficient for the teacher to follow the 'inquiry method'. Yet this received no mention whatsoever in the inspectors' reports until 1910.

> The teaching of the specialised subjects in the third and fourth years generally is good; but in several schools, the amount of practical work carried out and the pupils' manipulative powers are comparatively small. This is due to the facts that the minimum prescribed time is given to

[58] D.A.T.I. 5th annual general report 1905, p. 48.
[59] Ibid., p. 50.
[60] D.A.T.I. 8th annual general report 1908, p. 75.
[61] D.A.T.I. 9th annual general report 1909, p. 98.

> the teaching, and that little or no regular time is set apart for preparation of the lessons. When this is the case only a few of the typical experiments, without variations, can be carried out.[62]

Another factor was that very few schools had a teacher assigned principally to the teaching of science. This meant that they would have one and possibly two other subjects to deal with. With no assistant to help, it is understandable that very little time would have been available to prepare practical classes efficiently. Other courses such as Physiology and Hygiene (popular in the girls' schools) were almost all textbook-based, and observation and experimentation in these subjects were almost non-existent; instead rote-learning and memory exercises were the methods employed by the teachers. Consequently teacher training in practical work was unnecessary.

Teacher turnover in some of the schools, mainly under the Urban District Schemes, also caused disruption to the system. What caused their departure may be linked to the difficulties which a teacher encountered in attempting to teach according to Departmental regulations:

> It was usually found in the less satisfactory classes that the Teachers had not given sufficient attention to the preparation of lessons, the discussion of difficulties, the revision of note-books, or the keeping of the laboratory and equipment in good order. It is not difficult to trace some connection between these defects and the frequent changes in the teaching staff from which some schools suffer.[63]

However in some districts a measure of success was reported, and this appeared to be attributable to the quality and enthusiasm of the participating teacher

> ...the aims of Science Teaching are more correctly appreciated, less importance is attached to memory work; habits of self-reliance are inculcated, and on the whole the spirit of inquiry is developed and the pupils are trained to think for themselves.[64]

Some of the reports reflect the reality of the problems facing the inspectors on their visits. The fact that some of the more senior officers of the Department had spent a few years in this role must have given them a better insight into the problems to be overcome as they sat on the Board. For example, Vickers-Dixson writing in the 1910 – 11 Annual report stated:

---

[62] Vickers-Dixon writing in the 10th annual general report 1910, p. 95.
[63] Ibid., p. 114.
[64] Ibid., p. 117.

> There is still a tendency to place too much importance upon a knowledge of the facts to be learnt from the different syllabuses instead of how this knowledge was obtained, and, generally, too little importance is attached to method, accuracy, and neatness in manipulating apparatus. "Nearly" and "about", are far too often accepted as answers, and indeed the condition in which some of the laboratories and their equipment are kept does not promote or foster a scientific feeling. It may be noted here that while one-third of the laboratories are provided with clocks, not one-half of these are in working order. It is but right to add here that there has been much improvement of late in the condition of the laboratories – one seldom finds now unlabelled bottles, or chemicals kept in paper bags.[65]

Of all the inspectors, Vickers-Dixon represented the Department's practical ideals most strongly. He constantly made reference to the 'spirit of inquiry' which needed to be promoted, coupled with the 'powers of accurate observation' and 'legitimate reasoning'. These are all strong traits which represent Armstrong's heurism. He recognised that in the weaker schools, owing to the heavy demands on the teacher's time, lack of preparation, text-book instruction and dictation of notes coupled with poor maintenance of the laboratory and equipment resulted in the aims and ambitions of the Department not being met. He also recognised the need for laboratory workshops where repairs or even construction of simple apparatus might increase the pupils' interest and confer on this course a truly practical meaning. He also identified the most detrimental influence on the conduct of laboratory work:

> In this course the pupils are called on for the first time to write out an accurate description of what they have done and seen and also to state the conclusions they have drawn from their observations. The training that this gives to the pupils is of inestimable value... Much time is often spent upon writing useless descriptions in a stereotyped form and on needless transcription that would be better employed in discussing the work with the class that they may recognise the fundamentals of the experiments, assisting them to draw legitimate conclusions from their observations and to express these in their own words.[66]

It is quite possible that having attended the summer courses, and fulfilled the Department's requirements with respect to qualification, thereby becoming eligible for the grants, even the best-intentioned teacher found it very difficult to implement the training received. This fact comes through

[65] Vickers-Dixon writing in the 11th annual general report 1911, p. 106.

in the reports quite clearly and remained one of the most difficult obstacles for the Department throughout its history. The initial aims of the Programme which had as its principal object the training of the pupil in "scientific method", with great stress being laid on cultivating the pupils' powers of observation and of reasoning accurately from the observations made, was now being re-assessed.

From about 1914 onwards a dramatic change occurred in the policy of the Department in that it was prepared to sacrifice (to a degree) its belief that in order to train the executive powers of the pupil practical work on the part of the student has always been regarded as a matter of primary importance. Instead, the tone of the reports begins to change towards the acceptance of 'carefully arranged demonstrations'. For instance, the 1914 –15 Annual Report says:

> There are in the Preliminary Course a certain if limited number, and in the Special Courses a very large number, of cases where the principle can be brought home to a class more surely by means of a carefully arranged demonstration than in any other way.[67]

By 1918 following the implementation of the revised programme in March of that year this shift was apparent in the reports. This was brought about as a result of pressure put on the Department by the School Managers for changes that would enable them to classify their pupils in accordance with the grades of the Intermediate Education Board's Programme.

It was now left to the Managers of each School to put into practice their own Preliminary syllabus in Experimental Science so that it should,

> ...be introductory in character, and so designed as to interest the pupil in the study of Science. It is expected that the teaching will largely take the form of demonstrations by the instructor, but provision must be made for some practical work by the pupils themselves.[68]

Some of the syllabuses devised were innovative; however, these were few as many of the teachers assigned to the preliminary classes were relatively inexperienced. The topics that were selected included the following: air, water, fire, optical and electrical phenomena, physical geography, the weather, astronomy and plant life. This change was seen as a success in being able,

> ... to awaken an interest in the study of science, and to serve as an introduction to the practice of scientific method and of precise measurement.

---

[66] D.A.T.I. 13th annual general report 1913, p. 106.
[67] D.A.T.I. 15th annual general report 1914, p. 89.
[68] Ibid., p. 100.

However this success, albeit limited, was also to be short-lived. In the following year the state of Experimental Science instruction was reported in the following way:

> ...the standard of teaching unfortunately seems to show a tendency to decline. The training in habits of close observation, and the development of originality in devising and skill in fitting up apparatus, which had frequently been favourably noted in the work of the Schools, does not now appear to receive as much attention as heretofore. This lowering of the standard of teaching is considered to be mainly attributable to the detrimental effect on the practical work in Science of the Requirement of a written test in that subject for the purpose of passing the Intermediate Education Board's examinations.[69]

The schools experienced considerable difficulties in obtaining teachers, and too often poorly qualified teachers with little or no experience were put in charge of the Preparatory Grade Science Classes. Such action was fatal to the advancement of Science teaching because effort was confined to the teaching of mensuration and the academic treatment of some small branch of Experimental Science, and thus failed to awaken real interest or enthusiasm in the pupils.[70]

Sadly, the Department had to give way to the overwhelming power of the examination system, alongside which any form of heuristic training could not hope to survive. The demise of its practical programme was blamed on the Intermediate Education Board and its strict adherence to assessment by written examinations:

> The main cause is, undoubtedly, the introduction by the Intermediate Education Board of a written test for "Pass" pupils in this subject which has been in operation since 1917. The *amount* of scientific information given in secondary schools is less important than a sound training in scientific method, and the introduction of the "pass" written test has led to the latter being to a great extent neglected. The memorising of facts and formulae now occupies much time which should be devoted to the cultivation of the scientific attitude of mind and the spirit of scientific method and enquiry.[71]

---

[69] D.A.T.I. 16th annual general report 1916, p. 90
[70] D.A.T.I. 19th annual general report 1919, p. 91.
[71] D.A.T.I. 21st annual general report 1921, p. 91.

6.7 The summer courses of instruction for teachers and the role of the Royal College of Science

One of the first problems the Department faced in implementing a scheme of practical science instruction was the shortage of adequately trained science teachers. George Fletcher speaking in July of 1907 made reference to this:

> This duty (training of teachers) which is of paramount importance in any system of education, became vital in the case of Ireland, because as I have pointed out, technical education was practically non-existent in Ireland at the beginning of the present decade.[72]

To satisfy the initial demand some of these teachers were brought in from overseas via advertisements placed by the urban committees. For its long-term strategy the Department established schemes of training. The scale of the problem needs to be understood in the context of the time. First, the nature of the work required very highly trained and experienced science teachers, skilled in practical methods. Secondly, there existed at that time no means of obtaining this type of teacher in Ireland from any university. Thirdly, even at Intermediate level no such person existed with these qualifications hence; the need to import. As detailed in section 4.7, in order to employ Irish science teachers, summer courses of instruction were established. They were held during the months of July and August, covering 22 working days. Centres were appointed in the principal cities and enclosed religious orders were allowed hold courses within the confines of the convent. Instructors were brought in from the United Kingdom, and those in attendance had to sit both a theoretical as well as a practical examination at the end of the course.[73] Those successful were deemed to be provisionally qualified to teach the first year's course. In order to secure continued recognition and the certification to teach the subsequent three years of the course, attendance for a further three summer courses was obligatory. However, it was not until a successful fifth year's attendance at the summer course which involved either '...a revision of a previous course or a course in laboratory arts...' that the candidate was awarded the Irish Secondary Teachers' Science Certificate. The figures of attendance at these summer courses reflect the tremendous interest that was generated in the country amongst teachers. In 1901 276 teacher students enrolled, this rose to 838 in 1905, even two years later it was over 700. Giving evidence at the Digby Inquiry in 1906 Fletcher was questioned by the Chairman about the standard of the teacher trained under the Department's guidelines,

---

[72] Fletcher, G. *The organisation and position of technical education*....p. 9.

(Chairman):

How do you ascertain the qualification of the teacher to teach science? – At the end of each summer course we have an examination. The examination consists of three parts; firstly the report and remarks of the Professor in charge of the course; secondly a practical examination conducted by the Professor on laboratory work, and thirdly a written examination conducted usually by an extern examiner and an inspector of the Department.[74]

The hope was that in time properly qualified teachers would emerge from the Royal College of Science. The Department also had a particular type of instructor in mind. It was the intense training which guaranteed that the policy of the Department would be followed according to its expectations. Unlike the situation in England, where criticism was being levelled at the Science and Art Department, South Kensington for the low level of teacher training, the training provided by the D.A.T.I. through the Royal College of Science meant that the standard of instruction was kept high at all times.

The course covering the subject Experimental Science was specifically for those practising teachers who were teaching under the 'conditions of the Programme', although where numbers permitted, some teachers not engaged in this practice were admitted onto the course. Courses in Physics, Chemistry, Botany and Hygiene were held, and each course was divided into two parts, one dealing with the Middle Grade Syllabus the other with the Senior Grade. On passing the relevant examination each teacher was then qualified in the eyes of the Department to teach to that particular level. The control was such that qualification in two of the above disciplines was required for a teacher to give instruction in experimental science. Furthermore, National schoolteachers who were engaged in teaching the Elementary Experimental Science syllabus as Rural Science (including School Gardening) could also attend a special course that lasted for two summers. A certificate was awarded on successful completion of this programme. This qualification had the recognition of the Commissioners of National Education. This was only one of many ways in which the Department promoted co-operation between all three branches of education in Ireland. It is highly unlikely that these National teachers would have attended such a course unless it was based on heuristic lines, as this was the main focus of science instruction in the National Schools.

---

[73] Ibid, p., 10.
[74] Digby Inquiry, Cd.3573-3574, p. 128.

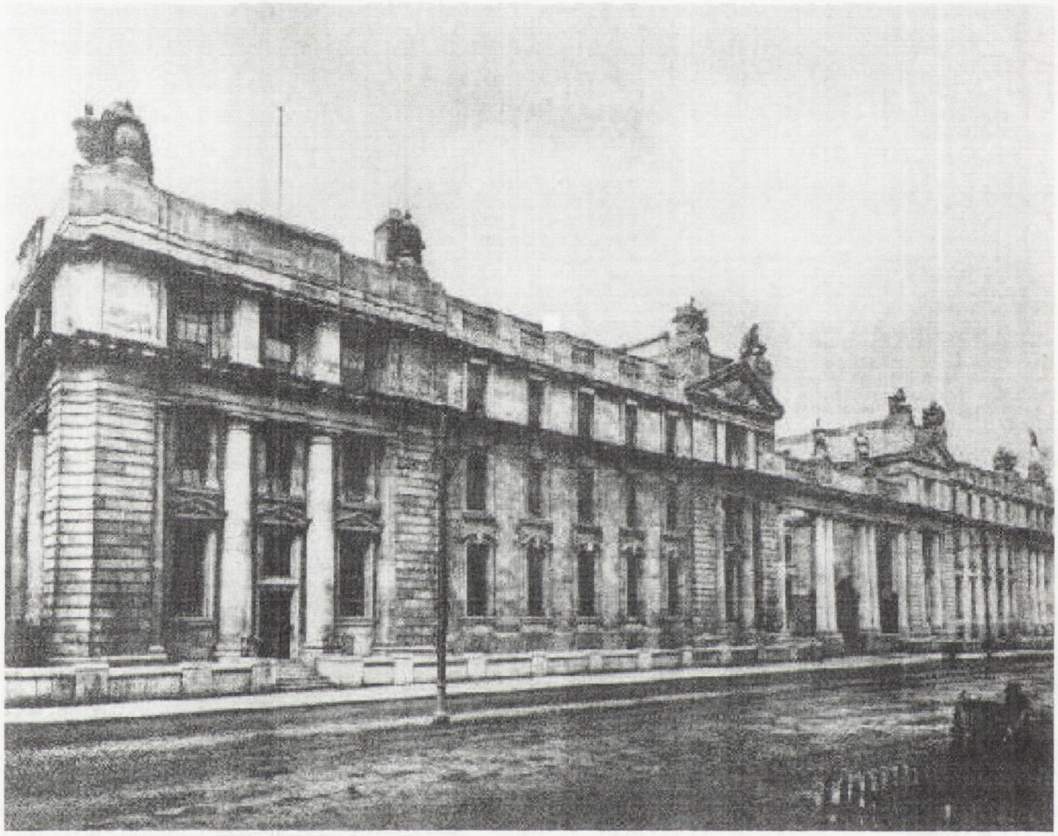

Plate 14. The new offices of the Department of Agriculture and Technical Instruction, Upper Merrion Street 1917.

Along with the administration of the grant in aid under the provisions of the Technical Instruction Act of 1889, and of those from the Department of Science and Art, South Kensington, the Department also took control of the Royal College of Science under the 1899 Act. Up to this time the success of the College, which had been founded in 1867, had been disappointing. However in its final report, the Recess Committee recommended that one of the roles of the College was that of teacher training. Thus began a relationship between the Department and the Royal College of Science, which permitted the introduction into the country in 1900 of a new method of science teaching.

The foundation stone for the new Royal College of Science was laid in 1904 by King Edward VII, and the main part of the building, including the domed centrepiece was opened in 1911 by King George V. The erection of this edifice was a response to the growing number of science students in the city in the 1880s. For more than thirty years these had been housed in the Museum of Practical Geology, 51 St. Stephens Green, which was then reorganised as the Royal College of Science. By 1876 this college was providing full-time courses in Chemistry, Physics, Mathematics, Zoology, Botany, Geology and Engineering.[75] Due to unprecedented demand, by 1897 the larger number of students could no longer be housed in the St. Stephen's Green premises, and the authorities were forced to search for a suitable location.

In order to justify the expenditure of such a building, provision was made to accommodate a number of Departments of Government. It was reasoned as prudent to have the Department of Agriculture and Technical Instruction and the College of Science close to one another; so it was decided that the newly created Department would occupy numbers 1-5 Upper Merrion Street, with the College of Science to the rear.

> A Departmental Committee is at present inquiring into the whole subject of the reorganisation of the Royal College of Science, which will carry on the higher scientific and technical instruction and form, as it were, the apex of the educational structure over which the Department exercises direct control.[76]

So said T.P. Gill in his address to the educational section of the British Association at the Dublin meeting in September 1908. However, since 1902 systematic courses of instruction lasting three years

---

[75] *A Journey through Government Buildings,* Published by the OPW for the Department of the Taoiseach. Dublin: Stationary Office, 1997 p. 15.

[76] Gill, T. P. Address to the 1908 Dublin Meeting of the British Association.

for teachers of Science and Technology, as well as for Itinerant Instructors in '...the highest forms of Technical Agriculture and... in Science and Technology' had been held there.[77] Those who passed the necessary examinations were recognised as qualified to give instruction, and '...to earn grants in the subjects of their course aided by the Department'[78]. Summer courses for the training of science teachers would take place in the college, with practical work occurring in its laboratories. If the Department hoped to implement a more heuristic form of science teaching it was imperative that structures be put in place in order to train the instructors in this scheme. Writing for the Department's Journal in 1918 Gilbert T. Morgan on the theme of its chemical work made it quite clear that the College was vital to the Department:

> The Royal College of Science in Dublin is regarded by the Department as the culminating step in its system of science teaching carried on in the Secondary and Technical Schools of Ireland.[79]

It was noted in the Annual Report for 1900-01 that

> ...it has been gratifying to find that a large number of teachers were willing to sacrifice their holidays in the work of preparation for the coming session. They attended the courses with admirable punctuality and regularity; and in work, beyond the regular hours of the course, displayed a keenness and enthusiasm which were remarkable, and augur well for the future of Science and Art instruction.[80]

The following year the Department organised a second series of short summer courses, and courses in Chemistry were held at the Royal College of Science in Dublin. It was hoped that after five years the crisis of teacher shortage would abate with these measures. This turned out to be perfectly accurate as table 6.1 attests. The table below gives information on the numbers who attended and were certified in Experimental Science.

---

[77] Journal of the D.A.T.I., Vol.II, p. 132.
[78] Ibid., p. 133.
[79] Journal of the D.A.T.I., 1918 Vol. XIX, p. 42.
[80] D.A.T.I. 2nd annual general report 1902 , p. 69.

Table 6.1 Showing numbers of pupils who worked under the Department in secondary schools during the years 1901 – 1907.[81]

	First Year Syllabus		Second Year Syllabus	
Year	Total no. of teachers who attended.	No. of teachers who attended satisfactorily.	Total no. of teachers who attended.	No. of teachers who attended satisfactorily.
1901	196	173	----	----
1902	166	114	160	110
1903	164	103	105	87
1904	129	68	128	105
1905	141	72	91	57
1906	131	49	90	53
1907	41	16	90	84

By 1908, 689 teacher-students attended the course given by 98 instructors, and the College agreed to run courses in experimental science. This in turn led to setting up a special competitive course for science teachers, which led to the award of "teacherships-in-training". Free tuition and a maintenance allowance were included in this award. Around this time the Department initiated a scheme whereby supplementary training of National Teachers in Rural Science and School Gardening could be carried out in the College.

By 1910 almost 200 teachers had received provisional recognition as teachers of the subject. The numbers of teachers presenting annually remained fairly steady over the next decade.

[81] D.A.T.I. 7th annual general report 1907, p. 101.

Table 6.2 Total numbers of teacher-students who attended the summer courses of instruction in chemistry since the opening of the new college of science.[82]

Year	2nd Yr. Syllabus of the preliminary course of experimental science	Special course in chemistry 3rd year syllabus.	Special course in chemistry 4thyearsyllabus.	Special course in chemistry 4th year syllabus repeat section)	Total
1912	(No class)	32 (2 repeating)	18	17	67
1913	40	23 (3 repeating)	18	16	97
1914	(No class)	16	23	12	51
1915	36	26 (6 repeating)	16	14	92
1916	(No class)	24 (1 repeating)	20	9	53
1917	(No class)	32 (1 repeating)	23	9	64
	76	153	118	77	424

From 1915 onwards it was felt that the teachers in training were expected to have achieved the highest qualification in the practice of heuristic science instruction, and consequently this course was not renewed. From 1914 onwards a new course in applied chemistry which was intended mainly for teachers in technical schools was initiated. This was aimed at those who were already qualified as science teachers and who held either a university degree or equivalent.

121 teachers of Experimental Science attended the summer courses held at the College in July and August of 1918, and this number rose to 125 in the following year. There were no courses held at the College for the summer of 1921 due to the state of emergency, which existed in the country at the time. According to the 1921 – 22 Annual Report it was stated that:

The Department had made arrangements for the usual Summer Courses for teachers engaged in Technical and Secondary Schools working under their regulations for such schools, but, owing to the conditions prevailing throughout the country during the month of July it was not found possible to hold the courses.[83]

[82] Morgan, G. *Chemical Work of the Department of Agriculture and Technical Instruction*. D.A.T.I. Journal, Vol. XIX. Dublin: HMSO, 1918, p. 45.
[83] D.A.T.I. 21st annual general report 1921, p. 73.

6.8 Heurism and the Department, Br. Burke's evidence

The study of heurism in Irish science education would not be complete without reference to Brother James Dominic Burke of the Christian Brothers' Schools, who was based at the North Monastery in Cork for most of his life. Mention has already been made in section 5.7 of Br. Burke's association with the Department at the Cork Exhibition of 1902. Long before Armstrong had begun his heuristic crusade, Br. Burke had adopted his own style of Pestalozzian heurism. Together with his lively personality, he taught science and technical subjects to his pupils, achieving results with his classes that did not go unrecognised. He lost no opportunity to exhibit this methodology and its results, so much so, that he could be considered, like Armstrong, to be on a crusade of his own here in Ireland.

Writing between 1909 and 1910 Fletcher refers to Br. Burke's endeavours around 1899:

> At the period referred to (1899) the South Kensington authorities were responsible not only for such evening classes in Science and Art as existed, but also made grants in aid of the teaching of drawing ... for a type of Day Secondary School, knows as Day Schools of Science. Only two of the latter existed in the whole of Ireland, viz., the Christian Brothers' School and the Christian Brothers' College in the City of Cork, which institutions, largely owing to the enthusiasm and devotion of the late Brother Burke, had become famed for their progressive and practical work as Secondary Schools.[84]

In an article published in the *Christian Brothers' Educational Record* in July 1904, an argument is proposed that far from being in a very neglected condition prior to 1900, both scientific and technical education both existed and thrived in the Brothers' schools. When Dr. Preston was appointed Senior Inspector of Science Classes in Ireland under the South Kensington Department, he visited the Brothers' schools in the North Monastery and St. Patrick's Place in Cork and was very enthusiastic about what he witnessed. He even proposed that both schools be used as models for the rest of the country. By 1904:

> Both institutions have been altered very much since; they have shared in the impulse resulting from the general awaking (by the Department); but it is still true that they may be

[84] Fletcher, George. *Summer Courses of Instruction for Teachers*, DATI Journal, Vol. X, Oct. 1909 to Jul.1910, p. 60.

unhesitatingly pointed out as the model exponents of that system of technical education that is being at present advocated by our educational authorities, and that is being embraced by the majority of the Secondary Schools in the country.[85]

The 'system of technical education' mentioned above incorporated Armstrong's heurism. The fact that the Department had heurism at the top of its agenda was clear from the evidence given by Br. Burke to the Palles Commission of 1898. The context of the questioning was to try to establish whether the heuristic method could be examined under the system, which existed at that time. He was questioned firstly by Dr. Barkley and then by Palles:

If it were found possible to adopt the examinations of the Science and Art Department for the particular subject matter of chemistry and physics, would that answer the purpose?

It would. I think that if some connection could be got with the Science and Art Department, the Intermediate would be the gainer and the country would be the greater gainer because the Department has money at its disposal, which is now being handed over. I think Scotland has got her share of it, and I fancy Ireland ought to come in too.

Chairman:

How could an examination be held that would test whether a boy had been well taught on the lines of the Heuristic method?

Well, of course it would be easier to test him in the usual practical way; but I think that by arranging a series of questions outside the ordinary paper, in order to see what he had been actually engaged in developing, you could sufficiently test a large number of boys in the work they had done.

Could you do that by a purely written examination?

No; a viva voce examination.

Would it be possible under our system to have such an examination?

I think it would.[86]

In the beginning of the twentieth century there was much vagueness about the meaning of the term 'heurism'. Nevertheless the method was enthusiastically embraced throughout the British Isles, but Br.

---

[85] C.B. Educational Record, *Pioneers of Technical Education*, J. Comerton as quoted in *The Irish Technical Journal*. Dublin: Browne & Nolan, 1904, p. 212.

[86] Kelleher, p. 123.

Burke would not have been in total agreement, as he had managed over the years since the 1860s to achieve a balance of heurism with the necessary bookwork and consequent written examinations. He had been careful not to implement completely the heuristic methodology, but had modified it in such a way as to achieve the educational aims he felt were justified.

> We are fortunate that there exists a detailed account of his teaching methodology (Br. Burke's). It shows the use he made with modifications of the heuristic method, which was to become very popular during the end of the nineteenth century. Thirty-five years later, this methodology was advocated by a government department.[87]

In an article which appeared in the *Irish Teachers' Journal* on 26th July 1902 reference was made to the joint policies of both the National Board of Education and the Department:

> Our readers are aware that the Commissioners of National Education have introduced a course of Experimental Science into the curriculum of the Primary Schools, and a similar course has been introduced into the Intermediate Schools by the Department for Agriculture and Technical Instruction. The programme for the two classes of schools is almost identical, and the mode of teaching recommended under the two Boards is the same. That method is what is known as the Heuristic, or, better, the Inductive.[88]

George Fletcher, who spoke on the 11th July, 1906 came closest to categorising the Department's method of introducing secondary school science as heuristic when he said:

> There is no necessity to make a fetish of the inductive method, but it is surely wise that in teaching the fundamental principles of Science we should seek to place our students as far as may be in the attitude of investigators.[89]

Even if not mentioned by name this philosophy of Fletcher's paralleled that of Armstrong. As already discussed in section 6.3, some of the people recruited by the Department to staff the technical branch had strong connections to Armstrong himself. E.M. Rich who came to the DATI along with Robert Blair had more than just professional connections. Writing in June of 1938 for the Central (a journal of the Old Students of the College known successively as the Central Institution), Rich writes:

---

[87] Ibid, p. 48.
[88] *The Irish Teachers' Journal*. July 1902. p. 4.
[89] Fletcher, George. *The Place of Science in a General Education*, p. 654.

> Let me begin by saying that I must have met the Professor when I was quite a small boy, and that his family and mine were on terms of close intimacy right up to his death. It was not, however, until 1892 that I really got to know him and his work, for it was then I entered the Central Technical College. It was his influence, which led me to take up an educational career. From then onwards I was in close touch with him, and I shall not easily forget his greeting to me when I saw him on his deathbed. His greeting to me was, "Rich, you ought to sack the lot." He was, of course, referring to teachers as a whole, but when I suggested that it might be well to tackle the job piece-meal he was clear that he would start with the Training Colleges. It will thus be seen that he was a fighter to the last.[90]

Armstrong felt that the teachers were '...the method's weakest point,' [91] and that this contributed greatly to the decline of heurism. He saw his heuristic method reduced to almost mechanical exercises in the classroom and would have realised from its earliest stages that his concept of heuristic practices and that of a practising teacher were not similar. Perhaps Armstrong's own lack of classroom teaching experience led to this naivety. It is also my belief that through a process of 'networking' many of the influential members of the Department came to be recruited. Even though there is little documented proof of it working with respect to enlisting of staff for the DATI, there is proof that this networking existed and was practised at this time by ex-members of the Department.

Robert Blair, who left the DATI to join the London County Council as Education (Executive) Officer in June 1904, used his influence to recruit E.M. Rich, J. Cameron Smail and Beresford Ingram who were still with the Department in Dublin. Rich had been a pupil of Blair's at Aske's Hatcham. Writing to Rich in October 1904, Blair informed Rich that:

> I am anxious to know whether if I can create a post in London of £400 a year – whether the post be inside or outside – you will become a candidate. I cannot undertake to put you in; but I believe I could do a good deal towards it.... Bear in mind your chances in Ireland and give me a definite reply...I am not sure if I could pull off a second at present but if so I have Smail in mind.[92]

---

[90] Rich, E. M. *The Central*, Vol.XXXV, No.83, London: W. Brown & Co. Ltd., June 1938, pp. 81-82.
[91] Brock, p. 51.
[92] Blair, R. *Policy-Making in Education: Robert Blair and the L.C.C. 1904-1924*. London: D.W.Thoms 1980, p. 1.

Who was responsible for recruiting these four men cannot be established at the present time. It is highly probable that they were brought over from Britain in order to help formulate the heuristic strategy that the Department adopted towards the teaching of science in the Intermediate schools at this time.

6.9 The Digby Inquiry, the strongest references to heurism in the Department's policy

The accusations levelled at the Department regarding expenditure of public monies on Intermediate rather than Technical education (for which it was primarily intended), included employing English and Scotsmen to do the work of Irishmen plus allegations of corruption. These led to the appointment of a Committee of Enquiry in 1906, under the chairmanship of Sir Kenelm Digby, to enquire into the workings of the D.A.T.I. The implementation of the 1899 Act, the way in which funds were being distributed by the Department and its relationship with the local authorities as well as other Departments were to be investigated and reported on. Although the scope of the inquiry was to focus primarily on technical education, the Intermediate schools also came to be mentioned in the final report, which was published in mid 1908. Many of the senior members of the Department were interviewed, some at great length – over days in fact. George Fletcher, who had succeeded Robert Blair in 1904 as Assistant Secretary with respect to technical education, was one of the senior officials interviewed by the committee. He went into considerable detail about the development of the Department's policy from its conception to its implementation. He stated clearly that the organisation of a system of practical science instruction in both primary and secondary schools was imperative in establishing a permanent system of technical education. He went to great lengths to emphasise that the best possible people were involved in this implementation:

> In drawing up our programme we had in full view the schemes which had been at work in Great Britain and elsewhere. My predecessor, Mr. Blair, had a wide experience in England and Scotland. I myself had wide experience in England, and we were fully aware, I think, of everything that had been done both in England and elsewhere in regard to science work in secondary schools.[93]

He also made it quite clear that the Department favoured the heuristic approach, even though he did not use this specific word. The term he used was that of 'scientific method':

---

[93] Evidence given to the 1907 Digby Inquiry, Cd.3573-3574, xviii, p. 124.

> Without burdening the Committee with a full statement of the reasons for this system of practical teaching, I would remind them that we regard the training in scientific method conferred by this practical work as being of great importance.[94]

He explained that '...the best results of the training are not so much as can be written by a written test...'[95] However at the 48th public sitting of the enquiry, on the 22nd November 1906 at Great George Street, Westminster, Fletcher once again faced the committee. He voluntarily gave evidence on the teaching of experimental science from the Department's point of view. After giving an account of the early history of this aspect of science teaching in the country he said:

> The Department therefore initiated the system that is now followed in the secondary schools. Will you allow me to say in one word what that system is?...The idea was to introduce a system which should be more practical in character, more educational, and in which the keynote should be the work performed by the student himself. In other words, it was thought that very much of the information that was given respecting scientific principles was a mere accretion. It was soon forgotten; and one of the guiding principles in the new system introduced is that the student should not be told any thing that he may fairly be supposed to find out for himself.
>
> (Chairman) – *That is what has been described as the "heuristic" method?*
>
> (Fletcher) – If I may say so, I very much dislike the use of the word. There is no need for the introduction of it, and a very great deal of discredit attaches to it. The discredit which attaches to it does not attach to the system as followed in Ireland, but one has again and again to discriminate between the work and the discredit attached to the name. The system is experimental, following roughly the inductive method which has been followed by good teachers from time immemorial.[96]

Why Fletcher was so vehemently against the use of the word heuristic can only be speculated upon. It is certainly possible that this term might have been consciously avoided by the Department in an effort to avoid association with those schemes being applied in Britain at this time. As contended in section 5.2, Plunkett saw the Department as being distinctly a Department of the Irish people. What is difficult

---

[94] Ibid., p. 124.
[95] Ibid., p. 124.
[96] Ibid., p. 946.

to reconcile is that the Department avoided the use of the term 'heuristic', a method which it was actively applying in its schemes for the Intermediate schools. From Fletcher's words one can also deduce that the Department were utilising a variation on the heuristic method of Armstrong.

The Department's regulations did not exclude the teacher from doing the experiment himself, yet in his evidence Fletcher indicated that they were having problems making this particular aspect clear:

> All those who have been engaged in educational work hold that when a student does a thing for himself he is much more likely to remember and to assimilate it, and it is much more educational in character than the mere memorising of information prepared, for the most part, in order to pass a written examination. We have broken in upon that, and I believe we have broken in upon it successfully. But as to the point whether a teacher may demonstrate, there seems to be a good deal of misunderstanding.[97]

Probably the most revealing evidence given before the committee was from the Christian Brother who had been trained and taught beside Br. Burke in Cork. Br. Hennessy went to great lengths to explain how the D.A.T.I. organised its courses and he outlined the particular methodology, which the Department insisted upon in the secondary schools. He said:

> The heuristic method must be followed, the boy experimenting, observing the relation between cause and effect, deducing definitions, and recording systematically the various stages in his operations.[98]

In his visits to the 61 Christian Brothers secondary schools spread throughout Ireland he observed the effects that this particular methodology was having in these laboratories,

> ...and I was much impressed by the keen interest which they displayed in their work and the intelligence which they showed in answer to my questions. The system is educational to a high degree, and is well calculated to develop, not only the "scientific method" but to awaken a love for Science, and to induce a continuance of its study when the boy shall have left the secondary school.[99]

However, even he was not totally convinced that this total heuristic approach was realistic, particularly with regard to the time required to pursue it in the school laboratory. It is more than likely that the

---

[97] Ibid., p. 946.
[98] Ibid., p. 946.
[99] Ibid, p. 916.

Christian Brothers were following a heuristic course halfway between those of Br. Burke and Armstrong. His argument was that with a more judicious use of teacher demonstration in order to save time, the pupils would gain a much wider knowledge of Science at the end of each school term. The influence of Br. Burke on him may possibly be seen in his choice of words to the committee when describing this particular modified approach.

> The Department insists, unduly, on the "heuristic method"; undoubtedly a very educational method if time were not so valuable. I would like to see a judicious mixture of methods. It is indeed educational for the boy to work out and record each stage of his experiment, but surely it is not uneducational for a teacher, with his superior knowledge and manipulative skill, to experiment under the attentive gaze of his pupils, and to require them to record accurately the result of their observation of his work.[100]

Br. Hennessy was then asked about the insistence by the Department on the heuristic approach towards science teaching. Mr Ogilvie asked him:

> *...does the Department insist upon the absolute adherence to the heuristic method*?
>
> Not absolute, but is insists on it very much.
>
> *Does it exclude the performance of experiments and description and deduction from it by the teacher?*
>
> It discourages such.
>
> *It does not forbid it but discourages it, and wishes the boy to do everything?*
>
> Yes. The boys, after working an experiment in the way I have described, might observe the teacher doing another experiment. He would lead the boys along, question them, and they say, after the experiment is concluded, "Now go and record all that you have seen." The boys would in that way get through more rapidly than if twenty of them were experimenting at a time, and so a wider course would be covered.
>
> *That is discouraged in what way?*
>
> If you read the Department's syllabus and directions, you will find that they insist very much on the heuristic method, and don't suggest any such course as I describe. I know from the inspectors, it is the wish of the Department that most of this work should be done by the boys.

[100] Ibid, p. 916.

> In the remarks which I have made I must not be taken as being unappreciative of the wonderful impetus given to the study of Science in secondary schools by the advent of the Department of Agriculture and Technical Instruction. Previous to 1900 the Intermediate education system was unduly literary, though it by no means deserved the reproaches which many and influential critics showered upon it.[101]

This evidence shows that the Department did indeed pursue a deliberate course, certainly up to 1907, which dictated that the heuristic or 'scientific method' form of instruction be practiced in the school laboratories of Ireland. Very little flexibility appeared to be given to teachers to work outside this methodology.

6.10 Sir William Ramsay and the heuristic debate

In the summer of 1902 a large number of Intermediate teachers underwent a course of training in the teaching of Elementary Physics and Chemistry under the auspices of the Department. This course was carried out in the Royal College of Science in Dublin. For its Chemistry course the Department had secured the services of the Scottish chemist, Sir William Ramsay. Ramsay was already a very famous scientist and had by that time discovered all the inert gases except radon, which he discovered and isolated the following year. (This pioneering research work would be honoured by the Nobel Prize for Chemistry in 1904).

Lecturing in the College of Science on the theme of progress of discovery in Chemistry, he made reference to the heuristic method of teaching. He referred to it in rather derogatory terms and this made its way onto the pages of the national and intermediate teachers' weekly journal. In an article published on 26th July 1902 the following paragraph appeared,

> ...during a recent lecture he [Ramsay] referred to the Heuristic method of teaching. He stated that the notion that we can train boys to teach themselves the science of Chemistry by the Heuristic method is "rank humbug".[102]

The significance of this remark is demonstrated in the following passage which voiced the concern with respect to the policies of both the Department and the National Board, which were so similar:

---

[101] Ibid, p. 916.
[102] *The Irish Teachers' Journal*. July 1902, p. 4.

> Here we have one of the most eminent chemists of the day describing, in rather strong language, the methods of teaching science proposed by both the Commissioners of National Education and the "Department". It will, therefore, be of some interest to examine the value of the assertion made by Sir William Ramsay, as if he could establish the truth of his statement, the methods of scientific instruction in both our Primary and Intermediate Schools should be radically changed.[103]

The Journal then went on to argue that even Ramsay's discovery of the inert gases was based on the application of a heuristic methodology. That is, when he noticed that in the preparation of nitrogen by the oxidation of copper by atmospheric oxygen, its density was one-half percent greater than the density of nitrogen extracted from compounds, such as nitrous oxide, ammonia, and ammonium nitrite. He could not discover any impurity, which could explain the excessive weight in one case, or the deficiency in the other. Storage for eight months did not disturb the density of the chemically extracted gas, nor had the silent electric discharge any influence upon either quality. The determining piece of apparatus was appropriately the balance, upon which Armstrong had himself put so much in store as part of his heuristic course for elementary science. Ramsay found that the nitrogen gas manufactured in one way had a greater density than the nitrogen gas manufactured in another way. He therefore concluded that one of the gases was impure and that it must be mixed with some other substance. That substance proved to be a hitherto unknown gas, now called argon.[104] Teachers who instruct pupils under the heuristic method endeavour to train them to draw no conclusion whatever when they have no grounds for arriving at a conclusion. However what is implicit in this training is that they be able to reason accurately. The problem is that the pupils must suspend judgement, acknowledge their lack of understanding at that moment and somehow preserve an open mind. This in a nutshell was the challenge put before the science teacher employing the heuristic method.

On August 2nd Ramsay replied in a letter to the Journal, in which he stated that whilst he agreed with their defence of heuristic teaching, '...the pupils are trained to draw no conclusion whatever, when they have no grounds for arriving at a conclusion...no conclusion whatever will ever be drawn by a child'[105]. However the Journal argued that when science was taught properly, the pupil could not but

---

[103] Ibid., p. 4.
[104] *The Irish Teachers' Journal*. July, 1903, p. 5.
[105] *The Irish Teachers' Journal*, August, 1902, p. 3.

draw conclusions, more importantly, in a way which will give the pupil the mental training which may in some (those with a natural aptitude for research) lead on to pioneering research not unlike Ramsay's. The main argument against the use of the heuristic method as proposed by Armstrong was that there was not enough time available to the pupil in their normal school-life to verify every statement uttered by the discoverers of science and to put these statements to the proof. In this belief Armstrong was certainly misinterpreted, but his lack of clarity in this domain must be held in question. In its reply the Journal gives a clue why both the National Board and the Department chose this particular methodology with respect to science instruction:

> But this [above argument] has really no bearing on the question whether Science in school should be taught by the Inductive method or not. The aim of the Science course is not to teach Chemistry on the one hand, or Physics on the other. Its aim is the education of the pupils by the cultivation of faculties, which cannot be developed without exercise, and which will not be as well cultivated in any other way as by the study of some branch of experimental science.[106]

Ramsay closed his letter with strong criticism of the system,

> ...it is an ignorance of chemistry on the part of the propounders of this system, and a wholly unphilosophical view of the function of the Teacher, that could possibly have led to its inception.[107]

Why then was Ramsay actively involved in promoting this very same system by assisting the Department in the training of its teachers? Armstrong and Ramsay had disagreed very strongly as fellow scientists back in 1891, when Armstrong, using his Presidency of the Chemical Society, called into question Ramsay's and Rayleigh's discovery of argon in the atmosphere. Jenkins suggests the fact that Armstrong missed an opportunity to promote his heuristic methodology by focussing on the mode of Ramsay's discovery, and that he did not do so was an indication of the level of bitterness between the two men. In 1891 Ramsay had claimed that,

> ...the conclusions to be drawn were those which it had taken men of genius 150 years to deduce and, as such, it was not expected that the average schoolboy should make out such deductions for himself.[108]

---

[106] Ibid., pp. 3-4.
[107] Ibid, p. 4.
[108] Jenkins, *E.W. From Armstrong to Nuffield.* London: John Murray, 1979, p. 44.

Ramsay lecturing at the Royal College of Science could be explained simply as an opportunity he availed of to pass on his own expertise to a new generation of pedagogues during a few summer weeks. The Department's system was professed openly as promoting the 'scientific method' and they avoided used the term 'heurism'; Ramsay might well have seen the Department's method of science instruction as more in line with his own investigative style, and so 'matters heuristical' would not have been an issue for him. What caused him to make the remark however remains a mystery.

The Journal closed the debate with the following sentiment:

> We make no apology for referring at length to the subject of the Heuristic teaching of science, as we regard the subject as of truly National importance. While we have no doubts on our own mind that the Heuristic is the proper mode of teaching science, we cordially invite those having experience of science teaching to state their views on the subject. It would be especially interesting to know whether time has confirmed the views put forth in the Report of the Committee of the British Association for the advancement of Science, or whether the members of that Committee now hold, with Sir William Ramsay, that "the Heuristic system, as applied to Chemistry, is rank humbug."[109]

[109] *The Irish Teachers' Journal*. August 1902, p.4.

Chapter 7

How some Intermediate schools fared under the Department of Agriculture and Technical Instruction

7.1 Introduction

It is the intention in this chapter to attempt to show how the Department's heuristic policy in implementing a more practical approach to science instruction influenced the teaching of science in some Intermediate schools. It is provided as a small window through which one might look some one hundred years later, with hindsight. Some schools have preserved their history well, and it is due to the care these schools took of their written history that it is possible to look back in order to discover how these schools coped with the regulations that were imposed upon them in order to secure monetary grants. For all of these schools the association with the Department of Agriculture and Technical Instruction proved a fruitful one, laboratories were built and equipped. For some it proved bountiful. For the schools which already had a tradition established through their connection with the South Kensington Department, the Irish Department allowed continued progress to be made in practical science instruction. In a few of the schools this tradition continued long after the demise of the Department, and excellent practical work was still being carried on decades later.

7.2 The early years

Not all schools which taught under the Intermediate Board did so with the full support of the parents. In a report by management committee of Wesley College published for the year ended 31st January 1883 the following extract appeared:

> We regret to learn that there is a growing dislike to the Intermediate System, and that many parents positively prohibit their sons from competing. This is partly owing to the impression that to do so must interfere with the courses of study specially preparatory to the avocations for which the boys are intended, and now that the rewards of success are so much reduced in value, there is less inducement for the better class to appear in competition.[1]

[1] Wesley College Report, 31st January 1883. No page number given.

The number of pupils doing Natural Science under the Intermediate Board in 1884 was 40 out of a school roll of 268, and in the following year when there were 240 pupils in the school, 27 were following the Chemistry course. The school benefited each year, particularly when its scholars did so well in science as they normally did. The total monetary value of exhibitions, scholarships and prizes for the years 1888 amounted to £1,213.[2]

The number of pupils who followed the Natural Science course in Wesley College the following year was 40 out of a school roll of 268, and the school earned in excess of £1,000 in exhibitions, scholarships and prizes per annum. Wesley had worked under both the Intermediate scheme and the Department of Science and Art, South Kensington since the late 1800s. Armitage says of this period in the school's history that:

> South Kensington courses and examinations in science and art were introduced and a chemistry laboratory was equipped with rising tiers of seats to enable the boys to see what the master was demonstrating on his table.[3]

Each year a form of prize day heralded the end of the school's academic year and at some of these a 'spectacular' in the form of a science demonstration took place for the amusement of the assembled pupils and guests.

> The Prize Distribution was held towards the end of the year and included instrumental music, a boarders' choir, recitations, and occasionally a demonstration of gymnastics or scientific experiments or 'magic lantern' pictures.[4]

The Chemistry examination for 1892 was indicative of the type of questions which were asked under the Intermediate Board, with the emphasis on memory:

Examiner: Francis Heron, B.A., F.I.C.

1. Mention two ways in which Chlorine Gas may be prepared, indicating the changes which take place by means of equations.

---

[2] Wesley College Report, September 1889. No page number given.
[3] Armitage, Ernest. *Wesley College Dublin 1845-1995 An Illustrated* .Dublin: Wesley College, 1995, p. 33.
[4] Ibid, p. 33.

2. How is Nitric Acid prepared? Mention its action on the following Metals – Silver, Copper, Tin.
3. What is Laughing Gas? Describe the method of its preparation.
4. One Thousand litres of Hydrogen are required to fill a balloon, the temperature being 15°, and the barometric pressure 756 m.m. What weight of Zinc and Sulphuric Acid will be required to produce this quantity of Gas?
5. If excess of Carbonic Acid Gas be passed into Lime Water, why does the precipitate first thrown down re-dissolve?[5]

The new headmaster of King's Hospital, Thomas Parry Richards, a Welshman who was appointed in 1897 appraised the condition of the school in the same year and noted that whilst the rest of the subjects being taught were healthy the state of science teaching was 'weak'. There are records in the archives of the school that provide evidence that the school was connected to the South Kensington Department as far back as 1891 when Mechanics, Electricity and Magnetism were being taught under the Science and Art Department.[6] Richards was himself an accomplished classicist and this is reflected in his quarterly reports which make for very interesting reading in examining the Department's work, even if his view is slightly biased. The school had a loose connection with Christ's Hospital in Horsham, both schools having the same uniform for a particular period. This connection might have originated from Richards; he had been educated at Cambridge and so may have established the connections here. In June of 1901 he wrote:

> The school is now fairly well equipped as far as the requirements of a classical, mathematical or commercial education are concerned but it is sadly deficient in scientific and technical teaching. It is probable that the Intermediate authorities will attach great importance to science and that to meet their demands a Laboratory will be necessary.[7]

Wesley College which led the way in the early years of the Department's scheme recorded the following in the Report of the Management Committee in September of that same year:

---

[5] Wesley College Quarterly, 1892. Printed: R.T. White, Dublin published by The Editorial Council, Wesley College, Dublin.
[6] King's Hospital Committee Book, 21st November 1891 p. 101.
[7] Headmaster's Report, King's Hospital. June 1901, p. 26.

> The Principal reported that the Sub Committee had before them the question of improvement and extension of the laboratory and after carefully considering the matter had accepted an estimate... for sum of £140.... The Principal also reported that deputations had met Mr. H. Plunkett President of Board of Technical Instruction and also Mr. Baird[8] Chief Inspector and that they had been received in a most friendly manner and assured of every assistance being given.[9]

Plunkett was anxious that the Corporation should provide grants to the school, and following this meeting the Headmaster of Wesley, Rev. Crawford called a meeting of the heads of both Roman Catholic and Protestant schools in Dublin to ensure that, '...the necessary steps had been taken to request the Corporation to receive a deputation.'[10] The school records indicate that Crawford was dominant in the role of co-ordinator of the schools in presenting a united front to the new Department:

> From 1902 the Department of Agriculture and Technical Instruction began to pay grants for practical subjects, including experimental science and drawing, provided that inspectors were satisfied with the teaching facilities. During the negotiations for these grants Rev. Mr Crawford took the lead and summoned a meeting of the heads of secondary schools in the Dublin area, both Roman Catholic and Protestant, which formed a deputation to present a united viewpoint to the Dublin Corporation which was to pay the grants.[11]

It would appear from what was reported in these minutes that Wesley College was,

> ...far in advance of many of the other schools in what had already been done to meet the requirements of the new scheme.[12]

Later the Board approved the setting up of a temporary room for the teaching of Physics, and this was fitted up. Apparatus was purchased and under the able stewardship of Mr. F. C. Cramphorn B.A. of Emmanuel College Cambridge, classes were begun in earnest. Cramphorn possessed an honours degree in Natural Science and had previous experience of being in charge of a laboratory at another school. Cramphorn had written a science textbook titles *Introductory Chemistry. Notes on the First Year's*

---

[8] Probably this was in fact Robert Blair.
[9] Management Committee Minutes, Wesley College. September 13th, 1901, p. 18.
[10] Ibid, p. 19.
[11] Armitage, p. 36.
[12] Management Committee Minutes, Wesley College. September 13th 1901, p. 19.

Course, based on heuristic methods whilst teaching under the employ of Kings Hospital. Such highly qualified and experienced men were hard to come by as Richards confesses in his report:

> The demand for science teachers both in Ireland and in England is so great that it is almost impossible to obtain them. I am not far wrong when I say that the difficulty ruined my holiday and cost me nearly £20 that I could have spent on a change after such a long period of work.[13]

Richards further claimed that the new science scheme as directed by the Department of Agriculture and Technical Instruction will '...bring great expense upon the school', as he foresaw the erection of a new building or the conversion of the Infirmary block into physics and chemistry classrooms. His feeling that the new scheme might be just a fad and quickly pass may certainly have crossed more than one headmaster's mind in Ireland at this time. As a man trained in the study of classics it might even have been a source of hope.

> Further we are not certain as to the demands of the Commissioners. The present programme is a tentative one and for all we know, science may again become of secondary importance.[14]

The school not unlike quite a number of other schools was operating on a very tight budget. The demands of this new department seemed excessive in terms of expenditure. Grants were available from two sources, the D.A.T.I and Dublin Corporation. In fact, loans were also available from the Intermediate Commissioners, but many schools avoided this borrowing tactic and availed of the grants instead. In December of 1901 the school was visited by an inspector from the Department and the two classrooms viewed were approved by him. This satisfied the Department on the issue of two Lecture Rooms.

In the Friends' school Lisburn, science instruction was held in chemistry, magnetism and physiology under the Science and Art Department. In 1890 twenty certificates were awarded including five in inorganic chemistry, and classes in all the named science subjects continued with electricity being added to magnetism to make a single subject.[15]

> With the introduction of the D.A.T.I's scheme, some modifications were made to the school which may have been made to allow for this which included the rather odd conversion of a small teachers' sitting room into a physical laboratory and classroom in 1902, and another

---

[13] Headmaster's Report, King's Hospital, p. 36.
[14] Ibid., p. 46.
[15] Newhouse, N. H. *A History of Friends' School Lisburn.* Lisburn: LM Press Ltd., 1974, p. 69.

modification to the chemistry laboratory which was enlarged and provided with a balance and store room.[16]

The type of chemistry teaching practised early in the new century can be glimpsed in the recollections of some of the school's past pupils:

> It was in Chemistry, however, that we had our greatest thrills. The lesson is Oxygen gas prepared by heating Potassium Chlorate. Phosphorus is burnt in a jar of this gas with great pyrotechnic effect and iron filings oxidise with a coruscating shower of sparks; whilst experimenting he was explaining each step; John Ward, of the Medical Hall, Lisburn, came up frequently when these classes were on – I think for entertainment – and he was warm in praise of the success of the experiments. At the College of Science afterwards I witnessed similar brilliant experiments by Prof. Hartley, but then he had an assistant who prepared everything.[17]

This type of recollection is reflected in many other schools by pupils who experienced the dramatics of either demonstrations or practical work. Professor J.P. Ryan recalls his days at St.Mary's in Portlaoise under the Christian Brothers:

> In 4th or 5th Class, too, we looked forward eagerly every week to a Science demonstration lesson given by either Bro. Curtin or Bro. Cronin. I recollect vividly our amazement at what I now recognise as the burning of sulphur in oxygen and the dazzling glare of burning magnesium ribbons. There was always something spectacular to impress us in these classes even though we might not be very clear on what was really happening![18]

Under the Department of Agriculture and Technical Instruction there was a large uptake of science in the school, and the necessary laboratories had to be constructed to meet this demand.

7.3 Some of the inherent dangers of the new scheme

The introduction of the heuristic approach to science instruction at primary, secondary and technical levels meant that for the first time in Irish schools the pupils themselves would perform the experiments.

---

[16] Ibid., pp. 86-87.
[17] Ibid., p. 93.
[18] St. Mary's C.B.S. Portlaoise. *Reminiscences of a distinguished past pupil, 1847-1947. Centenary Record 1913*, p. 91.

There were obvious inherent dangers attached to such a policy, and no other place was this evident than in the teaching of chemistry. In an article published in the *Irish School Monthly* in October 1906, the writer alludes to the result of the findings of a coroner's jury which found that a school-girl had died as a result of '...inadvertently swallowing a small quantity of caustic potash solution during the course of a practical lesson in chemistry.'[19] She had been pipetting the liquid and received a mouthful. There were suggestions that the Board of Education should review its syllabus in light of this fact. The problem was that in order to make the subject a safe one to practise in the school laboratory it would necessitate removing the very elements of it which made it so valuable as a practical subject. The value of being made aware of inherent dangers in an experiment was seen to be that it gave the student experience which would be needed in later life, be it experimentation or even momentary life saving decisions. The most dangerous part of a school experiment was seen to be, as in life, ignorance of the inherent danger. The teacher was seen to be crucial to the success of safety in the laboratory. Proper practical training was vital. The skill of proper pipetting was seen to be imperative among the students, as was the handling and dilution of concentrated acids such as sulphuric and nitric. The heating of solvents such as ether was also isolated as a potential hazard. But it was phosphorus which was given special mention as being of serious danger.

Laboratories were sometimes used by external teachers and classes and this was another risk factor, and such a case was outlined:

> In one such case the teacher had served out to each pupil the prescribed modicum of phosphorus, using all precautions. Two days later, the Principal noticed, on a casual visit, that the smell of phosphorus was still very pronounced in the laboratory, and returned at night to search in the dark. There, as he expected, was the greenish white glow of phosphorus on the floor, but in as many as six different places. The element being waxy was well trodden out on the wood. Possibly one pupil alone had been the cause of the danger, and had disregarded the smaller chips in the dish, and dropped them on the floor with the last few drops of water. The pieces had been then carried throughout the room by the feet.[20]

---

[19] *Irish School Monthly*, Vol. VIII, No.2, p. 48.
[20] Ibid., p. 50.

There were even instances where small amounts of phosphorus were carried knowingly or unknowingly back to a school by a pupil from a visit by a science class to an external laboratory. It is also interesting to note that over the centuries science pupils change little, as the following passage makes clear:

> Phosphorus, sodium, magnesium, etc., are delightful objects of possession to most beginners of chemistry, and one can almost hear the pupils say: "The teacher can't use these tiny scraps, and so..."[21]

The fact that so many dangerous and flammable substances were stored in the school must have invalidated many of the insurance policies, although it would appear that informing the insurance company negated this point.

Fume cupboards were also rare, and in some cases where they did exist, were not used as often as they should have been. Chlorine, sulphur dioxide and hydrogen sulphide were all produced openly by groups of pupils in the school laboratory at this time. Carbon monoxide could also be produced by the imperfect burning of gas by a bunsen burner, and there were suggestions that instances of coal-gas poisoning was the making of a huge subject in itself and the following advice was offered: 'A wholesome self-respect should be inculcated which will preserve the pupils from admitting deleterious gases into their lungs'.[22]

The teacher's action towards those pupils described as 'tricky' was two-fold, either instructing them well in the dangers in the experiment, or if this failed then outright exclusion from the science class. The risk of injury of National School pupils engaged in such a heuristic programme could be minimised by reserving the more dangerous materials for the advanced students without loss to their elementary training. It was suggested that these young pupils should not be allowed to handle such substances as phosphorus, and that such dangerous experiments be demonstrated by the teacher instead. An interesting insight into another application of the practical programme is that it provided the pupil with an opportunity to learn important lessons which would stand him in good stead having left school.

---

[21] Ibid., p. 51.
[22] Ibid., p. 51.

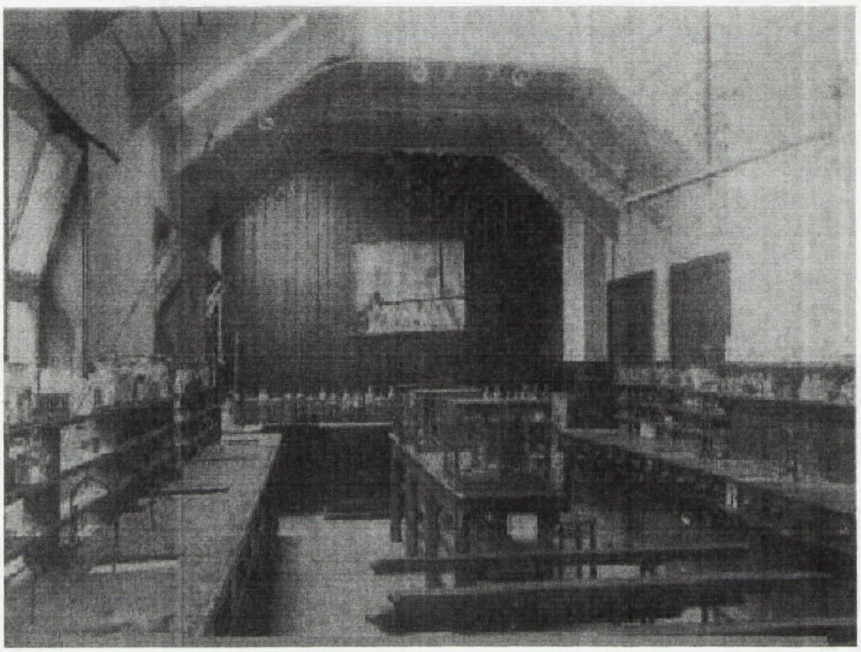

Plate 15. Science laboratory Wesley College in the early 1900's. Note the separate workbench and writing bench areas which characterise a heuristic laboratory.

> In the laboratory the numerous slight accidents that occur in manipulation of apparatus are full of instruction; they teach the young student to make his way safely, just as the falls and bumps received by the baby teach him to walk warily. In practical life the practical student will be found to be intelligent, dexterous, and resourceful in an emergency. The ignorance, thoughtlessness, and carelessness, which are the causes of accidents in life, are the very defects of character which the practical science courses are designed to remove...[23]

The head organiser of elementary school science at National School level, William Mayhowe Heller had his own suggestions about how dangerous or poisonous chemicals should be stored in the school laboratory:

> Phosphorus, acids and specially poisonous chemicals should be kept under lock and key, and the labels on the bottles should indicate the dangerous nature of the contents. The acid bottles should always stand on earthenware or porcelain saucers, so that table tops and therefore garments may not be spoilt by acid stains. Great care should be taken to explain to the pupils why these things are dangerous.[24]

7.4 The design of school laboratories

How does the typical structure of the science laboratory of a technical school reflect any degree of heurism? It is possible to identify similarities between the laboratories or 'workshops', which Armstrong designed and were built at Christ's Hospital School in 1902, workshops he felt, allowed for heuristic instruction. The design is basically classroom and laboratory as one, with the seating arrangements on one side of the room where pupils wrote up their practical work; the remainder of the room contained worktops with benches and stools. A blackboard was positioned in such a way to allow the pupils to stand around in order to analyse the results of class experiments.

It is possible to examine the layout of the chemistry laboratory in any school to see if it bears any resemblance to Armstrong's heuristic 'workshop'. For example the chemistry laboratory in the Technical School, Ballymena depicted this arrangement. Four rows of benches were arranged as in Armstrong's 'Davy' Laboratory at Christ's Hospital, and occupied one half of the room.

---

[23] Ibid, p. 52.
[24] *Irish School Monthly*. Vol. IV, No.2. July 1904, p. 366.

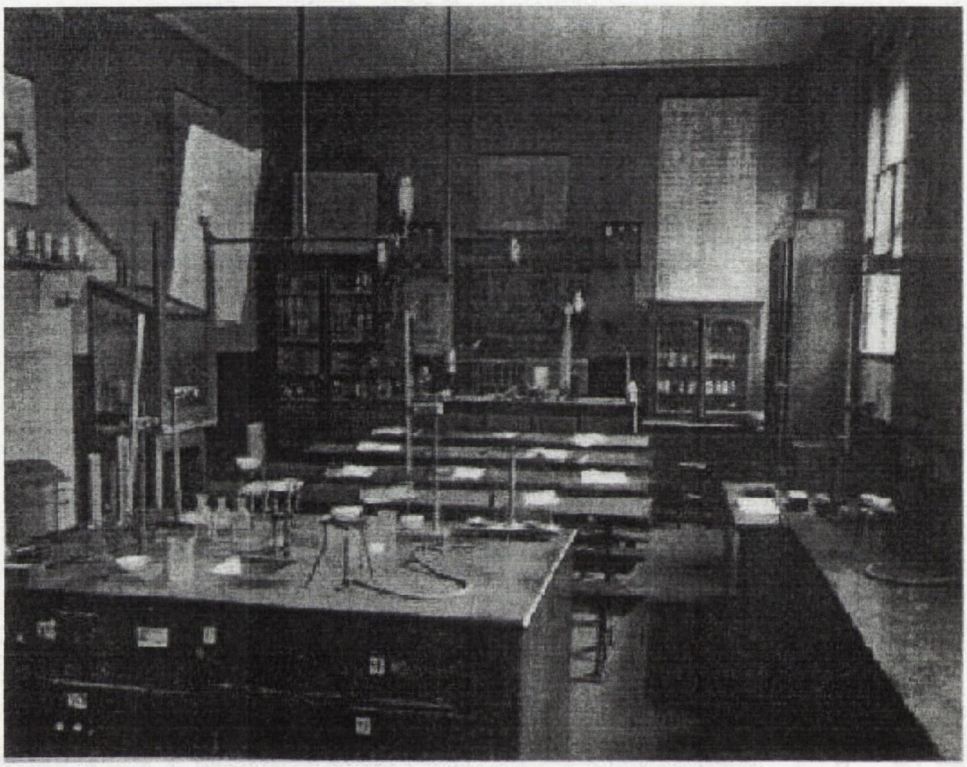

Plate 16. Municipal Technical School Ballymena, 1907. Note the separate workbench and writing bench areas in the room similar to the 'Davy' laboratory at Christ's Hospital school.

They faced the teacher's desk on which demonstrations could be carried out; behind this desk on the wall was a blackboard. The other half of the room was taken up by three large worktables at which practical work was performed. Along the walls in this area of the room, extra worktops were provided and a smaller table was placed against a wall at the rear of the room for a balance. In the D.A.T.I. Journal of 1907-08, this chemistry laboratory is described in detail. It was obviously constructed under the tightest of budgets and on the smallest of floor space:

> The exigencies of space demanded that one room should be used both for demonstrations and for practical work in science... It was evident that to equip this room satisfactorily as a Chemical and Physical Laboratory with modern furniture would mean a diminished expenditure on subjects of more immediate practical interest. Some old office counters with mahogany tops were therefore requisitioned, and with the aid of a carpenter were arranged along two walls and in the centre of the floor for chemical purposes, while ordinary tables are in use for Physical benches. At one end of the room is a demonstration bench 9 feet long, with a teak top, fitted with gas and water. A fume closet and distillation bench are fixed along the wall. In front of the demonstration table are arranged desks having accommodation for 20 students, and it is possible to accommodate 20 students for work either in Chemistry or Physics. Three cupboards, with glass fronts, for the storage of apparatus and shelves for chemicals, complete the equipment of this room.[25]

Heller writing in the *Irish School Monthly* in July 1904 gave his view on the arrangement of laboratories and the methods of fitting up apparatus in them. He felt that all schools should possess a workroom or laboratory. This could be a room provided with simple but strong tables from 2 feet 6 inches to 2 feet 9 inches in height; a sink and water tap with a gas supply was desirous but not essential. Fitting such a room he suggested would only cost '...a few pounds', and could be utilised for instruction in all practical subjects even literary. 'Sense, simplicity and space' were the mottos he advocated. However the key element to the design, and one which hallmarks a heuristic laboratory was the inclusion of,

> ...single benches 2 feet 3 inches wide, with all the pupils facing towards a demonstration table, is probably the best arrangement; if the floor space is restricted, double benches about 4

[25] D.A.T.I. Journal, Vol.VIII, 1907-08 pp.263-264.



Plate 17. Pupils of the North Monastery School Cork at the Cork Exhibition of 1902. This 'model' laboratory was specially constructed for the DATI by Phillip Harris & Co. Ltd. It appears to be modelled on an heuristic design in that the workbench and the writing bench areas are separate.

> feet wide will be required; if possible a considerable length of wall space should remain clear from the floor upwards.[26]

Several photographs have come into the possession of the author of school laboratories which were built under the Departments' regulations, and which conform to this suggestion by Heller. These photographs, some of which depict pupils actually performing science experiments reveal much of the heuristic methodology. For instance, the presence of balance scales (Armstrong's choice of core apparatus for any heuristic laboratory) and the centrality of its usage underline the importance of accuracy and recording of weighings under the scheme. Some schools, if they could afford it, actually had a special weighing room that adjoined the laboratory. It would appear that when Heller wrote the article many Irish National Schools were devoid of any of these 'special rooms' for experimental work. However, Heller felt that the provision of one or more flat-topped tables could enable '...much valuable individual practical work by the pupils.'[27] Some hundreds of schools were engaged in such an approach as detailed under the Commissioners' "Teaching Notes". Even so the emphasis on matters heuristic was still maintained:

> It is hardly necessary to insist once more, that a knowledge of an experiment which does not enable the pupil to carry out the experiment with accuracy and expedition is of very little use to him.[28]

Another design which appears in the school laboratories in the early 1900s is one which is mirrored in Armstrong and Heller's design of the 'Davy' laboratory at Christ's Hospital. One part of the laboratory is dedicated to workbenches, at which the practical work is performed, the other to an area where the students sat at desks in order to carry out the written work. This latter area had access to a teacher's desk on which demonstration work could be carried out and a blackboard. This exact layout is seen in the layout of Brother Burke's demonstration laboratory/classroom at the Cork Exhibition, which was constructed from plans drawn up by the Department of Agriculture and Technical Instruction.

The Department imposed strict conditions on the construction of these school laboratories and failure to comply with them resulted in the non-payment of grants. In the instance of King's Hospital this is reflected in the Headmaster's Report of June 1901 that says:

---

[26] *Irish School Monthly*. Vol. IV, No.2. July 1904, p. 365.
[27] Ibid., p. 365.
[28] Ibid., p. 365.

> The school is now fairly well equipped as far as the requirements of a classical, mathematical or commercial education are concerned but it is sadly deficient in scientific and technical teaching. It is probable that the Intermediate authorities will attach great importance to science and that to meet their demands a Laboratory will be necessary.[29]

Richards was conscious of the expense which this new scheme imposed upon the school.

> The scheme will bring great expense upon the school as it will be necessary either to erect a new building or to convert the Infirmary block into classrooms for Physics and Chemistry.[30]

He also felt, as is evident in his report, that the Department's scheme might not be as long-lived as expected: 'Further we are not certain as to the demands of the Commissioners. The present programme is a tentative one and for all we know, science may again become of secondary importance'.[31]

On 25th June, Richards reported to the school committee that there was only one room available which could be used as a physics laboratory and that he had submitted a plan for approval by the Department, but as of yet had had no notice from them.[32] He also reported later in the year that:

> The room which was approved of by the Board as a temporary one for the teaching of Physics has been fitted up. The apparatus necessary for this year has been purchased and the classes are now going on.[33]

By 5th July the Department had approved the lecture room on the conditions that only physics be taught and that this should occur in the new school term.[34] Expediency was obviously the call of the day. Richards was also informed that he was,

> ...authorised to procure, at an expense not exceeding £50 such requisites as are indispensable for the Physics course for the ensuing year, pending the Report of the Education Committee and Report of Board thereon under the resolution of the Board of 18th June.[35]

In October of the new school term, the committee examined the physics lecture room and the infirmary:

---

[29] Headmaster's Report, King's Hospital. June 1901, p. 26.
[30] General Board Meeting, King's Hospital, p. 36.
[31] Ibid., p. 46.
[32] Committee Book, King's Hospital, p. 260.
[33] General Board Meeting, King's Hospital, p. 34.
[34] Committee Book, King's Hospital, p. 262.
[35] Ibid., p. 262.

> They thought it might be found possible to form, in the existing Infirmary a sufficiently suitable Chemical Laboratory and Lecture Room, whilst keeping a portion of the Infirmary available for its present use... This would require a modification of the Infirmary rooms, none of which are sufficiently lighted for the scientific purposes required – The Committee here accompanied by the Chaplain and W. Cramphorn the science master, and the Committee requested both gentlemen to suggest to the next meeting of the Committee a rough scheme by which the two rooms could be practically adapted.[36]

And in November they had before them a plan, which showed in detail furnishing and fitting for the two rooms.[37]

The following summer, in order to retain continued approval by the Department, the committee inspected the infirmary buildings and reported,

> ...that the North Infirmary should be utilized as a Science Laboratory and that W. Sterling be requested to prepare a plan showing how the room can be made suitable for the intended purpose as to height light and ventilation with power to him to consult the Agricultural Department in company if possible with Sir Andrew Reed and Rev. D. Moore in time to report to the meeting of the 24th June.[38]

In December he requested that the Department send an inspector to examine classrooms No.1 and No.2 in order to have them passed as appropriate lecture rooms. The inspector did so and approved of them provided they were adapted according to the Department's wishes.[39]

By March 1902 Physics classes were being conducted and inspected, the laboratory was reorganised for another year. In his report Richards noted:

> Owing to the changes made by the Intermediate Board, as expressed in a recent circular, we are masters of the situation and we cannot now be forced to incur the great expense of fitting and equipping two laboratories in the same year. A grant may be obtained:
>
> 1) From the Board of Science and Agriculture
> 2) From the Corporation.

---

[36] Committee Book, King's Hospital. 10th October 1901, p. 265.
[37] Committee Book, King's Hospital. 14th November 1901, p. 266.
[38] Committee Book, King's Hospital. 10th June 1902, p. 279.
[39] General Board Meeting, King's Hospital. 16th December 1901, p.679

With regard to the grant from the Corporation I wish to state that the Inspector of the Board of Science and Agriculture called upon me and asked whether we would accept a sum of money from the Corporation for the teaching of science provided that no conditions were attached to the receiving of the same save those of the Board of Science and Agriculture. I may explain that the money is no sense the property of the Corporation. They are simply the distributors of it. I replied that I could see no objection. As to the grant from the Board of Science and Agriculture I am to prepare a claim and to send it in to the authorities. The Intermediate Board will lend money but a loan is not necessary in our case and it is always well to avoid borrowing.[40]

The monies received by the school and spent for the provision of science instruction had to be accounted for in the strictest ways. Outgoing letters written by the bursar of King's Hospital at the request of the Board indicate this.

To: Mr. T. P. Gill, Assistant Secretary Department of Agriculture and Technical Instruction.

Laboratory

Sir, I should be much obliged if you would let me know what papers you required in support of our application already sent in. G.R. Armstrong. [41]

To: Mr. Sec. City of Dublin Technical School, Lower Kevin Street.

Dear Sir,

In reply to yours of 4th inst (received to-day). The money received from the Corporation, and from the Department of Agriculture, has been spent upon the Laboratory and the receipts for expenditures have been lodged with the Department. No specific use was made of the sum received from the Corporation – except that it formed a portion of the sum total paid for equipment. If required, I shall be glad to show the voucher, when they are returned by the Agricultural Department.[42]

In June1902 the new programme of the Intermediate Board meant that schools engaged in teaching science under the Department had to provide instruction in chemistry. The short notice meant that additional stress was put on schools already stretched in terms of resources available, and this was clear from Richard's report:

---

[40] Headmaster's Report, King's Hospital. March 1902, pp. 56-58.
[41] Letter dated 26th March 1903. King's Hospital Letters Book, p.730.
[42] Letter dated 11th November 1903. King's Hospital Letters Book, p.739.

> I am afraid that the Board of Agriculture and Technical Instruction is rather exacting and from what I hear I gather that they may later on insist on our building a new room or converting one of our existing rooms into an Art School. The only schools which are really independent are the ones where all boys are taught Latin; at least they will be independent as long as the rules for 1903 continue, though of course, they may be changed next year.[43]

Richards also remarked about the difficulty some schools faced when the Department delayed its payment of grants: 'Grants which the schools depended on were not immediately forthcoming, and so some schools were forced to borrow the necessary funds in order to make the necessary physical changes to the school.'[44]

The expense that King's Hospital incurred is listed diligently in the Headmaster's report:

> Mr Richards reported to the Committee that the fittings for the Chemical Lecture Room will cost £150: appliances for same about £50. The structural alterations necessary to make the Infirmary rooms into classrooms in 'lieu' of No.1 and 2. Would amount to £25. The Committee were of opinion that an application to the Board of Agriculture etc., for a grant of as much as the requisite sum as they are enquiring will grant, and the Reverend Mr. Richards is asked kindly to confer with that Board explaining that though the Hospital has endowments these are absolutely required to meet the current expenses of the schools – and leave no margins for Capital expenditure like that in question.[45]

By December 1902, chemistry classes were being held in the chemical laboratory even though its construction was not quite finished.

However, approval from the Department was not forthcoming on the arrangement of the laboratory and for a few years the subject limped along on an annual approval basis. The Education Committee recorded the following entry on March 13th 1902 to the effect that:

> The plans for Chemical Laboratory have not been accepted. The Inspector will suggest a new arrangement for 16 boys. He has informed me that the present Physical Laboratory will be recognized for another year.[46]

---

[43] Headmaster's Report, King's Hospital, p. 62.
[44] Committee Book, King's Hospital. February 1902, pp. 271-272.
[45] Ibid., pp. 271-272.
[46] Education Committee, King's Hospital. March 13th 1902. No page number given.

In Wesley College the popularity of the science courses proved to be so great that the laboratory had to be enlarged in 1913.[47]

7.5 The Grants provided to the schools

The Department like most large bureaucratic organisations suffered from a lack of urgency when dealing with daily financial requests by the schools. Richards was especially scathing on this point, and never lost a moment to sarcastically record his contempt for such delays:

> No grant has yet reached us from the Department for the teaching of Science but it would be an unusual thing to find anything like promptitude on the part of a Government Department. Such bodies have a reputation which they must live up to.[48]

From the beginning of the scheme it would appear that the flood of monies which one would have expected to have entered the schools in response to such a radical change in educational policy was more of a trickle. Neither the Department, or in some cases, the Corporation saw immediate funding as a requisite to ensuring the scheme had as smooth a genesis as possible. The many fold delays in supplying grants to schools, sometimes towards work already completed did nothing but alienate the respective managers.

> No answer to our claim for a grant to meet the expenses of the Physical Laboratory has yet reached me from the Board of Agriculture and Technical Instruction, nor have we heard from the Lord Mayor and Corporation with regard to the sum of money entrusted to them by the Government for distribution among the Schools in Dublin which provide teaching in Science.[49]

In contrast it would appear that the annual payments from the Intermediate Board continued as regularly as before. 'Claim to the Intermediate authorities was for £602 8.6. Got £598 11s.'[50]

An amount of £65 was received by the school in March 1903 for the previous year,

> ...£65 paid in by the Agricultural Department Year 1902. Committee requested to report to the Board as to proposed application of this sum. The Committee recommended that this £65

[47] Armitage, p. 45.
[48] Headmaster's Report, King's Hospital. March 1906, p. 182.
[49] Headmaster's Report, King's Hospital. September 1902, p. 74.
[50] Minutes of Board Meeting, King's Hospital. December 1901, p. 42.

should be dealt with for last year the same way as the Intermediate Boards payments of that year.[51]

In June 1903 the following entry is recorded by the education committee with respect to funds received from the Corporation, Richards was exceedingly irritated by the small amount.

> The Corporation grant of £34.1s 9d towards equipping the Laboratory had been handed by me to the Registrar. I have no information as to the way in which this sum was calculated and I propose to inquire into the matter. A condition is attached to the acceptance of the money. We are expected to favour Irish manufacturers as far as possible. The sum itself seems very small if the statement is correct that Government funds to the amount of £10,000 have been handed to the Corporation for distribution.[52]

In reporting to the Board towards the end of 1903 he revealed the extent of the Department's grant towards the school, 'The Report of the DATI was placed before you at your last meeting and now I am in a position to state that the amount earned by the school is £117.15s.'[53] And in March of the following year monies were received from the Department towards the cost of the Laboratory:

> At last we have received another subsidy towards the cost of our Laboratory from the Board of Agriculture and Technical Instruction for Ireland. The amount is £88 14s 2d. I understand that the Corporation of Dublin owes us a considerably larger amount from the funds entrusted to them for distribution amongst the schools.[54]

At the end of that year another grant was received from the Corporation. Richards saw this money as plainly as treasury money, which was given to the Department in order for it to divide out amongst the school in the country. It was almost the right of the school to make its claim:

> This is a portion of the funds handed over by the Government to the Corporation for distribution among the various schools and institutions which afford facilities for the study of science. It amounts to £130. 8s. 11d.[55]

By 1910 the total amount of grants earned by the school from both the Intermediate Board and the Department had risen to nearly £700:

---

[51] Committee Book, King's Hospital. 12th March 1903, p. 291.
[52] Education Committee report, King's Hospital. June 1903, p. 83.
[53] Headmaster's report, King's Hospital. December 1903, p. 100.
[54] Education Committee report, King's Hospital. March 1904, p. 110.
[55] Headmaster's report, King's Hospital. December 1904, pp. 136-138.

> Last year was somewhat exceptional in its results as the amount earned from the Intermediate Board alone amounted to £513 12s 6d. In addition to this the sum of £167.13s 4d reached us from the Dept of Technical Instruction...Further the Departments' Rules are more stringent... our results for this year are likely to be considerably less than those for 1910.[56]

7.6 The provision of suitably trained science staff and the progress made

This proved a constant problem for headmasters like Richards, the problem being two-fold. Firstly there was the availability of suitably trained science teachers who taught under the Department's scheme, the demand for such teachers far outstripped the supply, particularly in the earlier years. Secondly the salaries that were paid to such teachers were not great. Consequently some highly qualified and very good teachers were lost to the country as they left to offer their services abroad. Richards did however manage to employ the services of an eminent teacher from the start.

> I succeeded in securing the services of a qualified man Mr. F.C. Cramphorn B.A. of Emmanual College Cambridge. He graduated with honours in the Natural Science Tripos and has had charge of a laboratory at another school. The demand for science teachers both in Ireland and in England is so great that it is almost impossible to obtain them.[57]

A Mr. Taylor succeeded Frederick Cramphorn and in 1905 applied for an increase in salary, the notation in Richards report reveals the dearth of suitable science teachers at that time.

> I have received an application from Mr. Taylor our Science Master for an increase of £10 in salary. His work has been very successful but were it not for the difficulty of obtaining Science Masters I should not for one moment countenance his application. As matters stand, the questions is simply one of expediency.[58]

Copping followed Taylor and appeared to be one of the more successful teachers in the school as the following report reveals:

> The Intermediate Results have reached us as well as the Report on the Science Teaching from the Department of Agriculture and Technical Instruction. The latter shows that the work is in

[56] Headmaster's report, King's Hospital. June 1910, p. 312.
[57] Minutes of the General Board Meeting, Kings Hospital, p. 679.
[58] Headmaster's report, King's Hospital. September 1905, p. 164.

every way satisfactory and that it reflects great credit upon Mr. Copping who is responsible for it.[59]

The difficulty in keeping suitably trained science teachers in the country was evident when, in September 1910 Copping emigrated to Australia having decided that he had very little option '...as the salary he was receiving was so small'. His departure was a great loss to the school and, as Richards notes in his report was sorely missed:

> During the vacation the Report of the Science Examinations reached me. It reflects great credit on the work of Mr. Copping and increases the regret which I feel at his departure. Unfortunately the scale of our salary is too low to retain for any great length of time the services of highly qualified and competent men.[60]

That same year Richards was successful in securing the services of a Mr.Bleakely. He appeared to have been of nervous disposition, and found the task of conducting science classes under the Department's scheme trying and difficult due to poor classroom control. In October of the next year the science report was received by the school. Richards's record of this event is revealing in that he makes reference to the demands of the Department:

> The Science Report was not quite up to our usual standard. This was to be expected from the change in staff. Mr. Copping was experienced in the work and knew exactly what the Department required. This was Mr. Bleakely's first year and therefore he was not at all familiar with the work. In any case he is not as good a teacher as his predecessor, but he will have better chance during the present academical year.[61]

By December 1913 Bleakely appeared to be managing well as the report from the Department shows. In his remarks Richards does not appear to show much appreciation of the system of inspectorate which was prevalent at that time:

> Since your last meeting the Report of the Inspectors of the Intermediate Board has reached us. That of the Department of Technical Instruction had been previously sent. ...I will read both of them though I would suggest that there are other and better ways of judging the worth of a school than that afforded by the reading of the Report of Inspectors. "Department of

[59] Headmaster's report, King's Hospital. September 1907, p .220.
[60] Headmaster's report, King's Hospital. September 1910, p. 322.
[61] Headmaster's report, King's Hospital. October 1911, p. 83.

> Agriculture. A distinct improvement has been effected in the conduct of the Introductory and Specialised Courses in Experimental Science". This is brief and to the point. It really marks an advance in Mr. Bleakelys' methods of teaching.[62]

The following year the report made reference to the worsening standard of the science instruction in the school. The report provides a valuable insight into the working of the Department at grassroots level and is an indication of the value it placed on the scientific method, which it espoused to. 'The Report of the Department of Technical Instruction... is not so eulogistic as usual. Personally I do not understand it but I have called the Science Master's attention to the criticism which notes certain weaknesses in a part of the work [63]

(From the Actual Report):

> Science:
>
> Instruction in Science in all classes was satisfactory and the pupils made adequate progress. At the Special Inspection they attempted willingly variations of the session's work; but, owing in part to uncertain acquaintance with the facts of the courses and in part to a too ready acceptance of defective methods and apparatus, they were frequently unable to carry out their investigations to definite conclusions. The use of summaries for each section, more systematic methods of recording work done and of correcting these records, and the regular critical discussions of the causes of success or failure in experiments would tend to remove these weaknesses. In the First Year graphs should receive greater prominence, and in the Second Year the early part of the syllabus should provide increased opportunity for a training in laboratory methods and processes.[64]

Richards's response to this report was to call Bleakley's attention to the criticism expressed and the weaknesses identified in parts of the work.

In September 1917 his report contains a reference to a certain pupil called Patterson, who in Richard's opinion was too old for the second year course in elementary physics. The Headmaster had the boy moved into the third year chemistry class and in June the pupil presented himself for the fourth year course. In his examination he obtained 333 marks out of a possible 400, that is 83%. This was the first

---

[62] Headmaster's report, King's Hospital. December 1913, p. 86.
[63] Headmaster's report, King's Hospital. September 1914, pp. 16-18.
[64] Summary of Inspector's report, from Headmaster report, September 1914, p. 118.

time that every candidate in science had been compelled by the Intermediate Board to sit a written examination. The boy was disqualified however by the Department and this was accepted by the Intermediate Board. As Richards said himself 'This is an absurdity which is quite beyond my own experience and this is by no means insignificant'.[65]

The school now entered lean times in terms of both its pupil number and the monies earned from the grants. The Department grant arrived early in December 1917 for the amount of £115-11s-3d. This was far below what had been received previously, the reason Richards gave as being '...not so much due to a deterioration in the quality of the work as to the fact that the demand for Science even in the school itself is not so great as it was.'[66] Although it is recorded for the same period that the numbers taking Greek had gone up. The results fees from the Intermediate Board amounted to £316-11s-11d. The school numbers were down to 85 by the beginning of the 1918 academic year and to make matters worse the Department modified its science programme the same year requiring schools to purchase extra equipment. This did not amuse Mr. Richards:

> ...the Department aided and abetted by the Intermediate Board has brought out a new programme of Science work for schools. Apparently after 15 years of slumber it is awake to the fact that the syllabus in use is inadequate and unsuited to our requirements.[67]

He felt that the programme defective as it was should have been allowed to run until the end of the War. Now the school was expected to spend 'about £60' on new apparatus. The Department were prepared to contribute half of this amount.

It would appear that in the last years of the Department's working it carried on with its programme regardless. Examinations had now replaced inspection, and in March 1920 the school presented its pupils for the examinations in science and drawing. Why the pupils were examined in March when the course ran from September through to June cannot be determined.

The final word of the school's association with the Department of Agriculture and Technical Instruction must lie with the Inspector, who in July of 1921 wrote the following report on the progress of heuristic science instruction,

---

[65] Headmaster's report, King's Hospital, September 1917, pp. 231-232.
[66] Headmaster's report, December 1917, p. 237.
[67] Headmaster's report, September 1918, p. 272.

> ...an undue proportion of the pupils displayed a very limited knowledge of the principles underlying the experiments carried out. The reasons for the methods employed and for the type of apparatus selected as well as the conclusions to be drawn from the experiments should be more thoroughly impressed upon the minds of the pupils. Better results would be obtained by attempting less and giving of fuller consideration.[68]

The inspector then went on to describe the serious lack of stock apparatus, such as metre sticks, gas tubing etc., and stated that this was affecting the quality of the teaching.

Richards was left to appeal for money from the Board in order to rectify this. He resigned due to ill health shortly afterwards. Bleakley was to die in the summer term of 1924.

7.7 The training of science teachers

The Department's summer courses whilst unable to provide suitably qualified science teachers for the first few years of the scheme proved very popular from there setting up. While many lay teachers attended at the Royal College of Science and other locations, science teachers in religious orders availed of the opportunity of attending the course in their own schools. The Christian Schools North Richmond Street was typical of this arrangement:

> Science Course in Connection with Department of Agriculture and Technical Instruction conducted in Physical Lab. by Professor Ryan Catholic University... Eighteen Brothers and two seculars twenty in all attended the course.[69]

In a letter written by the science master at The High School, Mr. Lyster to the registrar in February 1906, he explains the workings of the Department's Summer Courses.

> The Department of Agriculture and Technical Instruction for Ireland has instituted "Short Summer Courses of Instruction for Teachers" during three and a half weeks of the Summer vacation of Irish Schools, say from about 10th July to 4thAugust. In Dublin these courses are held at The College of Science Stephens Green and in certain of the larger schools laboratories, as the number of teachers attending the courses is too large to be accommodated at the College of Science. During the course each laboratory is directed by a professor specially appointed by the Department, the ordinary teacher belonging to the school laboratory

[68] Headmaster's report, September 1921, p. 362.

> is usually taken on by the Department as demonstrator, or assistant to the professor. I do not know how much the Department pays the School Authorities for the use of the laboratories, or how they settle the question of cost of chemicals and apparatus used, or how much they pay the ordinary school teacher for his services as demonstrator. The Students work 5 days a week from 10 am to 4 pm with an hour interval 1 pm to 2 pm. On Saturdays from 10 am to 1 pm are the working hours, the corresponding hours for the laboratory's remaining open being 9.30 am to 4.30 pm and 9.30 am to 1.30 pm. Roughly each student works 100 hours in the laboratory during the course.[70]

Not all teachers who enrolled in the Department's summer courses qualified with ease. Miss Caroline Hogan began her career as French teacher to the girls at Mercer's School in Castleknock, Co. Dublin in 1890. The School was anxious to avail of the Department's laboratory and equipment grants, and immediately sought to get Miss Hogan qualified through the Department's summer course. In January 1903 the minutes of the school record that: 'The Secretary has asked me to communicate with Miss Hogan in requiring her to obtain the necessary qualifications for teaching the Science Class.'[71] In the meantime a Miss G. Meade was appointed for a year as temporary science teacher at a salary of five shillings per hour. In June of the following year the school's new science laboratory built at a cost of £270 was opened by the Archbishop. The school met part of the cost with the aid of a Departmental grant.[72] Miss Hogan attended the summer course in that year but failed in the ensuing examination to get the necessary qualification from the Department. The Board agreed to keep Miss Meade on pro tem and raised her salary to six shillings per hour. They urged Miss Hogan to keep trying, as they did not want to terminate her employment with the school, she had been teaching there for fourteen years.

> In the event of Miss Hogan's failing to obtain the qualifications required by the Science Department, the Governors regret that they will be obliged to make new arrangements for the post the duties of which Miss Hogan has discharged efficiently and faithfully during the past fourteen years.[73]

---

[69] Principal's Report, C.B.S. North Richmond Street, pp. 323-324.
[70] Letter dated 1st February, 1906. Source: The High School Archive. File GS 471 17.
[71] Minutes of the Board of Mercer's School, 6th October 1903. No page number given.
[72] Ibid., 5th January 1904.
[73] Ibid., 3rd November 1904.

In November Miss Hogan requested time off in order to study for her examination, and in January 1905 she was '...granted the freedom from evening duties for the winter'.[74] By the following September she had passed her 1st year science examination, but failed to get the qualification to teach science to the 2nd year level. The Board arranged for Miss Meade to teach 2nd and 3rd year science and for Miss Hogan to teach 1st year science only. The ultimatum that she pass was moved to May 1906. There is a break in the minutes with regard to this matter, and it is not until January of 1907 that it was recorded again. In that year, Miss Hogan requested a grant of ten pounds from the school for tuition in experimental science.[75] A year later she had passed her 2nd year examination and was studying for her 3rd year's course. The minutes for 27th March 1908 stated that '...Miss Hogan had passed her third exam in scientific instruction.'[76] To have gone through this struggle for almost five years, probably never having had any prior experience in science teaching, continuing her own daily teaching of French along with her boarding duties and persevered is a testimony to her determination. The facts above also reveal how difficult it was to qualify as a science teacher under the rules and regulations of the Department. Posterity records that she continued to teach in the school, and was Headmistress from 1930 – 1942.

7.8 Adhering to the Department's scheme

In Richards's case his attitude was straightforward. He resented the intrusion of science into what he considered to be a rounded education which could be achieved solely by a study of the classics. He was of the opinion that the amount of time which the new subject was taking up was totally out of proportion to its significance in the Intermediate schools. The 1902 Intermediate results were not good in the school, and he was forced to submit to the Department's will in order to avail of the grants on offer. His expressed his thoughts on paper in his written report:

> We are at present under a dual control which is, and must continue to be, a failure. I object most strongly to:
>
> 1) The attempt to make science compulsory in the Preparatory Grade, and to the difficulties thrown in the way of those boys in the Upper Grades who do not wish to take it as a subject.

[74] Minutes of Board of Mercer's School, 3rd January 1905.
[75] Ibid., 8th January 1907.
[76] Ibid., 27th March, 1908.

2) To the passing of classes taken as a whole as is done by the Board of Agriculture and Technical Instruction. Nothing can be more prejudicial to Education than this practice.

3) To the division of the school year as made by the same board. This does not agree with that made by the Intermediate Board. This disagreement causes endless annoyance.

4) To the rule which compels us to take Science in lessons of such a length that the whole work of the school becomes disorganised by the attempt to fit in other subjects.

5) To taking science as a separate subject so that some boys have to be taken out of the class to from part of another which is being instructed in it.

6) To the practice of Inspection.[77]

In June 1904 his resentment had deepened; in addition to the rules of the Intermediate Board, his school had also to adhere to the regulations of the Department. His report reveals the distain he felt towards the Department, which is contained in the expression '...the so-called Board...'

> The scheme of Intermediate Examinations as at present arranged is radically bad. The Schoolmasters of Ireland are compelled to serve two masters – the Intermediate Board and the so-called Board of Agriculture and Technical Instruction. We were under the impression that some of the most objectionable conditions of the Intermediate Board would be removed but as far as I can see their conditions are much the same and we are obliged to adopt the Regulations of the Department in Upper Merrion Street although they are most disastrous to any school which seeks to give its scholars a liberal education.[78]

In September he reported that W.L. Ruttledge had gained a Teachership in Training at the Royal College of Science as a result of an open competition. It was a landmark as it marked the school's first success in science work at an outside examination.[79]

The fourth point that Richards had made in the above list complains about the amount of time that the Department insisted had to be given to science instruction. The restriction undoubtedly put extra strain on an already full timetable. The pressure placed on the school timetable by adherence to the Department's programme in practical science can be seen in the weekly timetable of The High School in Dublin.

---

[77] Headmaster's report, King's Hospital. September 1902, p. 72.
[78] Headmaster's report, King's Hospital. June 1904, pp. 116-118.
[79] Headmaster's report, King's Hospital. September 1904, p. 126.

1905 Timetable

Mon 11-12 Science Notes (III) Mr. Paterson

Tues 9.30 – 11.30 Science (VI, V) Mr. Lyster (8 in number)

11.30 – 12.30 Laboratory arrangement

12.30 – 2.00 Science (V, IV) (17 in number)

2.00 – 3.00 Laboratory arrangement

Fri 9.30 – 11.30 Science (VI, V) Mr. Lyster

11.30 – 12.30 Laboratory arrangement

12.30 – 2.00 Science (V, IV) Mr Lyster

2.00 – 3.00 Laboratory arrangement

Interestingly, four full hours were given on Tuesdays and Fridays each week in order to allow the apparatus to be set up and ensure continuity of practical work among the various classes.

What little regard Richards had for the Department and its work was eroded completely towards the end of 1905. The Intermediate Board had begun a policy of reducing the scale of prizes for every grade, with those of the Junior and Preparatory Grades described as 'trifling'. He saw possible difficulties for those schools that relied on the grant income from these particular grades.

Two years later his attitude had hardened into a belief that the scheme was inoperable:

> However of late years the Intermediate Board in their weakness have allowed the Department of Agriculture to have first claim upon the schools and the conditions of work have become such as to be almost impossible,[80] and he saw the ultimate destruction of all the 'weaker schools'.

This state of affairs caused an outburst towards the Department that exploded onto the pages of his report for December of 1905.

> The Intermediate Board entered into an alliance with the Department of Agriculture and forced Schools to build laboratories. Those who failed to do so were stamped out of existence or their usefulness was materially impaired. Those who succeeded in raising the money have had a most extraordinary experience. Science was made compulsory in the lowest grades where it was practically useless, and young boys' time is to a very large extent spent in

[80] Headmaster's report. June 1906, p. 184.

> acquiring a trifling smattering of Physics and Chemistry when it should rather be devoted to the elements of education. In addition such boys must take a course of Drawing though schoolmasters know perfectly well that some boys will never draw a straight line. The expense of all this has been enormous and now our efforts to please the Intermediate Board are rewarded by a reduction in Results Fees.[81]

The experience in Wesley College appears to be slightly different, and the progress of elementary science instruction under the Department went more smoothly. For example in 1911 the Headmaster reported that: 'The Classes in Experimental Science and Drawing are largely attended, and the reports of the Inspectors on this department of work are encouraging.'[82]

7.9 The advent of practical science instruction in the schools

It is possible to glean some insight into the change that occurred in the way school science was taught under the Department's scheme after 1900. The reports of the inspectors provide valuable information on the application of the new scheme in the school classroom and laboratory. Early in the new school term of 1904 following a visit to the Christian Schools North Richmond Street, the Principal recorded the Department's report for the more able pupils that:

> A good series of experiments has been carried out and neatly recorded. The pupils have derived much benefit from the years' training in practical methods, and on the whole satisfactory progress has been made.[83]

For the lower classes the progress was less satisfactory:

> The general education of Class F is low and its theoretical and practical knowledge of the subject very weak. Many failed to read graduated vessels correctly, and the true value of decimal notation is not appreciated. Easy variations of the experiments prescribed should be practised by all and notebooks may with advantage be more closely revised.[84]

Not all the schools embraced the Department's new science scheme with enthusiasm, as the following entry in the 'School Notes' of Wesley College testify:

---

[81] Headmaster's report. December 1905, pp. 172-174.
[82] Wesley College Quarterly, June 1911, p. 316.
[83] Principal's report September 1904, C.B.S. North Richmond Street, p. 324.
[84] Ibid., p. 325.

> The Intermediate Board greeted us on our return with the pleasant news that every Intermediate boy must take Science and Drawing, except the favoured few who learn Greek! So the classes were formed on this basis, and worked along for more than a month; when the news was solemnly promulgated, that the Commissioners were only joking, in fact taking a rise out of the Middles and Seniors; and in parenthesis we are told the rule does not apply at all... So the panic is past; and the happy Middles and Seniors who were girding themselves with many growls to Physics and Chemistry are kicking up their heels and relapsing into their natural ignorance of metres, specific gravities and bad smells.[85]

The following year the report was even more positive as the remarks for Introductory Chemistry reveal:

> A good series of experiments has been worked by the pupils and their records of these experiments have been well revised. The laboratory is well kept and apparatus is readily available. At the Special Inspection the pupils displayed a good knowledge of facts, knew how to perform simple chemical operations, and understood the sequence of related experiments. The actual performing of practical exercises, however, was not quite so satisfactory; average results were obtained, but weakness was manifest in the handling of apparatus and in the recording of observations made. Cork-boring, glass-bending, filtration, and evaporation may, with advantage, form the subject of occasional demonstrations by the teachers. [86]

The large amount of time necessary for the instruction of science under the Department put pressure on the teachers, committed to a full timetable. There would have been very little time between practical classes to prepare the laboratory for the next class of instruction, and the provision of suitably qualified assistants was necessary in order partially to rectify this situation. The fact that the heuristic approach suited the more able pupil is borne out by the following remark made by the Principal:

> Many of the pupils in the first year course had not reached such a standard of education as to enable them to follow the course satisfactorily and showed themselves quite unable to carry out the simplest exercise. The second year pupils, with the exception of some of the Honours

[85] Wesley College Quarterly, October 1904, p. 13.
[86] Principal's Report, 1905 C.B.S. North Richmond Street, p. 336.

> pupils were deficient in their grasp of the work. Good results have been secured in the Special Courses, but many of the Chemistry pupils showed an insufficient acquaintance with experimental methods.[87]

These reports must have made difficult reading for the teachers concerned, as the remarks made about the standard of practical work were quite critical, although later in the report some of the blame was taken off the teachers concerned: 'Much careful and conscientious work has been given by the various teachers but their task has been one of exceptional difficulty owing to the defective organisation of the classes'.[88] This 'defective organisation' referred to was the lack of a proper laboratory in order to cater for the large uptake of this subject. The following year the July 1907 Report states that the,

> ...provision of an additional temporary laboratory has relieved the pressure due to the number of the classes, and it is hoped that a permanently equipped laboratory, worthy of the school, will at the earliest possible moment, replace the present temporary arrangement which is not altogether suitable and convenient.[89]

Again the report praised the teachers for the standard of the instruction which had been achieved, although some criticism towards the heuristic method used was evident.

> Throughout the courses, thorough discussion of experimental results obtained, and their application is desirable, and the results of such discussions might usefully be recorded in the note books of the pupils.[90]

Some suggestions were made in that more use should be made of certain aspects of the heuristic method, for example:

> Methods of investigation should be more fully employed, with the introduction of graphical methods wherever possible...In practical work, pupils should be taught to test their apparatus before using it and to regard the checking of the results as part of their experiments.[91]

The examination results in science achieved by the school were considerable, one first class entrance exhibition in experimental science (value £20), one second class exhibition in experimental science (£10), one Royal College of Science scholarship (£50) a year for three years, with free tuition for same

---

[87] Principal's Report, 1906 C.B.S. North Richmond Street, p. 343.
[88] Ibid., p. 343.
[89] Principal's Report, 1907 C.B.S. North Richmond Street, p. 347.
[90] Ibid., p. 348.
[91] Ibid., p. 348.

period. Obviously the school considered the subject to be of prime importance. In 1908 the report cites the work of the introductory chemistry as the pupils displaying,

> ...keenness and interest in the work and have learned to observe with a fair degree of judgement and accuracy... while the value of the note-book records has been depreciated by want of continuous correction and supervision.[92]

One can only surmise that this implied that the true nature of the heuristic method, that of the pupil's being discoverers, was not occurring spontaneously enough in the laboratory, but was being 'teacher-led'. This criticism continued to be made, for in 1909 the report states that:

> ...pupils show a good degree of accuracy and observation, but insufficient system in carrying out experiments...more quantitative work should be brought into the course and notebook records made more complete.[93]

For the first time the scheme of the Special Chemistry Course came in for some criticism in that it,

> ...requires more logical development, and the theory introduced should be from the results of practical work. Pupils carry out practical exercises previously performed in a satisfactory manner, but show little resource and have no ideas of using quantitative results in simple investigation.[94]

The Annual Distribution of Prizes was held in Wesley College, Dublin on Friday, Dec. 14th 1912, and the Rev. J. T. Irwin, Principal, made reference to the then current dissatisfaction among certain 'quarters' with the Intermediate system, which he did not agree with.

> He did not share this. He considered the Intermediate syllabus – including the practical work supervised by the Department of Technical Instruction – an excellent one, and he was of opinion that an Irish public school boy, who had gone through the Intermediate courses satisfactorily, was as well an educated lad, as that produced by any educational system in the Kingdom.[95]

It is possible to glean some information on the type of science work that was being implemented in the school laboratories of the country under the Department. Due to sheer serendipity the chemistry

---

[92] Principal's Report, 1908 C.B.S. North Richmond Street, p. 352.
[93] Principal's Report, 1909. C.B.S. North Richmond Street, p. 355.
[94] Ibid., p. 356.
[95] Wesley College Quarterly, March 1913, pp. 413-414.

practical notebook of a sixteen-year-old Belvedere student has survived. The fact that his school books were preserved was mainly due to the importance this boy achieved historically a few years after leaving school. Between the years 1916 to 1917 Kevin Barry studied chemistry at the school. His laboratory notebook provides a glimpse of the chemistry he was engaged in. The experiments include the diffusion of gases, a study of the oxides of carbon, including their preparation and properties, and a comparison of the two gases carbon monoxide and carbon dioxide.

He did not appear to be interested in the subject, for scattered liberally throughout his write-ups are his teacher's comments such as 'Sketch', when he had not drawn the apparatus, or 'No conclusion', where he had finished his written work prematurely. There are also occasional blank pages where he had not written up his work. His mark for this subject in his Christmas 1916 school examination was 36%. At the back of this laboratory notebook may be found rough work and worked calculations, nestling in the midst of this work in his own handwriting the following:

Vapour density I don't know

Relative density I don't care

Following this he wrote: 20.30 = Ans = Bosh = Rubbish = Bunkum = Humbug.

Clearly the subject was not for this boy, yet strangely Kevin Barry was admitted into the National University of Ireland where he began his medical studies. However he did not complete them.

On the other hand the then Headmaster of The High School, Mr. Wilkins, was extremely anxious that his daughter then aged 13 would be allowed to avail of practical science instruction in a school that only took boys. In October 1904 he wrote to the purser of the school, Mr. Chatterton, that she '...must for the Intermediate Examinations attend Technical classes somewhere...'[96] She was being educated at home, but this presented a problem when under the rules of the Department pupils who presented for science had to pass inspection in a school laboratory. For the majority of girls' schools heuristic science instruction could only be pursued with the co-operation of the nearest boys' school. This situation continued well into the 1960's in many parts of Ireland. Wilkins revealed the extent of the problem:

[96] Letter from Headmaster dated 27th October 1904. The High School archives.

> Next August I think we may have offers, for these classes, of other girls home educated, the supply of these classes for girls not sufficing the demand. Such girls in England, and often-whole schools of girls, get their Science in this way at the laboratories in boys' schools. [97]

She became the first girl pupil thus making The High School a co-educational establishment as early as 1904.

At this time The High School divided certain subject choices into three areas according to what careers the pupils intended to enter. 'Boys are admitted to the school from the age of 7, and are prepared for University, Intermediate, Civil Service, Army and Navy and other professional and commercial examinations. For these purposes the school is organized into three main divisions:

I. A Junior and Preparatory Department

II. A University Department, with provision for High Classical, Mathematical and Scientific teaching;

III. A Commercial and Civil Service Department.[98]

By 1924 the Department of Agriculture and Technical Instruction had ceased to exist, and the newly formed Department of Education under the Irish Free State sent its inspectors into the schools for the first time. The changes that were eventually to come into force are evident from the summary of the Department's inspector:

> In the proposed Rules for Secondary Schools and in the Programme published this year by the Intermediate Commissioners drastic changes are contemplated. Examinations are retained for Educational and other important purposes, but it is not intended that they should hold as important a position in the educational System and policy as they have done in the past. Pupils are required to pursue a course of study of certain duration at a Secondary School before admission to either of the public examinations two in number. The grants payable to schools from State funds no longer depend on success of individual pupils at the public examinations. The normal grant paid to the manager of a recognised school shall be reckoned on a capitation basis. Prizes, Medals, Exhibitions are no longer awarded. There shall be two Certificate Examinations, conducted by the Commissioners each year viz: the Intermediate Certificate Examination and the Leaving Certificate Exam. The purpose of the Intermediate Certificate is

[97] Ibid.

> to testify to the completion of a well-balanced course of general education suitable for pupils who leave school at about 16 years of age and alternatively, to the fitness of the pupils for entry on more advanced courses of study in a Secondary or Technical School. There shall be awarded in each year scholarships of the annual value of £40 each for boys and £30 each for girls tenable in approved Secondary Schools. The aim of the Leaving Certificate is to testify to the completion of a good Secondary Education and the fitness of a pupil for entry on more advanced courses of study at a University or and Educational Institution of similar standing. The regulations to come into operation as from the 1st day of August 1924.[99]

This was exactly twenty-four years and four months to the day since the establishment of the Department of Agriculture and Technical Instruction. The Principal of North Richmond Street, C.B.S. School records a two-day visit in April of 1930, of four inspectors from the Department of Education. At the end of the inspection they spoke in 'high praise' of the work being done in practical science. One of these men was William Mayhowe Heller.

---

[98] The High School Prospectus 1911. Dublin: University Press Ponsonby & Gibbs, p. 2.
[99] Principal's Report, 1924. C.B.S. North Richmond Street, pp. 191-192.

Chapter 8

Conclusion

8.1 Introduction

The purpose of this chapter is to summarise the evidence for the existence of a heuristic methodology of science instruction in Irish schools as professed by H. E. Armstrong, under the Department of Agriculture and Technical Instruction from 1900 until 1922. This chapter will take the main points which have been discussed in the previous chapters and attempt to draw them together in order to complete the thesis.

One of the more difficult aspects in researching this thesis has been linking the Department of Agriculture and Technical Instruction's policy of science instruction to that of the heuristic methodology. Whilst the Department and all its educational officers consciously avoided using the word 'heuristic', the people who chose to attack the Department did not, and in their criticisms of the Department they used the term freely. There was a deliberate attempt by the Department to dissociate itself with any mention of the term in its many written reports, and publicly by representatives of the Department giving evidence at Government inquiries set up to report on its workings. Interestingly, its very critics provide the strongest argument for the existence of a definite heuristic policy on behalf of the Department, which operated from 1900 onwards.

8.2 Criticism of the Department's heuristic approach

The criticism levelled at the Department's application of heurism in science teaching appears to come from two main sources. Those who opposed its educational policies and those who opposed the structure of the Department in terms of what it stood for and the way in which it was staffed.

As early as 1902 opponents of the Department's introduction of heuristic methods into the Irish school system were vocal in their opposition. They argued against the assumption that pupils were taught that conclusions could be reached on the basis of certain 'particular instances':

> To teach children to draw conclusions from particular instances, to teach them to draw conclusions which are not conclusions, is a dreadful thing to do. Yet it is being done every

> week at present in a large number of schools in Ireland. We cannot lay the blame of this atrocity on any particular shoulders. It may be the teachers who are at fault, it may be the organisers, it may be the system. We do not see any necessity for bringing home the guilt to anyone in particular, so long as pupils are left uncontaminated by this very serious and unscientific method of teaching.[1]

Across the waters a mere year later heuristic methods in science education were being called into question as the following extract from an article which appeared in the February issue of the *Irish School Monthly* journal shows:

> At the Manchester Science Conference the "Heuristic Method" of teaching science came in for some hard knocks. The "method" may generally be described as the art of making children discover facts for themselves. The objections were that it was useless in the higher stages, and that the nomenclature was childish. Dr. Armstrong defended it on the ground that it encouraged individuality and character on the part of the pupils.[2]

Another criticism was that Armstrong's methods allowed little room for textbooks in the science classroom, particularly in the earlier formative years. At the end of 1904 Armstrong's book *The Teaching of Scientific Method* was reviewed in the *School World*. The reviewer had some hard things to say about the "no text-book advocates".

> The fact is that the advocates of this doctrine fall into a mistake common with educational reformers – Herbart and Rousseau are good instances – of prescribing for class-work what they have found to be efficacious when dealing with an individual in the capacity of private tutor. If more of the writers on education had served an apprenticeship as masters in a school, thereby becoming acquainted with the actual conditions of class-room teaching, there would be far fewer fanciful theories to pervert and confuse young persons imbued with the pedagogic passion.[3]

By 1916 matters had changed little, for opponents of the heuristic methodology as practised in Irish schools gave full vent to their opinion. In an article published in the *Irish Journal of Education* entitled

---

[1] *Irish School Monthly*, Vol. II, No.6. February 1902, p. 178.
[2] *Irish School Monthly*, Vol. III, No. 6. February 1903, p. 211.
[3] *Irish School Monthly*, Vol. V, No.4. December 1904, p. 137.

'Literature v. Science' the author, more than likely a classicist, makes a strong and forceful argument against the heuristic method:

> Let us have as much science as possible, but let it be real science, not the fiddling with scientific instruments, the legerdemain with test tubes, and all the rest of the juggling that is covered and, perhaps, disguised by the name of the "Heuristic Method".[4]

The opponents of the Department began to make their voices heard more loudly. One of these was the Jesuit Father Timothy Corcoran S.J., First Professor of Education University College Dublin. Writing in 1923 he had this to say about the Department's work:

> Owing to a want of clearly defined aims, the instruction given by teachers of Science in Ireland, who have had to work under the DATI since 1901, has been very largely ineffective. The work of a manipulative character done in the "school laboratory" from 12 years of age was made the basis and core of all instruction. Manipulative skill is not the aim, or even necessary adjunct, of general education through science; the verification of certain processes in a school laboratory is a useful consequence of such education, but by no means a foundation for it. The record of "experiments" made in the student's notebook was made to replace and suppress the use of a textbook. Training in the use of a textbook is the basis of all progressive education in science: and this reactionary plan of ousting the textbook persisted in for many years, inflicted severe and permanent damage on Irish education and scientific progress.[5]

Corcoran was correct in his criticism of the lack of textbooks in the heuristic scheme, he was making a plea for a balance between laboratory and theoretical work, no more so than Br. Hennessy of the North Monastery School in Cork had done when giving evidence before the Digby Inquiry as discussed in section 6.9. To follow a heuristic method of science instruction was not an option given the time constraints place upon the teacher. The judicious mixture of methods as Br. Hennessy stated would involve judicious use of pupil experimentation, teacher demonstration and textbook in the classroom and laboratory.

---

[4] *Irish Journal of Education*. Vol. VI, No.8. September 1916, p. 128.
[5] Corcoran, T. 'The place of the sciences in general education'. *Studies*, Vol. XII, Dublin: The Educational Co. Ireland, 1923, p. 408.

Corcoran was also correct in his opinion that Armstrong's heuristic method when taken to the extreme as it was for a period of time, was not the true course of science instruction. It had a place but it should not have been the main focus of the scheme. Corcoran was not the only educationist to write in such a way. In the section 'educational notes' in *The Irish Educational Review* in 1911 an article appeared under the subtitle 'Nature and Quality of Work'. The author began by praising the Department for not only introducing experimental science into the schools but for rooting out and destroying the tradition of teaching science without experiments. However, in his opinion the Department had utilised the heuristic method to an extreme degree.

> This probably justified an exaggerated insistence on heuristic methods, but we are convinced that the time has come for getting rid of what is exaggerated, and encouraging such an amount of sound didactic teaching as will give the pupils some real grasp of scientific knowledge.[6]

Corcoran also chose to criticise Armstrong's heuristic form of science instruction which the Department had used as their main methodology:

> It seems to have mattered little that Sir William Ramsay, imported to bless the scheme in 1903, declared publicly that this heuristic method was mere humbug. When it was urged that neither Germany nor France would employ this precious "discovery method" for secondary of general education, Professor Henry Armstrong came over in 1908 to declare that, in respect of education in science at the secondary stage, Germany was a benighted country![7]

Corcoran had little time for the Department's policy of science instruction, and he defended the policies of the schools that had been brave enough to resist those of the Department and independently carry on the traditional methods of science instruction. To the credit of these schools, they distanced themselves from the science methodology of the Department of Technical Instruction. This they did by giving '...independent courses on the older and much sounder lines'.[8] Corcoran argued that there was a misuse of both public authority and public purse in order to coerce schools into adopting the '...faddist methods of unqualified officials'.[9] He criticised the Department's adherence to the promoting of heuristic methods in science instruction on the grounds that it was misleading.

---

[6] *The Irish Educational Review*. Vol. IV. October, 1910, to September, 1911. Dublin: Browne & Nolan, p. 754.
[7] Corcoran, p. 409.
[8] Ibid., p. 410.
[9] Ibid., p. 410.

Although Corcoran has been accused of being over-zealous with regard to promoting Irish as a school subject, what he did say about training research scientists in school laboratories had a ring of truth. For example he correctly pointed out that the ordinary school laboratory was not and never would be a research laboratory.

> Apart from the manifold fallacies of this attitude of mind, this exclusive cult of the experimental sciences on the "heuristic plan" has the specially untoward consequence that it fosters an entirely false and arrogant concept of what we term school science. The student, supposed to be personally investigating and working out a piece of experimental research in a school laboratory, and then led or compelled to make such work the basis of conviction and belief regarding scientific truth, is grossly misled.[10]

He put forward the argument that school laboratory work neither resembled nor prepared the pupil for the real work of discovery and research. He claimed that the pupil's mind was misled about the value and nature of what was done in the school, instead the pupil was led to believe that the functions of the pioneer in scientific investigation is easy, direct in approach and palpably certain. Instead the fact was that ninety-nine out of one hundred, in the realities of arduous effort towards discovery, were eliminated in the school laboratory. Every part of the planned experiment, which the pupils had to carry out, safeguarded them against exertion, responsibility, errors, and the untold number of dead-ends which had to be traversed along a route towards an achievement, all of which are constants in true research. Corcoran attacked Armstrong's heurism on the grounds that it failed to get science pupils to grasp the true nature of science based on the scientific method. Another Jesuit, Fr. Henry Gill, writing in an issue of *Studies* in 1932 referred to the policy of the Department of Agriculture and Technical Instruction with respect to school science and made the assertion that the policies of the Intermediate Board had been far more advantageous for science education than those employed by the Department.

> It may seem a strange assertion to maintain that the method in use thirty years ago was far better than that employed until recently. Whatever improvement is to be noted to day is due to the fact that there has been some return to the older method, which was displaced by the terrible regulations of the "Department". These methods almost destroyed science in our schools and justly made it abhorrent both to boys and their masters. It had only one merit: to

[10] Ibid., pp. 412 – 413.

> provide grants for badly off schools by the exploitation of pupils who were otherwise incapable of obtaining "result fees".[11]

Other members of the education department of University College Dublin were also among those who opposed the Department's policy of school science instruction since 1900. Writing in 1926 with respect to the proposed Shannon Development Scheme, W.J. Williams a lecturer in education there said of the heuristic system imposed by the Department:

> For almost three decades the science teaching of our secondary schools has followed the lines known as the "heuristic method" – surely an unhappy misnomer. In school conditions such lines are not only utterly useless from the standpoint of national utility, but also educationally indefensible.[12]

He noted that the great continental countries, famous for their scientific achievement, had not employed this heuristic system. He singled out Germany in particular, which is ironical considering that Armstrong had received some of his scientific training there and had returned to England greatly impressed by this experience. In fact Williams cited Sir Richard Glazebrook, then director of the Cavendish laboratory in Cambridge who in 1918 publicly declared his regret for the role he played for imposing on the schools the 'methods of advanced research'.[13]

8.3 Criticisms of the Department's structure and staffing

The opponents of the Department initially concentrated on the appointment by Punkett of so many officials from England and Scotland. The departure of Robert Blair from the post of Assistant Secretary in 1904 and the appointment of his successor George Fletcher was commented on in the *Irish School Monthly*. The article made reference to the appointments of Scotsmen to the department and is very critical of what it saw as an ongoing policy of employing its senior staff from either Scotland or England. *The Irish School Monthly* commented on this in 1904 when it said:

---

[11] Gill, Henry V. 'Science in our schools'. *Studies*, Vol. XII September, 1932, p.467.
[12] Williams, W. J. 'The Shannon scheme and the teaching of science – a plea for realism in education'. *Studies*, Vol. XV, 1926 p. 179.
[13] Ibid, p. 180.

> One result of the change we hope will soon be apparent, namely, that we have seen the end of the Scotch importations to fill all the positions, large or small, that were in the gift of the Department.[14]

The article goes on to imply that these appointments were only belatedly being realised by the respective local committees to have been a 'huge mistake'. Blair was seen by some as a rather unpopular choice and that under his organisation the Department had lost the good will of some of the school managers; hence his elevation to a position with the London County Council was welcomed.

In March of 1905 the *Irish School Monthly* ran an article under the section 'Intermediate and Technical' in which it claimed that 'The appointment of Mr. Rich to an important position under the London Board of Education creates another vacancy on the Irish inspection staff. It will be interesting to watch the efforts that will be made to secure the services of *another* Irishman.'[15] Plunkett was attacked on the basis that only six months prior to Rich's departure, he was making public pronouncements about the appointments of the board that those chosen were '...thoroughly imbued with the "Hibernian" spirit', that they would remain with the Department come what may. Unfortunately for Plunkett events played into the hands of his detractors with the departure of some of its top educational policy makers between 1904 and 1905.

In an article published in *the Irish Educational Review* in 1909 an article appeared on the introduction by the Department of inspection into the Intermediate schools, and the question of where these inspectors would come from: 'Will the inspectors be Irish, or will they be imported?'

The author attempted to make a case for the employment of inspectors from Ireland, and that they should be drawn from the ranks of the practising teachers, for such teachers would be,

> ... thoroughly alive to the drawbacks of the present system, to the directions in which improvement is needed, and to the lines on which such improvement might be made really profitable, as experienced teachers, who have chafed under the disadvantages which, as inspectors, it would be their work to remove.[16]

Judging by the sentiments expressed in the *Irish Educational Review*, there appeared to be more of a sense of the Irish people wanting to control their destiny in education more so than in the previous four

---

[14] *Irish School Monthly*. 'Intermediate and Technical'. Vol. V, No.1. September 1904, p. 34.
[15] *Irish School Monthly*. Vol. V, No.7. March 1905, p. 253.
[16] *Irish Educational Review*. Vol. II, October, 1908, to September, 1909, pps. 147-148.

years, and doubt was being expressed about the 'Irishness' of this new Department. The Department was seen by many nationalists in Ireland as merely an extension of another Department – that of the Science and Art Department in South Kensington. Even though Plunkett had gone to great lengths to emphasise the fact that the new Department was a people's Department, along with his choice of Gill – an Irishman through and through, as secretary, many of the criticisms directed at the Department show that it was often perceived as far from being an Irish Department. Amongst the arguments used by its critics were:

1. Many of the personnel (particularly its senior officers) were imported from Great Britain.
2. The enormous availability of funds, with the complete transfer of the finances of the Science and Art Department, which could be used for whatever means the Department necessitated.
3. The generous facilities accorded to the new Department particularly in 1910 when it was relocated alongside the Royal College of Science of Ireland in almost palatial surroundings would have been eyed jealously by some. The fact that this 'Irish' Department of Agriculture and Technical Instruction operated under Royal emblems would also have made it difficult to be seen as a distinct Irish bureau.
4. The implementation of heuristic science instruction in the Irish schools, would also be perceived by some to be yet another 'English import'.

Much of the work of the Department, particularly in the early years, for example the 'Suggestions' and 'Prefatory notes' in which were published its aims and policies, and its policy with respect to the way school laboratories should be constructed in order to qualify for Departmental grants, mirrored a similar strategy pursued by the Board of Education in England.

The *Leader* newspaper, whilst praising and encouraging the Department in its very early days, turned into quite a vocal opponent within a few years of its life. In the closing months of 1901 in an article entitled "The New Department" it commented on the ideals which had been expressed on the subject of technical instruction in the Department's first Annual Report. 'These are new and pregnant educational ideals, not so much in themselves as coming from an Irish Government Office. A Department whose guiding spirits keep them steadily in view cannot go far wrong and deserves to succeed.'[17]

[17] DATI First Annual Report, p. 255.

Barely a year later whilst commenting on the proposed scheme of Intermediate school inspection it began to display the genesis of its dislike for some of the members of the Intermediate Commissioners:

> By their new rules, the Intermediate Commissioners have, as "M.F." pointed out, practically taken over from our Catholic authorities the government of our Intermediate schools. They claimed this year the right of inspecting all the classes and methods of teaching, of examining the qualifications of the teachers, and of inspecting generally the whole school premises.[18]

The article went on to reveal sentiments about the way in which it perceived the Department's work. It is indeed strange that such a turnabout should have occurred in such a short space of time, unless of course one assumes that the *Leader* was simply adopting a much stronger nationalist stance:

> It is strange how we Irishmen allow ourselves to be led by any person who assumes authority over us with a sufficient amount of cheek. When one of the Ascendancy is in question we take him at his own valuation. Here we have an anti-Irish Board quietly trying to assume control over our secondary schools because they have passed over to us out of public money five shillings for every fifteen we have spent. They provide a student with his breakfast, and for that insist on dictating how he is to have his other meals cooked, what kind of professors he is to have, and how they are to teach him. If the Commissioners were giving the money out of their own resources, of if they were trustees of a Carnegie gift, they might exact whatever conditions they chose before giving the grant...These have no right to exact whimsical conditions nor to try experiments in education before disgorging the money.[19]

It is true to say the many people had high hopes that benefits would accrue for the country as a consequence of the establishment of the new Department. There were some who from its very conception were critical of it, but most were prepared to give it the time and the assistance necessary before passing judgement. However, by the beginning of 1903 a degree of cynicism began to creep into some of the more nationalistic Irish publications. The *Leader* was no exception, when in January 1903 it published an article entitled, 'Is it another Anglicising Board?' It struck at the heart of all that Plunkett had hoped to create – an Irish Department for the Irish people. The article attacked the composition of the Department's non-Irish staff.

---

[18] Ibid, p. 155.
[19] Ibid, p. 156.

> We had hoped that this Board, at least, would be worked in accordance with Irish ideas, and for the benefit of Irish people. It seems that this is a mistake. The tide of emigration continues. Our fine young men and young women are rushing from the country, seeking situations abroad, and in the meantime this new Board is acting as a kind of bureau for bringing in outsiders to take up most of the positions worth having under its control, and which are the rightful inheritance of Irishmen and women. That it was necessary in the very beginning to import some trained instructors nobody will deny. But what everybody thought was only a mere temporary expedient, seems to be intended as the practically normal condition of things.... The English and Scotch officials of the Board, already numerous enough, will naturally try to secure more positions for their co-nationalists, and we, Irish people, are expected to look on with perfect complacency at this new process of Anglicisation[20]

In February 1904 the *Irish School Monthly* ran an article which was published under the heading 'The Department of Agriculture and Technical Education', in which it criticised the system of appointments been made,

> ...that in the matter of appointment of additional Junior Inspectors for Intermediate Science the claims of several fully qualified Irish teachers have been ignored, and the "foreigner" with absolutely no experience of educational methods and with inferior qualifications, and no knowledge of local circumstances, has been appointed over their heads...is it that the Technical Department really thinks that the home growth is so miserably dwarfed that it would be futile to look out for even a solitary specimen of the home-manufactured educationist? [21]

8.4.1 An overview of the scheme

The education system which prevailed in this country prior to the establishment of the Department militated against its heuristic policy. For example, some national schools in the country were in such a poor condition that practical science classes would have been impossible. In his thesis, Carton refers to this when he discusses the state of some national schools in the early years of the Department. 'Many

[20] The *Leader* newspaper. January 3rd, 1910. Article written by D.Hallinan DD re: arguing for the establishment of a Domestic Economy training school in Limerick over Dublin, p. 310.
[21] *Irish School Monthly*. Vol. IV, No.6. February 1904, p. 199.

of the schools were in such a bad state of repair as to be little better than hovels...'[22] Furthermore any attempt to initiate a heuristic course in schools with a history of low attendance would also have been problematic, as the very heart of the investigative nature of heuristic work would have been lost due to lack of continuity. Ireland lagged behind the United Kingdom in this regard, '...the average attendance in 1902 of 63.0% compared very unfavourably with 82.4% in England, 82.9% in Scotland and 79.7% in Wales.'[23]

The state of the technical schools, or what few there were in 1900, was also poor. Many of the 108 which were known to be in receipt of science and art grants in the country were located in the major cities. Technical education outside these urban areas was so scattered that it could be said to be almost non-existent. Intermediate schools were in the grip of the payment by results scheme, and bookwork leading towards examinations was the order of the day. Teachers in these schools, as well as the National Schools must have played the system for the maximum payments possible under the scheme. Any form of practical work in science would have been very difficult in a climate which saw the pupils' results coming from the study of books alone.

To aspire to changing such a situation as existed was indeed a noble and bold endeavour. Much of what was achieved, particularly in the early years, must be attributed to Plunkett himself. His vision of the construction of a new Ireland in which its inhabitants become its builders is contained in Chapter VII of his book, *Ireland in the new century*. The Chapter is entitled: *The New Movement: Its Foundation on Self-Help*, and in it Plunkett makes several points with respect to education:

> On the contrary, we must seek to instil into the mind of each individual the too little recognised importance of his own contribution to the sum of national achievement. The building of character must be our paramount object, as it is the condition precedent of all social and economic reform in Ireland.[24]

Plunkett saw education as '...the only real solvent to the range of problems discussed in this book.' [25] The situation in which the country found itself he put down to the fact '...that our educational systems have had little regard to our history or economic circumstances.' [26]

---

[22] Carton, J. J. *The Development of Technical Education in Ireland 1889-1930.* M. Ed. Thesis, 1972, p. 65.
[23] Ibid., p. 65.
[24] Plunkett, H. *Ireland in the new century.* London: Kennikat Press, 1970, p. 176.
[25] Ibid., p. 177.

Onto this stage Plunkett brought a system of practical education, one in which the aspect of action was emphasised in the form of practical education instead of the more bookish form which had preceded it. The Recess Committee of 1897 (set up as a result of Plunkett) and the Belmore Commission of 1898 set forces in motion that gathered pace until the momentum expressed itself in the establishment of the Department of Agriculture and Technical Instruction. It was then only a matter of assembling the people necessary to create and oversee such a practical form of education. With the beginning of a scientific revolution, in such matters as the discovery of atomic structure, electricity, radio waves and the telephone, public perception was that a knowledge of science would be important in the new century. Consequently the study of science in the school was chosen as the tool with which to educate the youth of Ireland, and on this foundation industry would grow and flourish. Gill, a classicist by training, referred to his own experience of conversion in this regard when speaking in the presence of Armstrong at the Belfast Meeting of the British Association in 1902 when he stated that:

> ...if I admit the claim of science in general education and champion it as I do, it is as a convert, and one who has been brought to that realisation of the power and value of science which is forced upon every modern man.[27]

However, the focus for the Department under Plunkett was on the methodology which was to be used in the school classrooms and laboratories. As the heuristic methods of Armstrong were at the forefront of English education at that time, it is more than likely that it was the only methodology considered by the Department. The person in the Department who was responsible for the appointment of Robert Blair cannot be established; however it was more than likely Plunkett himself. As discussed in Chapter 1 the thrust of Armstrong's heuristic philosophy was in '...learning through doing', that is through practical work.

Armstrong believed that other subjects could also be taught heuristically, and this took place at Christ's Hospital. Under the heuristic method textbooks were not encouraged, particularly for the younger learners, each child had to be the author of their own textbook, their laboratory notebook.

---

[26] Ibid., p. 177.

[27] Gill, T. P. *Science in Secondary Schools, the Department's programme.* A paper read on the 12th September, 1902, at the Meeting of the British Association in Belfast, p. 5.

8.4.2 Heurism in the Irish Department and the British Association

It was through the British Association that Armstrong furthered his heuristic method of science instruction, and this linkage led him at least twice to Ireland. At the Belfast meeting in 1902, (Armstrong as president of the science education section) T. P. Gill of the newly formed Department spoke about its educational policy and detail of this was given in Chapter 6. In his address Gill stated that,

> ...because the teaching of experimental science according to this programme involves a method, now commonly called the heuristic method, which we believe has a great educational value, and which may, I think, be applied to the advantage of the study of other subjects as well as science.[28]

Armstrong would have met many of the senior members, including Horace Plunkett, Robert Blair (assistant secretary) and E. M. Rich (senior inspector) at his meeting, and his address would have had to have impressed these men as he referred to the Irish people as having '...rich powers of imagination such as no other section of the nation possesses: it is only necessary that these powers be trained...'[29] This is evident in the fact that Plunkett himself used a similar phrase when speaking at the Cork Exhibition later that year.

Six years later at the Dublin Meeting Armstrong again met members of the Department, and sat on various committees with them during the course of the conference. One of these committees, the Gregory Committee, which was set up to report on studies which were most suitable for elementary schools. Blair's new replacement George Fletcher together with Armstrong and Heller among others comprised the committee.

That heurism was forefront in their minds is evident from the following statement its Chairman Sir Philip Magnus made with reference to the Gregory Committee's report when he said:

> The Report very properly refers to the successful efforts of Professor Armstrong during the last twenty years to improve the method of science teaching in our schools. It emphasises the contention of the Committee that the spirit of scientific inquiry must pervade our school teaching if effect is to be given to the educational reforms which we have recommended. [30]

---

[28] Ibid., p. 4.
[29] Armstrong's presidential address to the 1902 Meeting of the British Association, p. 842.
[30] Report of the 1908 (78th) Meeting of the British Association. London: John Murray, 1909, p. 498.

8.4.3 The National Board's heuristic policy in the National Schools

Chapter 3 discussed heurism in elementary science in the National schools. The appointment of Heller, a disciple of Armstrong's, by the National Board in 1900 following the recommendations of the Belmore Commission of 1898 heralded a new era in science education at the primary level. Never before had such a system been attempted on such a grand scale, and Heller together with a staff of five was given the mandate, as head organiser, to oversee the training of teachers, the equipping of schools and the monitoring of its progress via inspection.

Heller having consideration of the policy of the Department of Agriculture and Technical Instruction saw the importance of this training at primary level in order to provide students who would go on and study science in the technical schools. As discussed in section 3.10, he spoke about this at the 1902 Meeting of the British Association when he referred to Plunkett's efforts to establish a system of technical education throughout Ireland and that these efforts,

> ...cannot bear full fruit until the National School is producing material, with a taste for, and capable of benefiting by, the instruction given in the Technical Schools; on a sound foundation of Practical Instruction in the National School, with a ground floor of Technical instruction, the upper stories of a noble fabric of Industrial Development may be built.[31]

8.4.4 'Networking' of staff in the Department and their connection with Armstrong

Section 6.3 in Chapter 6 discussed the officers of the Department who were involved in implementing its educational policy. Detail was provided with regard to their connection with Armstrong, and it would appear that there were some who had good knowledge of heuristic methods. These officers ranged through all grades in the Department. George Fletcher who succeeded Robert Blair as assistant secretary in 1904. According to Parkes, Fletcher '...was much influenced by the work of H. E. Armstrong'[32], and was also a supporter of the work of the National Board in developing a system of practical elementary science instruction in the national schools of Ireland. Fletcher took a very keen interest, particularly in the early years, of the Department's work in the secondary schools.

---

[31] Heller quoted in the *Irish School Monthly*. Vol. III, No.2. October 1902, p. 40.
[32] Parkes, S. M. *Mr. Fletcher of the Department,* p. 43.

Edmund Rich, who was engaged by the Department as assistant science inspector, had also been a pupil of Armstrong's at the Central where he experienced the heuristic method first hand, and as Armstrong was a family friend, had known Rich since he was a boy. After his course was completed at the Central Institute, Rich spent some time in the East London teacher training school which had been set up by Armstrong in the late 1890s to promote the heuristic method of science instruction. Heller held training sessions here from 1894 to 1897, so it is possible that Rich and himself became acquainted.

> Edmund M. Rich, after some experience of the teachers' classes in East London, undertook similar pioneer work in the Schools of the Staffordshire County Council, and was later appointed to the inspection staff of the Department of Technical Instruction in Ireland, which body controls the teaching of science and practical studies in all the Irish secondary schools. [33]

W. Lethbridge, another inspector with the Department '...also followed Rich in Staffordshire and in Ireland.'[34] W. Vickers Dixon who was appointed inspector for technical instruction in 1901, had previously taught at the City and Guilds Finsbury Technical College in London along with E. A. O'Keeffe who had also taught there was appointed organising secretary of the scheme in the same year. The apparent 'networking', in which staff were appointed as a direct result of word of mouth of an already existing member would appear to have been quite a normal procedure at that time. Confirmation of this would seem to be had when Blair left the Department in July 1904, as he brought Rich and a few more officers back with him to work with London County Council. With so many senior figures connected in some way to Armstrong, working together in the same branch of the Department, points to a link between Armstrong's heuristic method and its implementation in practical science instruction in schools working under the Department.

8.4.5 The teacher training programme 1900-1922

Heller realised that the utmost importance to the successful implementation of a heuristic methodology lay in a body of well trained teachers. Armstrong realised this also, and saw that science teachers graduating from the training schools at that time were not being trained heuristically. At the Lahinch educational conference in July 1916, Mr. T. F. Bowman read a paper titled, *A sketch of the history of*

[33] *The Central.* 'A Reform in Education', Vol. XIII. Birmingham: Percival Jones Ltd., 1916, p. 19.

curricula, and the place of science in the curriculum of a national school. In it he stated that the teacher '...is the soul of the system, and on him depends the making or the marring of whatever curriculum you place in his hands.'[35] He was very unimpressed with the standards of the training colleges, and singled out St. Patrick's Training College in Drumcondra for special mention.

> This institution appears to me nothing better than an educational boarding house, in which the be-all and the end-all of the students was to pass a literary examination at the end of the course, so as to improve their classification, and hence their emoluments....[36]

He came to the very heart of the problem as far as Heller was concerned when he spoke about the characteristic of a successful teacher when he said:

> Upon his leaving the training college, the teacher's education is not supposed to be complete. Every educationist knows that the moment a teacher ceases to be a student he ceases to be a successful teacher, because he gets out of touch with the manner in which education enters the child's mind, and he is then apt to grow over-bearing and pedantic.[37]

Speaking to his past pupil Edmund Rich on his deathbed in 1937, Armstrong was in no doubt but that the teachers were the main cause for the failure of his heuristic methodology in the schools, for he said:

> "Rich, you ought to sack the lot." He was, of course, referring to teachers as a whole, but when I suggested that it might be well to tackle the job piece-meal he was clear that he would start with the Training Colleges. It will thus be seen that he was a fighter to the last.[38]

Heller therefore began an ambitious training programme as soon as he arrived in Ireland in 1900, aimed specifically at the teachers. Detail is given on these courses in section 3.6 of Chapter 3. Addressing an assembly of forty teachers at the first of these he quoted Armstrong when he said:

> If we can but graft on the modern tendency to be practical, a proper utilisation of heuristic methods, we cannot fail to succeed in training up a race of competent workers of all grades.[39]

This theme resonated with that of Plunkett's already discussed in section 8.4.1 of this chapter. Heller's courses ran until 1906 when they were abandoned due to two reasons:

---

[34] Ibid., p. 19.
[35] Bowman, T. F., writing in *The Irish School Weekly*, Vol. LI, No. 25, August 6th, 1910, pp. 779.
[39] Ibid., p. 779.
[37] Ibid., p. 780.
[38] Rich, E. M. *The Central*. Vol. XXXV, No. 83. London: William Brown & Co. Ltd., 1938, pp. 81-82.
[39] *Irish School Monthly*. Vol. I, No. 4. December 1900, p. 115.

Firstly the training colleges were seen to be turning out large numbers of qualified teachers, and secondly the existing teachers could not be trained in local technical schools. However, there was only a 50 % pass rate in the training colleges final examination and so the number of teachers graduating was far less than that required by Heller. This proved to be a conflict that never got resolved. To add to this problem newly qualified teachers were given charge of the more junior classes containing pupils which Heller saw as the most likely initiates for the heuristic science programme.

From 1908 until 1912 due to a lack of funding Heller and both of his assistants conducted a limited amount of training in the schools themselves, and it was not until 1912 that he re-prioritised his strategy by conducting short courses at twenty four centres nationally. However, it was too little too late and very soon after this the teacher training courses stopped altogether.

The Department on the other hand set about tackling the problem in quite a different way. Student teachers were trained over the long term at the Royal College of Science, whilst three-week summer courses were organised all over the country which aimed at providing suitably trained teachers immediately. The Department's control on these summer courses emphasised the importance attached to them. Detail was given in section 7.7 on a Miss Hogan at Mercer's School regarding the lengths which teachers had to go in order to become qualified to teach practical science.

These courses were run on the same lines as the teachers would themselves teach on returning to their respective schools. Both a written and a practical examination together with an assessment of the participating teacher's laboratory notebook were used as criteria for qualification or not as the case might be. From 1906 onwards a new course was added in the form of Laboratory Arts. This course was intended to provide more practical laboratory experience for those teachers who had attended, and been successful at the previous four summer courses in order to,

> ...give them special practice in the construction, adjustment, and repair of laboratory apparatus of a simple character, and to demonstrate how the equipment of a laboratory may be most suitably used and extended.[40]

The Department's objective for this course was to give better efficiency to the apparatus then being used in the schools, and by training the science teacher, enable them to carry out repairs on damaged

[40] Details of Summer Courses of Instruction for Teachers, 1906. Issued by the D.A.T.I. Form S 41. (Source: The High School archives), p. 2.

equipment. It was further hoped that the teachers themselves might construct their own apparatus for the use of their pupils in the laboratory.

8.4.6. Armstrong's heuristic syllabus and that of the Department of Agriculture and Technical Instruction

At the 59th Meeting of the British Association for the Advancement of Science in September 1889 Armstrong's heuristic syllabus for elementary science was discussed by a committee (which included Armstrong) chaired by Dr. W. J. Russell. In the final report of this committee it was stated that:

> It cannot be too strongly insisted that elementary physical science should be taught from the first as a branch of mental education, and with this object in view, is capable of developing mental qualities that are not aroused, and indeed are frequently deadened, by the exclusive study of languages, history and maths.[41]

Armstrong put forward suggestions for a course of elementary instruction in physical science in which six stages were identified. Pupils following this syllabus would pass through each stage in the various years of the course. Although this has already been discussed in section 1.5, it is necessary to compare Armstrong's scheme with that adopted by the Department and implemented in both the secondary and technical schools. Armstrong suggested that at Stage II the pupils should learn how to measure.
This would occur after the simple rules of mathematics were learned. Then they should progress through:

- Lineal measurement.
- Measurements of rectangular figures and area.
- The lever and how to manipulate the simple balance.
- Work on solid figures, density and relative density. [42]

In the Department's syllabus for secondary schools it was recommended that the First Year course should be in Introductory Physics with emphasis on the following aspects of the subject:

- Measuring length, area and volume.

---

[41] Report of the Russell Committee at the 59th Meeting of the British Association for the Advancement of Science at Newcastle-upon-Tyne, September 1889, p. 229.
[42] Suggestions for a course of Elementary Instruction in Physical Science drawn up by Professor Armstrong. Contained in the Report of the Newcastle-upon-Tyne Meeting of the British Association, 1889, p. 231.

- The lever leading to use of the balance.
- Measuring mass and density.[43]

Stages III and IV in Armstrong's scheme involved studies of the effect of heat on things in general and of their behaviour when heated The objective was to '...lay the foundation for the study of change, i.e. chemical studies proper.'[44] This was followed by the Problem Stage. The following aspects were covered:

- Action of heat on metals like lead, tin and magnesium.
- Action of heat on chalk (or 'chalkstuff' as Armstrong called it), i.e. Chalk to Lime and Chalk Gas.
- To determine what happens when Iron rusts. 'Something from somewhere has been added to the Iron.'[45]
- To investigate the burning of phosphorus. Hence to separate the active from the inactive constituents from the air.
- Reactions of metals and oxides with acids.

The Department's syllabus for the Second Year's course in the secondary schools was one of Introductory Chemistry, and included the following topics:

- Action of heat on metals.
- Action of heat on iron, leading to an understanding of the concept of rusting.
- Reaction of phosphorus, leading to an understanding of the composition of air.
- Action of acids on metals and chalk.
- Quantitative analysis emphasised together with the use of the laboratory balance.[46]

Both syllabuses not only had many topics in common, but their phasing in the classroom and laboratory was also very similar. In the technical schools the Department introduced the same scheme of elementary science into the First Year Course, which consisted of two parts, Elementary Physics and Elementary Chemistry.

---

[43] Suggested Syllabus. D.A.T.I. 1st annual general report, p. 193.
[44] Ibid., p. 233-245.
[45] Ibid., p. 234.
[46] Suggested Syllabus. D.A.T.I. 1st annual general report, 1900-01, pp. 194-195.

In his paper *How Science must be studied to be useful*, Armstrong makes reference to the heuristic teaching of this syllabus, and that the scheme was not new:

> The method is in no way novel; it is the historical method - that used in days when examinations and text-books were not that used in principle by ever explorer. [47]

8.4.7 The Digby Inquiry of 1907

Two pieces of evidence from this Inquiry provide further proof that the Department implemented a heuristic policy of science education between 1900 and 1907. Br. Hennessy who had taught alongside Br. Burke at the North Monastery School in Cork City, and was a member of the executive of the order of the Christian Brothers in Ireland, gave his evidence regarding the organisation of secondary school science under the Department. He spoke about the preliminary course, and gave details about it:

> This course aims not so much at the acquiring a knowledge of any special branch of science as at the development of what is styled the "scientific method", by placing the boy in a well-equipped laboratory in which, under the direction of a qualified teacher, he is set to solve numerous practical problems and to record, in a concise and graphic form, the various stages by which he was enabled to arrive at the results. Two years thus spent are supposed to have prepared the boy to commence one or other of the special courses for which the Department's syllabus provides.[48]

He then proceeded to put a name on the particular method which the Department insisted on:

> The heuristic method must be followed...the system is educational to a high degree, and is well calculated to develop, not only the "scientific method" but to awaken a love for Science, and to induce a continuance of its study when the boy shall have left the secondary school.[49]

Br. Hennessy expanded his viewpoint when he went on to suggest various improvements he would suggest to make the Department's scheme more effective. One wonders to what extent Br. Burke had influenced him over the years of teaching together. He stated that '...the Department insists, unduly, on

---

[47] Armstrong, H. E. 'How Science must be studied to be useful'.. From *The Teaching of Scientific Method and other Papers in Education*. London: Macmillan & Co. Ltd., 2nd Edition 1925, p. 45.
[48] 1907 Report of the Departmental Committee of Inquiry into the Provision of the Agricultural and Technical Instruction Act. 1899. (Digby Inquiry), p. 916.
[49] Ibid., p. 916.

the "heuristic method"',[50] and in his opinion he would rather see a more balance mix of teacher demonstration and pupil experimentation, both situations demanding the pupils to record the event in their laboratory notebooks. This had been the methodology that Br. Burke had employed so successfully during his teaching years. Mr. Ogilvie (a member of the committee) pushed Br. Hennessy further on the Department's heuristic policy when he asked him '...does the Department insist upon an absolute adherence to the heuristic method?', and the reply he received was: 'Not absolute, but it insists on it very much'.[51]

The Headmaster of Blackrock College Rev. Dr. Crehan, followed Br. Hennessy, and was questioned regarding Br. Hennessy's allegations regarding the heuristic policy of the Department. He was asked:

> Do you concur with Br. Hennessy's evidence that the Department definitely discouraged any such instruction as by class demonstration of experiments in contrast with the heuristic method applied absolutely – that is to say, requiring the pupils to perform every experiment on the course?[52]

Crehan replied:

> To my mind, the Department have discouraged that. Of course there are lessons in which the more difficult experiments can be performed by the Professor, but I think, as a general rule, they are not satisfied unless all experiments are performed by the students themselves.[53]

At the 48th public sitting of the committee at Westminster in London, on November 22nd 1906, the assistant secretary in respect of Technical Instruction of the Department, George Fletcher was questioned by the chairman Sir Kenelm Digby as to the educational methods employed in the secondary schools by the Department. Fletcher stated that:

> The idea was to introduce a system which should be more practical in character, more educational, and in which the keynote should be the work performed by the student himself...and one of the guiding principles in the new system introduced is that the student should not be told anything that he may fairly be supposed to find out for himself.[54]

---

[50] Ibid., p. 916.
[51] Ibid., p. 916.
[52] Ibid., p. 919.
[53] Ibid., p. 919.
[54] Ibid., p. 946.

The chairman intervened by saying: That is what has been described as the "heuristic method"? This provoked Fletcher to reply that he did not like the term being used because a great deal of discredit was attached to it. The sequence of questioning has been discussed in section 6.10 of this thesis and it is only repeated here as it affirms the Department's policy.

What followed this particular line of questioning was also important as it confirmed that the Department thought very much along the same lines as Armstrong. For example when Fletcher was questioned about the possibility of the teacher demonstrating a particular experiment, his reply contained the following statement in referring to the Department's Prefatory Note which it published in 1900 and which was sent to all the secondary schools working under it:

> The mere acquisition of the facts of science – assuming it possible to convey them without practical work – must be regarded as quite secondary in value to the mental training and discipline involved by following out a few simple lines of investigation involving the exercise of the observing and reasoning faculties. This method, which has been called the 'Research' or 'Heuristic' method, involves the exercise of the highest powers of a teacher.[55]

8.5 The place of practical science in Irish schools after the demise of the DATI

The method of science instruction which preceded the Department's intervention was textbook-based and only very few schools would appear to have used even science demonstrations. This changed to an educational system where almost all the schools employed a practical-based form of instruction and more importantly, assessment. Grants were paid by the Department on the basis of an inspector's report. There were no written examinations in science. In the declining years of the Department's influence, demonstration lectures became the norm, and the assessment had once again returned to the form of a written examination.

The education records of the Christian Schools North Richmond Street continue up to 1927, and in the years following the demise of the Department of Agriculture and Technical Instruction give a glimpse of the state of science instruction between 1922 to 1927. It would appear that practical science continued after 1924, and was examined at both Intermediate and Leaving Certificate levels. In 1926 the Principal recorded the Department of Education's report as:

---

[55] Ibid., p. 946.

> The practical tests in science for Intermediate Certificate candidates were on whole (sic) well done. Candidates were skilful at manipulation and secured results of reasonable accuracy within the time specified for the examination... The practical work in Chemistry for Leaving Certificate was satisfactory in every respect. Candidates showed great self-reliance, got to work quickly and obtained excellent results. The results in Physics for Leaving Certificate were not quite so good as usual. While the candidates had ample knowledge of general principles to enable them to discuss their experiments intelligently, they were unable to perform them in a convincing manner. The methods used were awkward and lacking in precision and many candidates were unable to obtain results in a reasonable time.[56]

The following year (and the last one recorded by the Principal of the school), the Inspector's report pointed out the decline in the standards of science instruction mainly due to the lack of experience of some of the science teachers:

> For many years this school has maintained a very high standard of science instruction. Changes in staff and the necessity for employing teachers with less experience than those they replace must inevitably affect temporarily efficiency in instruction in some parts of so large a school. It is satisfactory to note that the authorities of the Order have taken steps to provide additional training to enable the less experienced teachers to deal with the subject matter recently introduced into the programmes. This training should ensure a marked improvement in the treatment of the preparatory syllabus that makes severe demands upon preparation of lessons and teaching skill. The pupils in Intermediate Certificate classes showed evidence of solid teaching. They have a good knowledge of principles and carried out practical tests well and intelligently. The Leaving Certificate class showed general weakness in their practical work.[57]

With so many school laboratories in existence following the demise of the Department of Agriculture and Technical Instruction, it was unlikely that the practice of practical school science would simply stop abruptly. It did not. Although the awarding of grants on the basis of compliance with Departmental regulations came to an end with its demise, the newly formed Department of Education acknowledged the fact that the practical nature of school science had a role to play.

---

[56] Principal's Report, North Richmond Street C.B.S., 1926, p.



Plate 18. Science laboratory, The High School. Built under the auspices of the Department in 1904, this photograph was taken in the 1930's. Note the separate workbench and writing bench arrangement similar to the 'Davy' laboratory at Christ's Hospital School.

Practical science work was performed in Irish schools around 1956, and although it was not assessed by an inspector with a view to awarding marks towards either the Intermediate or Leaving Certificate examinations, it played an important part in providing pupils with hands on experience in a laboratory. Although in schools where science was traditionally a strong subject and where laboratories had been constructed in the early years of the last century, such as the Christian schools, the practical approach towards science instruction never waned. Past pupils still recall their science instruction in the 50s and 60s and speak about laboratory notebooks being kept carefully to record their laboratory work. One past pupil of King's Hospital recalls a limekiln in the centre of the old laboratory at Blackhall Place where he remembers limestone being roasted. The action of heat on limestone had always been an important part of Armstrong's syllabus for elementary science; he used to refer to it as 'chalkstuff'. Another teacher there recalls piles of laboratory notebooks for each class, and it was not uncommon for one pupil to have recorded his practical work in not one but many notebooks. These notebooks were required for inspection by the Department of Education, and this procedure remains in place up to the present day.

With the advent of more modern conditions prevalent in Ireland following its political independence, with ever higher standards required in order to gain entry into third level education, there was very little room for the slower and time-consuming practical science work which characterised the heuristic approach. That school practical science survived at all is due to the large expenditure by the Department of Agriculture and Technical Instruction that led to the construction of so many school laboratories during its initial years.

School laboratories that were built after 1900 and grant aided by the department had to conform to strict departmental conditions. The High School was such an example. Its science laboratory was built around 1904, and although no records appear to exist documenting the funding of this construction, the minutes of the board refer on numerous occasions to the fact that the department had a large say in the details of the science laboratory. From the plans that exist it is clear that the type of science taught in this building was heuristic. Apart from an alteration which involved installing a new heating system in 1907 no other major changes in this building occurred afterwards. This laboratory layout would have helped promote a more practical type of science instruction even after the demise of the Department of

[57] Principal's Report, North Richmond Street C.B.S., 1927.

Agriculture and Technical Instruction. This would have been true of many other schools that constructed laboratories under the department's scheme of providing laboratory and equipment grants. In this way the Department's policy of a solid practical base for school science would have had a much longer lasting effect in schools than the records detail. The construction of so many school laboratories remained a legacy which exposed many more pupils to practical science long after the demise of the Department, and this alone represents a considerable value which can be attributed to it.

Unlike Ireland, which saw the demise of Armstrong's heurism earlier than in Britain, heuristic methods returned to the English schools almost forty years later somewhat modified in the guise of the Nuffield Science courses that were taught from the mid-sixties to the mid-eighties. Gordon Van Praagh was credited with overseeing it. For a number of years he taught science at Christ's, and has written an authoritative biography of Henry Edward Armstrong. In his book *From Armstrong to Nuffield,* E.W. Jenkins refers to the contribution made by Armstrong to practical school science.

> Despite the virtual eclipse of the heuristic method of teaching science, many of Armstrong's ideas were to continue to influence school science education. An emphasis on practical experimental teaching and a belief in the importance of learning by doing became the established features, and science curriculum reform, a generation after his death in 1937, was to incorporate Armstrong's view that science could best contribute to liberal education by initiating pupils into its greatest professional mystery, its method.[58]

It would seem that even to-day many educational theorists advocate the discovery methods for science education yet in reality they seem to be seldom practised. Funding for practical science in our schools is still low on Government's agenda, a cry that appears in our newspapers on a regular basis. In an editorial in the *Irish Times* on the 19th November 2001 under the heading *Science for School*, referring to the Government's Science Technology and Innovation Awareness Programme and mission to promote greater public understanding of science it is stated that:

> The Programme is there to promote awareness of science but it has a more practical role, one perhaps more important to our future economic well being... The number taking science in the Leaving and at Third Level has plummeted and this decline shows no sign of halting. [59]
>
> The article closes with an appeal for science to become a real and practical subject in all our

[58] Jenkins, E.W. *From Armstrong to Nuffield.* London: John Murray, 1979, p. 52

> schools, 'Will an opportunity to play with a few magnets on a school desk help to bring this about? Not in itself, although it might spark the imaginations of a few. Rather, what is needed is concerted Government action to make science a real subject in our schools. State investment to improve science labs and facilities in our schools is underway but more is needed and quickly to improve access to experimental work. Science needs to be more deeply embedded in the primary curriculum. Pupils at all levels must have the chance to experience it first hand.[60]

These sentiments could well have been written one hundred years ago prior to the establishment of the Department of Agriculture and Technical Instruction. It would appear that once again we have come full circle.

---

[59] *Irish Times* article 'Science for Schools', 15th November 2001, p. 17.
[60] Ibid, p. 17.

Photographs - sources

1. Henry Edward Armstrong in 1885. Facing page 10 (courtesy Imperial College of Science London).
2. Pupils working heuristically. Clongowes Wood College chemistry laboratory 1902. Facing page 16 (source: The Clongownian 1902).
3. Pupils working heuristically. Clongowes Wood College physics laboratory 1902. Facing page 18 (source: The Clongownian 1902).
4. The 'Davy' laboratory at Christ's Hospital School which was designed by Armstrong. Facing page 19 (courtesy Christ's Hospital School archive).
5. Natural Philosophy Hall Clongowes Wood College 1902. Facing page 34 (source: The Clongownian 1902).
6. Br. Burke in old laboratory. Facing page 35 (courtesy North Monastery School archive).
7. Advertisement for laboratory balances 1907. Facing page 79 (source: The Irish Teachers' Journal 1907).
8. An object lesson. Facing page 86 (courtesy London Metropolitan Library).
9. Sir Horace Plunkett. Facing page 98 (courtesy Institute of Public Administration).
10. Mr. T. P. Gill. Facing page 99 (courtesy IPA).
11. The old offices of the Department. Facing page 101 (courtesy IPA).
12. National schoolteachers attending summer course at Municipal Technical School in Waterford c. 1908. Facing page 113 (source: D.A.T.I. Journal).
13. Advertisement for the Department's model laboratory at the Cork Exhibition 1902. Facing page 164 (source: The Clongownian 1902).
14. The new offices of the Department 1917. Facing page 216 (courtesy IPA).
15. Science laboratory Wesley College early 1900s. Facing page 240 (courtesy Wesley College archive).
16. Municipal Technical School Ballymena early 1900s. Facing page 241 (source: D.A.T.I. Journal).
17. Pupils of the North Monastery School Cork at the Cork Exhibition 1902. Facing page 242 (courtesy Allen Library).
18. Science laboratory The High School. Facing page 288 (courtesy The High School archive).

Bibliography

Primary Sources:

Manuscripts

St. Ciaran's College archives. Annals of St. Ciaran's College Kilkenny
St. Ciaran's College archives. Birch, P. Personal notes from first draft of his book, *History of St. Ciaran's College Kilkenny.*
King's Hospital archives:
Committee Book, King's Hospital. 21st November 1891.
Committee Book, King's Hospital. 10th October 1901.
Committee Book, King's Hospital. 14th November 1901.
Committee Book, King's Hospital. February 1902.
Committee Book, King's Hospital. 10th June 1902.
Committee Book, King's Hospital. 12th March 1903.
Imperial College of Science archives, London: Copy of letter from C. M. Stuart, Headmaster of St. Dunstan's College to Armstrong, June 15th 1890.
Whitely, Martha Annie. Chemistry notes – 1897.
King's Hospital archives:
Education Committee report, King's Hospital. March 1902.
Education Committee report, King's Hospital. June 1903.
Education Committee report, King's Hospital. March 1904.
Headmaster's report, King's Hospital. June 1901.
Headmaster's report, King's Hospital. December 1901.
Headmaster's report, King's Hospital. March 1902.
Headmaster's report, King's Hospital. September 1902.
Headmaster's report, King's Hospital. December 1903.
Headmaster's report, King's Hospital. June 1904.
Headmaster's report, King's Hospital. September 1904.
Headmaster's report, King's Hospital. December 1904.
Headmaster's report, King's Hospital. September 1905.
Headmaster's report. King's Hospital, December 1905.
Headmaster's report, King's Hospital. March 1906.
Headmaster's report, King's Hospital. June 1906.
Headmaster's report, King's Hospital. September 1907.
Headmaster's report, King's Hospital. June 1910.
Headmaster's report, King's Hospital. September 1910.
Headmaster's report, King's Hospital. October 1911.
Headmaster's report, King's Hospital. December 1913.
Headmaster's report, King's Hospital. September 1914.
Summary of Inspector's report, from Headmaster report, September 1914.
Headmaster's report, King's Hospital, September 1917.
Headmaster's report, King's Hospital, December 1917.
Headmaster's report, King's Hospital, September 1918.
Headmaster's report, King's Hospital, September 1921.
King's Hospital Letters Book. Letter dated 26th March 1903.
King's Hospital Letters Book. Letter dated 11th November 1903.
Minutes of Board Meeting, King's Hospital. December 1901.
Minutes of the Board of Mercer's School, 6th October 1903.
Minutes of the Board of Mercer's School, 3rd January 1905.
The High School archives:
Letter from Headmaster, dated 27th October 1904. The High School archives.

Letter from The High School Archive. File GS 471 17 pp. 1st February 1906.
The High School Prospectus 1911, Dublin: University Press, Ponsonby & Gibbs.
Wesley College archives:
Management Committee Minutes, Wesley College. September 13th, 1901.
Allen Library, Dublin:
Principal's Report, 1904, C.B.S. North Richmond Street.
Principal's Report, 1905 C.B.S. North Richmond Street.
Principal's Report, 1906 C.B.S. North Richmond Street.
Principal's Report, 1907 C.B.S. North Richmond Street.
Principal's Report, 1908 C.B.S. North Richmond Street.
Principal's Report, 1909. C.B.S. North Richmond Street.
Principal's Report, 1924. C.B.S. North Richmond Street.
Principal's Report, 1926. C.B.S. North Richmond Street.
Principal's Report, 1927 C.B.S. North Richmond Street.
University College Dublin archives:
Letter from Professor Orr of the Royal College of Science to George Fletcher of the Department.
Reports of the Royal College of Science of Ireland.

Official Papers

Report of the South Kensington Board. London HMSO, 1853.
1881 Royal Commission on Technical Instruction (Samuelson Commission). 1st Report 1881 C.3171 **XXVII**. Further reports with evidence and appendix 1884 C. 3981 **XXIX, XXX,** and **XXXI**.
1888 Annual Report of the Intermediate Board, Cd. 5355, **XXXIX.** Dublin: HMSO.
Report of the Recess Committee on the establishment of a Department of Agriculture and Industries for Ireland. Dublin: Browne & Nolan, 1896.
Memorandum on Agricultural and Technical Education – Arnold Graves. From the Recess Report, 1896.
Part II of Appendix to Final Report (1899 C. 9513), **XXIV**.
Recess Committee Report, Appendix O.
1897 Intermediate examination papers. Dublin: Browne & Nolan.
Copy of the 13th and 14th Meetings of the Royal Commission on Manual and Practical Instruction in Primary Schools under the Board of National Education in Ireland. (The Belmore Commission), March 19th – 20th, 1897.
Final Report of the Belmore Commission. Appendix F. Digest of minutes of evidence.
Revised Programme of Instruction in National Schools under Notes, Hints and Observations for the information of Managers and Teachers, Appendix F.
1898 1st Report of the Commissioners on Intermediate Education (Ireland) – Palles (with appendix).
1898 Annual Report of the Intermediate Board. Dublin: HMSO.
Evidence 1899 (C. 9512) **XXIII**.
Final Report 1899 (C. 9511) **XXII**.
(C. 9116 C. 9117) **XXII**. Dublin: HMSO, 1899.
Suggestions, pamphlet issued by the Department. Dublin: HMSO, 1900.
Board of Technical Instruction minutes of the 8th meeting, April 15th 1902.
D.A.T.I. miscellaneous bulletin, Dublin: HMSO Alexander Thom & Co. (Ltd.,) 1903.
Intermediate Board examiners' reports for 1883. Dublin: HMSO.
Intermediate Board examiners' reports for 1886.
Intermediate Board examiners' reports for 1887.
Intermediate Board examiners' reports for 1888.
Intermediate Board examiners' reports for 1890.
Intermediate Board examiners' reports for 1896.
Intermediate Board of Education. Annual Report. Dublin: HMSO, 1898
Intermediate examination papers issued at the 1st Examinations under the Intermediate Education Act (Ireland) 1878. Dublin: Browne & Nolan, 1879.
Department of Agriculture Library:
Minutes of the 3rd Board Meeting of the Technical Instruction Branch, October 1900.

Minutes of the 5th Board Meeting, May 1901.
Minutes of the 6th Board Meeting, August 1901.
Minutes of the 12th Board Meeting, July 1903.
Minutes of the 20th Board Meeting, March 1906.
Minutes of the 14th Board Meeting, March 1909.
Minutes of the 36th Board Meeting, February 1912.
Minutes of the 37th Board Meeting, 1912.
Minutes of the 44th Board Meeting, April 1915.
Minutes of the 45th Board Meeting, July 1915.
Minutes of the 49th Board Meeting, July 1916.
Minutes of the 58th (Special) Board Meeting, 18th December 1919.
Minutes of the 38th meeting of the Council of Agriculture, May 1921.
Prefatory note to the Department's programme for Day Secondary Schools.
Report of Messrs. F. H. Dale and T. A. Stephens, His Majesty's Inspectors, Board of Education, on Intermediate Education in Ireland. Cd 2546 **XXVIII**. Dublin: Alexander Thom & Co. Ltd., 1905.
Report of the Departmental Commission of Inquiry into the Provision of the Agricultural and Technical Instruction Act 1899. (1907 Digby Inquiry). 1907 Cd 3572 **XVII**.
Department of Education, *Report of the Council of Education*, 1962. The Stationary Office, Dublin.

Reports

Report of the 1889 Newcastle-upon-Tyne Meeting (59th) of the British Association. London: John Murray, 1889.
Report of the Russell Committee at the 59th Meeting of the British Association for the Advancement of Science at Newcastle-upon-Tyne, September 1889, p. 229.
Report of the 1902 Belfast Meeting (72nd) of the British Association for the Advancement of Science. London: John Murray, 1903.
Report of the 1908 Dublin Meeting (78th) of the British Association for the Advancement of Science. London: John Murray, 1909.
Report of the 1920 Cardiff Meeting (88th) of the British Association. London: John Murray, 1920.
Report of the Council of Education. Stationary Office, Dublin 1962.
Heller's 1900-01 General Report. Appendix to the 67th report.
Heller's 1905-06 General Report. Appendix to the 72nd report.
Heller's 1909-10 General Report. Appendix to the 76th report.
Heller's 1913-14 General Report. Appendix to the 79th report.
44th Report of the Science and Art Department.
Department of Agriculture and Technical Instruction. *1st annual general report*. Dublin: HMSO 1901.
Department of Agriculture and Technical Instruction. 2nd *annual general report*. Dublin: HMSO 1903.
Department of Agriculture and Technical Instruction. *3rd annual general report*. Dublin: HMSO 1904.
Department of Agriculture and Technical Instruction. *4th annual general report*. Dublin: HMSO 1905.
Department of Agriculture and Technical Instruction. *5th annual general report*. Dublin: HMSO 1906.
Department of Agriculture and Technical Instruction. *6th annual general report*. Dublin: HMSO 1907.
Department of Agriculture and Technical Instruction. *7th annual general report*. Dublin: HMSO 1908.
Department of Agriculture and Technical Instruction. *8th annual general report*. Dublin: HMSO 1909.
Department of Agriculture and Technical Instruction. *9th annual general report*. Dublin: HMSO 1910.
Department of Agriculture and Technical Instruction. *10th annual general report*. Dublin: HMSO 1911.
Department of Agriculture and Technical Instruction. *11th annual general report*. Dublin: HMSO 1912.
Department of Agriculture and Technical Instruction. *12th annual general report*. Dublin: HMSO, 1912.
Department of Agriculture and Technical Instruction. *13th annual general report*. Dublin: HMSO 1914.
Department of Agriculture and Technical Instruction. *14th annual general report*. Dublin: HMSO 1915.
Department of Agriculture and Technical Instruction. *15th annual general report*. Dublin: HMSO 1916.
Department of Agriculture and Technical Instruction. *16th annual general report*. Dublin: HMSO 1917.
Department of Agriculture and Technical Instruction. *18th annual general report*. Dublin: HMSO 1919.
Department of Agriculture and Technical Instruction. *19th annual general report*. Dublin: HMSO 1920.

Department of Agriculture and Technical Instruction. *21st annual general report*. Dublin: HMSO 1922.
Department of Agriculture and Technical Instruction. *22nd annual general report*. Dublin: HMSO, 1924.
Report of the Gregory Committee contained in the Report of the 1908 Dublin Meeting of the British Association.
Wesley College Report, 31st January 1883.
Wesley College Quarterly, 1892. Printed: R. T. White, Dublin published by The Editorial Council, Wesley College, Dublin.
Wesley College Quarterly, October 1904.
Wesley College Quarterly, June 1911.
Wesley College Quarterly, March 1913.
Wesley College Quarterly, April 1920.

Journals

The Central, edited on behalf of the Old Centralians. Vol. XXXV, No. 83, June 1938. London: William Brown & Co. Ltd.
Journal of Science and Art, Vol. V, No. 56. November 1891.
Science and Art and Technical Education Journal, 1891.
Irish Educational Review, Dublin: Browne & Nolan, 1893.
Irish Educational Review. Vol. VII No.1, 1903.
Irish Educational Review. Vol. III No.9, May 1903.
Irish Educational Review, Vol. 1, June 1908.
Irish Educational Review, Vol. I No.12, September 1908.
Irish Educational Review. Vol. II. October 1908 to September 1909.
Irish Educational Review. Vol. IV. October 1910 to September 1911.
Irish Educational Review. Vol. V. No.4. January 1912.
Irish Educational Review. Vol. VII No.1, 1913.
Journal of The Department of Agriculture and Technical Instruction. *Science training in the secondary school.* Vol. III, September 1902-June 1903.
The Irish School Monthly. Vol. I, No. 1. September 1900.
The Irish School Monthly. Vol. I, No. 4. December 1900.
The Irish School Monthly. Vol. I, No. 7. March 1901.
The Irish School Monthly. Vol. I, No.9. May 1901.
The Irish School Monthly. Vol. I, No.10. June 1901.
The Irish School Monthly. Vol. I, No. 11. July 1901.
The Irish School Monthly. Vol. XXXV, No. 33. August 1901.
The Irish School Monthly. Vol. II, No.1. September 1901.
The Irish School Monthly, Vol. II, No.2. October 1901.
The Irish School Monthly, Vol. II, No.6. February 1902.
The Irish School Monthly. Vol. III, No. 1. October 1902.
The Irish School Monthly, Vol. III, No. 2. October 1902.
The Irish School Monthly, Vol. III, No. 4. December 1902.
The Irish School Monthly. Vol. III, No.6. February 1903.
The Irish School Monthly. Vol. III, No. 8. April 1903.
The Irish School Monthly. Vol. III No.9. May 1903.
The Irish School Monthly. Vol. III, No. 11. July 1903.
The Irish School Monthly. Vol. IV, No. 2. October 1903.
The Irish School Monthly. Vol. IV, No.6. February 1904.
The Irish School Monthly. Vol. IV, No.9. May 1904.
The Irish School Monthly. Vol. IV No.2. July 1904.
The Irish School Monthly. Vol. V, No. 1. September 1904.
The Irish School Monthly. Vol. V, No.4. December 1904.
The Irish School Monthly. Vol. V, No.5. January 1905.
The Irish School Monthly. Vol. V, No.7. March 1905.
The Irish School Monthly, Vol. VI, No. 9. April 1906.
The Irish School Monthly. Vol. VIII, No.2. October 1906.

The Irish School Monthly. Vol. XLX, No.8. October 1921.
The Irish School Monthly. Vol. XXIV, No. 20.
The Irish School Monthly. Vol. LXXI, No. 5. February 1922.
The Irish School Monthly. Vol. LXXII, No. 51. December 1922.
The Irish School Monthly. Vol. LXXII, No. 7. February 1923.
The Irish School Monthly. Vol. LXXIII, No. 16. April 1923.
The Irish School Monthly. Vol. LXXIV, No. 17. April 1923.
The Irish School Monthly. Vol. LXXIV, No. 28. July 1923.
The Irish School Monthly. Vol. LXXIV, No. 24. June 1923.
The Irish Teachers' Journal, October 1900. Dublin: Blackie & Son, Ltd.
The Irish Teachers' Journal, November 1900.
The Irish Teachers' Journal, April 1901.
The Irish Teachers' Journal, November 1901.
The Irish Teachers' Journal, August 1902.
The Irish Teachers' Journal, March 1901.
The Irish Teachers' Journal, October 1903.
The Irish Teachers' Journal, July 1902.
The Irish Teachers' Journal, July 1903.
The Irish Teachers' Journal, August 1902.
The Irish Teachers' Journal, February 1901.
The Irish Teachers' Journal, April 1881.
The Irish Teachers' Journal, December 1905.
Irish School Weekly. Vol. I, No. 2. October 2nd 1900.
Irish School Weekly. Vol. V, No. 1. September 1904.
Irish School Weekly. Vol. VII, No. 4. December 2nd, 1905.
Irish School Weekly. Vol. XLIV, No. 1. September 22nd, 1906.
Irish School Weekly. Vol. LIII, No.4. May 6th 1911.
Irish School Weekly. Vol. LI, No. 25. August 6th 1910.
The Irish School Weekly. Vol. LXXIV, No. 50. December 15th 1923.
Armstrong, H. E. *How Science must be studied to be useful*, from *The Technical World*, 1896.
Christian Brother's Educational Record, *Pioneers of Technical Education*, J. Comerton as quoted in *The Irish Technical Journal*. Dublin: Browne & Nolan, 1904.
Corcoran, T. *The place of the sciences in general education*. Studies, Vol. XII. Dublin: The Educational Company of Ireland, 1923.
Fleming, G. F. *The case of Ireland against the Science and Art Department*. Irish Ecclesiastical Record, Vol. XV, and Dublin: Browne & Nolan,1904.
Technical instruction in Ireland. New Ireland Review, Vol. XII, Nov.1899.
Fletcher, G. *The place of science in a general education*. Department of Agriculture and Technical Instruction Journal Vol. VI. No. 4. Dublin: Browne & Nolan, 1906.
Fletcher, G. *The Organisation and Position of Technical Education in Ireland*. Department of Agriculture and Technical Instruction Journal Vol. VIII. Dublin: Browne & Nolan, 1907-08.
Fletcher, G. *Summer Courses of Instruction for Teachers*, Department of Agriculture and Technical Instruction Journal, Vol. X. No. 1. Dublin: Browne & Nolan, 1909-10.
Fletcher, G. *A Decade of Technical Instruction in Ireland.* Department of Agriculture and Technical Instruction Journal, Vol. XII. No. 2. Dublin: Browne & Nolan, 1911-12.
Fletcher, G. *The Department's new scheme of examinations for technical schools.* Department of Agriculture and Technical Instruction Journal, Vol. XII. No. 4. Dublin: Browne & Nolan, 1911-12.
Journal of the Department of Agriculture and Technical Instruction, Vol. XV, 1904.
Appendix to the 1911 – 12 Journals of the Department of Agriculture and Technical Instruction.
Journal of the Department of Agriculture and Technical Instruction, Vol. XIX, 1918.
Gill, Henry V. S. J., *Science in our schools*. Studies, Vol. XII, September 1932.
Williams, W. J. *The Shannon scheme and the teaching of science – a plea for realism in education*. Studies, Vol. XV, 1926.
Irish Journal of Education. Vol. VI, No.8. September 1916.

Secondary Sources:

I Contemporary sources pre-1920

Annals of the Christian Brothers for 1904.
Armstrong, H. E. Address to the Educational Science Section of the British Association for the Advancement of Science, Belfast 1902.
Armstrong, H. E. *On the Teaching of Natural Science.* Published in Health Exhibition Literature, Vol. XIV August 1884. London: William Clowes & Sons Ltd., 1884.
Armstrong, H. E. Presidental address at the Belfast Meeting of the British Association for the Advancement of Science, 1902.
Armstrong, H. E. Quoting Huxley in *How Science must be studied to be useful.*
Armstrong, H. E. *Suggestions for a course of elementary instruction in physical science.* Paper read at the 59th Meeting of the British Association, 1889.
Armstrong, H. E. *The Heuristic Method of Teaching or the Art of Making Children Discover Things for Themselves – A chapter in the History of English Schools.* 1898. Special Reports on Educational subjects. Vol. 2, 1898 (Sadler Report), London: printed for HMSO by Wyman & Sons Ltd.,
Armstrong, H. E. *The Teaching of Scientific Method and other Papers on Education.* London: Macmillan & Co. Ltd., 1910.
Browne, C. E. *Elementary Science Teaching introduced in the Christ's Hospital Science School,* (from Christ's Hospital's archives), May 1899.
Christian Brothers Educational Record. Dublin: William J. Alley & Co., 1891.
Christian Brothers Educational Record. Dublin: William J. Alley & Co., 1893.
Christian Brothers Educational Record. Dublin: Fowler., 1902.
Christian Brothers Educational Record. Dublin: William J. Alley & Co., 1903.
Christian Brothers Educational Record. Dublin: Fowler., 1905.
Christian Brothers Educational Record. Dublin: William J. Alley & Co., 1905.
Cramphorn, F. *Notes on the First Year's Course in Introductory Chemistry for Intermediate Schools.* Dublin: Browne & Nolan, 1902.
Department of Agriculture and Technical Instruction for Ireland, Form S. 255.
Details of summer courses of instruction for teachers, 1906. Issued by the D.A.T.I. Form S. 41.
Fletcher, G. Addressing the Association of Technical Institutions, Belfast Summer Meeting, July 12th –14th, 1907.
Gill, T. P. *Character and Educational Efficiency in Ireland.* An address to the 1908 British Association
Gill, T. P. *Science in Secondary Schools: The Department's Programme.* Paper read on 12th September 1902 at the Meeting of the British Association in Belfast.
Harrison, W. J. *The Science of Home Life.* London: T. Nelson & Sons, 1888.
Heller, W. M. Address to the Annual Meeting of the British Association at York, September 1932. London: Office of the British Association.
Heller, W. M. *Impressions of three years experience of science teaching in East London schools,* Appendix D, (Sadler Report). Vol. 2. Wyman & Sons, London 1898.
Intermediate Board Examination Papers, 1901. Dublin: Browne & Nolan.
Intermediate Examination papers for June – July 1879. Dublin: Browne & Nolan.
Letter written by G. F. Fitzgerald to W. M. Heller. Published in *The Heuristic Method of Teaching,* H. E. Armstrong in Sadler Report.
Molloy, G. *Secondary Education in Ireland.* Irish Ecclesiastical Record, Vol. IV, July – December 1898. Dublin: Browne & Nolan.
Norwood, C. & Hope, A. H. *The higher education of boys in England,* London: Murray, 1909.
Notes on Fr. Molloy's testimony to the 1899 Commission on Intermediate Education.
Plunkett H. Address to the Council of Agriculture, 1904.
Plunkett, H. Address delivered at the Council of Agriculture, 29th May 1900.
Plunkett, H. *Ireland in the new century.* First published 1904. 2nd Edition, London: Kennikat Press, 1970.
Plunkett, H. *The Cork Exhibition and after*, address delivered to the Cork Literary & Scientific Society, January 1903.

Simmons, A. T. and Jones, L. M. *Elementary General Science.* London: Macmillan & Co. Ltd., 1908.
Watson, G. *A Second Year Course in Chemistry for Intermediate Schools.* Dublin: Browne & Nolan, 1909.

II Post 1920

A Journey through Government Buildings. Published by the OPW for the Department of the Taoiseach. Dublin: Stationary Office, 1997.
Armitage, E. *Wesley College Dublin 1845-1995 An Illustrated History.* Dublin: Published by Wesley College, 1995.
Armstrong, H. E. Huxley Memorial Lecture, from Brock, W. H. *H. E. Armstrong and the teaching of science, 1880 – 1930.* London: Cambridge University Press, 1973.
Atkinson, N. *Irish Education a history of educational institutions.* Dublin: Allen Figgis, 1969.
Blair, Robert. *Policy-Making in Education: Robert Blair and the L.C.C. 1904-1924.* D. W. Thoms 1980
Brock, W. H. *H. E. Armstrong and the teaching of Science, 1880 – 1930.* London: Cambridge University Press, Colchester 1973.
Browne, C. E. *Henry Edward Armstrong – Educational Work.* London: Harrison & Sons Ltd.
Browne, C. E. *Henry Edward Armstrong and Charles E. Browne.* Imprint: Christ's Hospital. London: Harrison & Sons Ltd., 1968.
Cooke, J. *The Dispute between the D.A.T.I. and the City of Dublin T.I.C., 1901-12.*
Coolahan, J. *Irish Education – Its History and Structure.* Dublin: Institute of Public Administration, 1981.
Corcoran, T. *Clongowes Record, 1814 – 1932.* Dublin: Browne & Nolan. Source: Clongowes archives.
Duff, T., Hegarty, J. and Hussey, M. *The Story of the Dublin Institute of Technology.* Dublin: Blackhall Printing, 2000.
Durcan, T. J. *History of Irish Education from 1800 (with special reference to manual instruction).* Bala, North Wales: Dragon Books, 1972.
Edmund Ignatius Rice and the Christian Brothers. Dublin: Gill & Son, 1926.
Eyre, J. V. *Henry Edward Armstrong, 1848-1937.* London: Butterworths Scientific Publications, 1958.
Gill, H. V. *Science in our schools.* Studies, 1932.
Heller, W. M. Address to the Annual Meeting of the British Association at York, September 1932. London: Office of the British Association.
Hoctor, D. *The Department's Story – A History of the Department of Agriculture.* Dublin: Institute of Public Administration, 1971.
Hyland, A & Milne, K. *Irish Educational Documents.* Vols. 1 and 2. Dublin: C.I.C.E. 1992.
Jenkins, E. W. *From Armstrong to Nuffield.* London: John Murray, 1979.
Kelleher, D. V. *James Dominic Burke – A pioneer of Irish Education.* Dublin: Irish Academic Press, 1988.
McMillan, N. & Meehan, J. *John Tyndall – 'X'emplar of scientific and technological education.* Dublin: ETA Publications, 1980.
McMillan, N. *Tyndall the philosopher, John Tyndall (1820-1893).*
Newhouse, N. H. *A History of Friends' School Lisburn.* Lisburn: LM Press Ltd., 1974.
Pamphlet written by Dr. Adrian Mallon, 1990. Belfast: Shanaway Litho printers.
Parkes, S. M. *George Fletcher and Technical Education in Ireland, 1900-1927.* Irish Educational Studies, Vol. 9. No.1. 1990, pp 13-39. (Reprinted in Irish Educational Decisionmaker, No. 4, Autumn 1991, pp 42-47.
Parkes, S. M. Guides to Sources in the History of Education No. 5. Irish Education in the British Parliamentary Papers in the 19th century and after, 1801-1920. History of Education Society in association with Cork University Press, 1978.
Royal Society of Chemistry. *Chemists through the years, Part 1.* Edited by Douglas Servant. London: R.S.C., 1994.
St. Mary's C.B.S. Portlaoise. Reminiscences of a distinguished past pupil. 1847-1947 Centenary Record.
Terakawa, T. and Brock, W. H. *The Introduction of Heurism into Japan.* History of Education, Vol. 7, No.1, 1978.
Wallace, J. *Science Teaching in Irish Schools 1860 – 1970.* Irish Journal of Education, 1972.

III Theses

Carton, J. J. *The Development of Technical Education in Ireland, 1889 – 1930.* M. Ed. thesis, Trinity College Dublin, 1972.
Clune, M. *Horace Plunkett, the origins and development of the D.A.T.I. and the political context 1895 – 1907*, 1978.
Kelleher, D. *Br. James Dominic Burke a pioneer of Irish Education.* Ph.D. thesis, Maynooth College, 1977.
Kerr, J. F. *The Development of the teaching of Science in Ireland since 1800.* Ph. D. thesis, Queen's University Belfast 1957.
O'Connor, D. C. *Secondary education in Ireland 1878 – 1968,* M. Ed. Thesis, St. Patrick's College Maynooth.
Quane, M. *Henry Edward Armstrong – William Mayhowe Heller and the implementation of Elementary Science in the Irish National Schools System from 1900 – 1922.* M. Sc. thesis, Trinity College Dublin 1999.

IV Papers

Nott, M. *Rediscovering Armstrong's heurism.* Paper read at NARST conference, March 1999.
Nott, M. *Representing and re-presenting science education.* Paper read at NARST conference, March 2000.

V Newspapers

The *Freeman's Journal,* newspaper, March 30th, 1895.
The *Irish Times* article *Science for Schools*, 15th November 2001.
The *Kilkenny Journal,* 22nd November 1894.
The *Leader* newspaper. *The New Department,* editorial article December 7th 1901.
The *Leader* newspaper. *The Department and the Cork Exhibition*, November 1902.
The *Leader* newspaper. *Is it another Anglicising Board?* D. Hallinan DD, January 3rd 1903.
The *Leader* newspaper. January 3rd 1910.
The *Leader* newspaper, April 11th 1903.
The London Times, September 7th 1908.