

Pioneers of Science Education

Peter E. Childs

Emeritus Senior Lecturer, Dept. Of Chemical Sciences, University of Limerick,
Limerick, Ireland
peter.childs@ul.ie

In this series I will look at some of the pioneers of science education, either in terms of pedagogy, curriculum development or science education research. Some of them have an Irish connection, but all have had an influence on the teaching and learning of science in Ireland. In PoSE #1 we looked at Maria Edgeworth, who was a friend of Jane Marcet (PoSE #3), and in PoSE #2 at Richard Dawes, a pioneer of child-centred science in context. In PoSE #3 we looked at the life of Mrs Jane Marcet, one of the earliest popularisers of science, especially for women. PoSE #4 looked at J.M. Wilson, who served on a Royal Commission with Thomas Huxley (PoSE #5), who also promoted technical education as Br. James Dominic Burke did in Cork, who also used inquiry in science teaching as did Henry Armstrong (PoSE #7). Armstrong's ideas were brought to Ireland by William Mayhowe Heller (PoSE #8), one of his early disciples.

#8 William Mayhowe Heller, 1868-1949 : Heurism comes to Ireland

Introduction

In the last article (PoSE #7) we looked at the work of Henry Armstrong, the father of heurism (discovery learning) in science teaching, and his influence on inquiry-based science education (IBSE). His ideas were spread by his former students who became his disciples in propagating the gospel of heurism in teaching science. One of these ex-students was William Mayhowe Heller, who brought Armstrong's ideas to Ireland in 1900 and who had a major influence on the development of science education in Ireland. We are fortunate in having three studies describing his work: an article by Gerry Beggan (Beggan, 1983), a PhD thesis by Michael Quane (Quane, 2003), and a Master's thesis by Julienne Gallagher (Gallagher, 2007) and I have drawn on these sources and others in writing this article. Until independence in 1921 there was much interaction and exchange between Britain and Ireland in education and so it was natural that the radical ideas of Henry Armstrong, as they then were) should have crossed the Irish Sea, as he himself did.

W.M. Heller's career

He was born in 1868 and his father was a well-known teacher. He was educated at Westminster School and then went to the City and Guilds Central College where was taught by Professor Henry Armstrong (PoSE#7). Heller was infected by Armstrong's passion for science teaching the virus of heurism and worked closely with him until he left for Ireland in 1900, and thereafter kept in close touch. Eyre (1958, p. 273) said this about Armstrong's heuristic disciples: *"In this manner a small stream of ardent young protagonists from the chemistry department of the Central Technical College, fired by the enthusiasm of their 'Master', carried the torch of Heuristic teaching into many sections of the community, particularly in the teaching profession, where many of Armstrong's students became highly successful."*

Heller gave evidence with Armstrong to the Belmore Commission (1897-98) which looked into Manual and Practical Instruction in National schools in Ireland (Belmore Commission, 1898). He also submitted a science syllabus (Syllabus H, Box 1) in 1898 which he had developed to use with London schools in his work for the London School Board. This was well received and became the basis of the elementary science syllabus (Syllabus I) used in

Irish national schools from 1900. Science was a compulsory subject until 1923 when it became optional due to the increased emphasis on Irish in the new Irish Free State.

He was headmaster of the Municipal Technical School, Birmingham 1887-1900 and thus gained experience in administration and promoting science in secondary education. He was recruited to work in Ireland, possibly through the agency of Professor George Fitzgerald of TCD, who was on the Belmore Commission. He was appointed as the chief organiser of science in national schools and inspector of schools under the new Department of Technical Instruction. After Irish independence in 1922 this became the Department of Education and he remained as Senior Inspector for Scientific and Technical Education until his retirement in 1933. He died in Dublin on May 13th 1949 at the age of 81. He married Madame Clossett, a famous singer and musician in Dublin.

Table 1 Summary of W. M. Heller's career

1868	Born in London Educated at Westminster School, London
1885-1888	Student of H. E. Armstrong, City and Guilds Central College, London
1888-1889	Promoting heuristic approach with Armstrong in St. Dunstan's College, Catford and at Christ's Hospital, Greyfriars
1892-1894	Science master, King's College School
1894-1897	Science demonstrator for the London School Board
1897-1900	Headmaster of Municipal Technical School (now Central Grammar School) in Birmingham
1897	Interviewed by Belmore Commission (1897-1898) on science teaching in Ireland and submitted an experimental science syllabus (1898)
1900-1919	Head Organiser, Elementary Science in National Schools (Ireland)
1903-1908	Committee member, BAAS Report on Teaching Science
1905	W.M. Heller and E.G. Ingold, <i>Elementary Experimental Science – an introduction to the study of scientific method</i> published
1922-1933	Senior Inspector of Technical and Scientific Education in the Department of Education, Irish Free State
1932	President, Foundation Section of the British Association of the Advancement of Science
1949	Died 13 th May aged 80

Heller's teaching career in England (1888-1900)

In 1887 Hugh Gordon came to work with Armstrong in the Central College (Eyre, 1958, 272-273), became interested in school teaching and became a peripatetic (travelling) demonstrator for the London School Board (1891-1894). With the help of Armstrong he established a training centre in a deserted rice mill in Berners Street, Whitechapel. He and a band of teachers got together to share ideas and experiments in science teaching, with Armstrong's input and encouragement. In this way Armstrong's ideas on teaching science was adopted in a number of London schools. Gordon went on to be a science inspector of schools and later of training colleges. Heller took over from Gordon and worked from 1894-1897, introducing science into girls' schools as well as boys' schools. *"In this manner a small stream of ardent young protagonists from the chemistry department at the Central technical College, fired by*

the enthusiasm of their 'Master', carried the torch of heuristic teaching into many sections of the community, particularly in the teaching profession, where many of Armstrong's students became highly successful." (Eyre, 1958, p. 275). We have a description of Gordon's and Heller's methods (Armstrong, 1903, p. 298-299). In this way science teaching was introduced into around 40 schools in North and East London.

The Method adopted by Messrs. Gordon and Heller in giving Instruction in Elementary Schools

The demonstrator usually made one visit to a school per fortnight and gave one lesson of three-quarters of an hour duration to each of Standards V, VI and VII, or to whatever Standards there were in the school. The schools visited may be divided into two classes: first, those in which the assistant teachers had been through a course of training at Berners Street; secondly, those in which the teachers were beginning the subject (Course 4) without previous knowledge of the methods to be used. In the case of those of the former class the demonstrator was free to teach the scholars alone, without considering the class teacher. The monitors of the class usually had charge of and were responsible for keeping the apparatus clean and in order. This was stored in a specially designed lecture table and cupboard combined, fitted with lead sinks and draining-boards, divided drawers, etc., which cost nearly £10 ; in many cases, however, such a table was not provided and the apparatus was kept in ordinary stock cupboards, the experimenting-table being improvised by placing a blackboard across two dual desks. In many cases a hinged flap table folding down against the wall was found most convenient for experimental work by the scholars. The demonstrator usually spent a few minutes questioning the class as to the work accomplished during the previous fortnight and dealt with the difficulties that had occurred, taking care to emphasise the exact position the experiments already made had left the scholars in ; he then invited suggestions as to what would be the next point to elucidate. Very good suggestions were often made but as a rule the class had to be led to the consideration of the next question to be answered. 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, fit it up and make the necessary weighings. Perhaps other boys would carry through the experiment to the finish. 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 the closest attention of their fellows. A living interest in what was going on and a condition of enthusiasm was thus aroused, which was reflected in the whole subsequent work of the class. Between the demonstrator's fortnightly visits there were, as a rule, three intermediate lessons, which were utilised in repeating the last lesson, for back work and in writing up notes ; advantage was often taken of writing lessons and composition lessons for note book work. 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. In the second class of school, in the case of a teacher unfamiliar with the work who was, perhaps, at first not willing to take the extra trouble involved in keeping the boys at experimental work, it often happened that the class lost interest and results were unsatisfactory. Apparatus was supplied to the school at the beginning of the year's work, everything that was required for the work being provided and due allowance made for breakages. Did the occasion arise, apparatus was loaned from the central laboratory to schools likely to use it with advance, so that work was never allowed to stand still for want of apparatus. At annual inspections sufficient additional apparatus was sent to schools to enable fifty boys to be at work at once.

Heller was a member of a subcommittee of the British Association which from 1903-1908 drew up an influential science syllabus, together with H.E. Armstrong, Arthur Smithells and C.W. Kimmins (Jenkins, 1979, p. 42; BAAS, 1908).

His work with the London School Board was picked up in New Zealand who published Syllabus H of the London School Board in an Appendix on Education: Manual and Technical Instruction for the New Zealand House of Representatives (Riley, 1898). This syllabus H was adopted in Ireland as Syllabus I when a new programme of study for national schools was

adopted in 1900. Professor Fitzgerald of Trinity College was a member of the Belmore Commission and visited England to see Heller's work in London schools. He was very impressed as the extract below shows and it would seem that he was mainly responsible for recruiting Heller to work in Ireland for the Irish Board of National Education. He moved to Ireland in 1900 and was to spend the rest of his working life there.

“The ‘heuristic method’ is a scheme by Mr Heller, formerly demonstrator to the London School Board, and now of Birmingham. The system is strongly advocated by Professor Armstrong, Inspector Gordon, of the Science and Art Department, Professor Fitzgerald of Dublin, and many other educational authorities. With Mr. Heller’s permission, I give the following extract from a letter of Professor Fitzgerald’s upon the subject of the ‘heuristic syllabus. He says, “I have had a good opportunity of comparing the methods of science instruction in several different places in England during my recent visit to Ireland in connection with the Commission on Manual Practical Instruction in Primary Schools in Ireland. [Belmore Commission] I took keen interest in what I saw, and especially your work in London. I have been more favourably impressed with the methods you are employing, and, from what I saw of its work in schools, am convinced that it is working out in practice what it is designed to do, and is capable of being introduced into any school by intelligent and well-trained teachers. Your methods are intelligible methods, and can consequently be made the basis of an intelligible system which can control all the methods of the teacher, and give him an intelligible clue for developing the methods to suit the varying circumstances of his school and locality. In that respect it seems to me to have an overwhelming advantage over what I may describe as the hand-to-mouth methods of others.... 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 I feel no doubt that, wherever science education is practicable, your system, modified as to its details 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.” (Riley, 1898, p. 8)

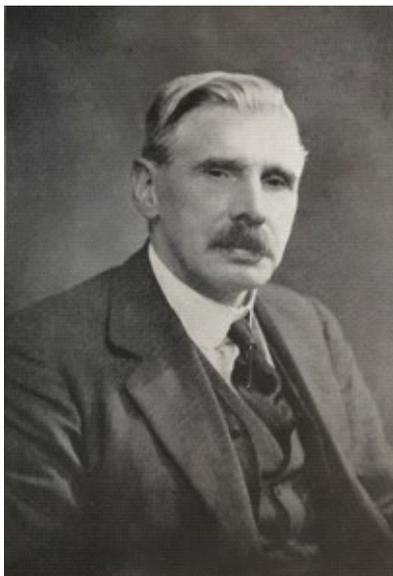


Figure 1: W. Mayhowe Heller, Headmaster Central Grammar School, Birmingham
<http://centralgrammarschool.org.uk/head-teachers/>

He moved from the London School Board to be headmaster of a school in Birmingham.

“On the day of my appointment it was agreed that the school should be free from the constraints of external examinations, but would welcome constructive help from Government inspectors. Here I must pay a tribute to George Kitchen -the inspector in charge. He threw himself into the work of the school as if he were a member of the staff. He frequently taught classes and helped with all exhibitions and social functions. With the Art masters he painted most of the scenery for the school plays. His cheerful and inspiring help endeared him alike to masters and boys. He followed me to Ireland where we often made use of our experiences in Birmingham.”

<http://centralgrammarschool.org.uk/head-teachers/>

Heller and heurism in Irish science teaching (1900-1933)

The Belmore Commission (1898) was very influential in shaping Irish science education in elementary (national) schools in the early 20th century. McLoughlin (2017) summarises its importance:

“In 1897, a vice-regal commission was set up, with the Earl of Belmore as chairman, “to enquire and report with a view to determining how far and in what form manual and practical instruction should be included in the educational system of primary schools under the Board of National Education in Ireland”. Members of the commission visited Britain, Germany, Holland, Denmark and Switzerland to study the practical work being done in the schools in those countries. Their report, published in 1898, shaped the pattern of education in Ireland for the next quarter of a century. The influence of Henry Edward Armstrong and his “Heuristic Method” was to become evident through the work of William Mayowe Heller, appointed to effect the proposals of the Belmore Commission in Ireland. A new primary programme was implemented in 1900. It had proposed that agriculture, since it did not properly belong to primary education, should be replaced by a course of elementary science for rural schools, especially as the experts who appeared before the commission described it as “quite valueless”. The theory of agriculture that had been taught in schools since 1873 was replaced in 1907 by a scheme of nature study which, in turn, made way for Rural Science and Horticulture in 1912. This was followed by changes in the teacher education colleges to train teachers in these new subjects.”

Walsh (2005) comments on the new programme for national schools:

“The Revised Programme (1900) advocated the abolition of the Payment by Results system that had been in operation since 1872. In addition, the introduction of a wider curriculum, a focus on kindergarten education, the inclusion of more practical content and an emphasis on schools as an interesting and humane place for children was prioritised. Education was to be enjoyable and discovery-oriented and the inculcation of a disposition for learning was prioritised over actual content. The didactic methodology heretofore used was replaced with a heuristic approach, with an emphasis on practical education (Belmore Commission on Manual and Practical Instruction, 1898).”

Heller was appointed in June 1900 and took up his post in August 1900 as Chief Organiser and Inspector of Science Instruction for the Commissioners for National Education in Ireland. He immediately got down to work to implement the revised programme which made object lessons and elementary science compulsory for those schools equipped to teach it. He produced his first report for the Commissioners in 1901 (Heller, 1901) and immediately started running courses to train teachers in the new subject matter and methodology (heurism). He started by visiting many schools and could say: “There was not at that time, nor had there been for many years past in the majority of schools, any teaching of Experimental Science.” (Heller, 1901, p. 93) The scheme of payment by results which

operated from 1870 to 1900 had effectively eliminated science from the national schools. Heller was allowed to reshape Irish elementary science education and introduce heurism into Irish schools from 1900 onwards. From October 1900 he started a 6 week course for 50 teachers in a laboratory in the Central Model Schools, Dublin. This involved 5 hours of laboratory work and 3 hours writing up reports in the evening for a total of 30 days, and during it Heller performed nearly 200 experiments. He commented on this first cohort of national teachers: *“The ability and enthusiasm displayed by teachers attending this first course were beyond all praise and I shall always look back to this course as one of the pleasantest experiences of my professional work.”* (Heller, 1901, p. 94) In November he was allowed to appoint 6 sub-organisers, Mr Ingold, who came from England and the Central Technical College (the Armstrong stable), and 5 local teachers who had attended the first course. In the rest of the year similar courses were held in Belfast, Cork, Londonderry, Waterford and Killarney. In October 1900 courses started in the primary training colleges and these involved a 3 hour practical exam run by Heller and Ingold, his right-hand man. In the first year 552 teachers were trained and Heller requested a total of 12 sub-organisers in order to meet the demand for courses. He repeated the request for extra staff every year but it was not granted. In fact, he was only given the 6 staff for 5 years and after that only 2 were reappointed, even though it meant that the job of retraining teachers and refreshing them after initial training could never be completed. However, it was not for lack of trying and in Figure 2 we can see how many teachers were trained and how many schools were equipped in the first 5 years, an impressive achievement.

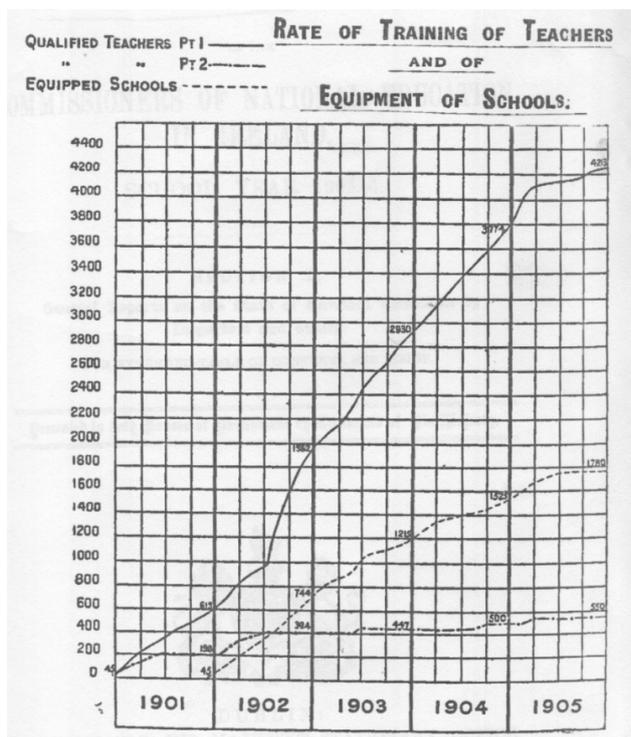


Figure 2: Statistics on teachers trained and schools equipped 1900-1905 (Heller, 1905, p. 153)

At the conclusion of his first course he was commended by the *The Irish Teachers' Journal* (*The Irish Teachers' Journal*, 1900, November, p. 3):

“Mr. Heller proved himself a very capable 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."

From 1902 Heller produced a series of articles for the *Irish School Monthly* on the teaching of elementary science. In 1905 he and Ingold published a book on *Elementary Experimental Science – an introduction to the study of scientific method* (London: Blackie and Son, Ltd., 1905) to support their courses.

The Clare County Library has a copy of a student's notebook, Mary Curry, from her time at Our Lady of Mercy Training College in Dublin, 1902-3, in which she describes 55 experiments. One of the final lessons is stamped: "N.E.I. Examined, W. Mayhowe Heller, Head Organiser, Elementary Science."

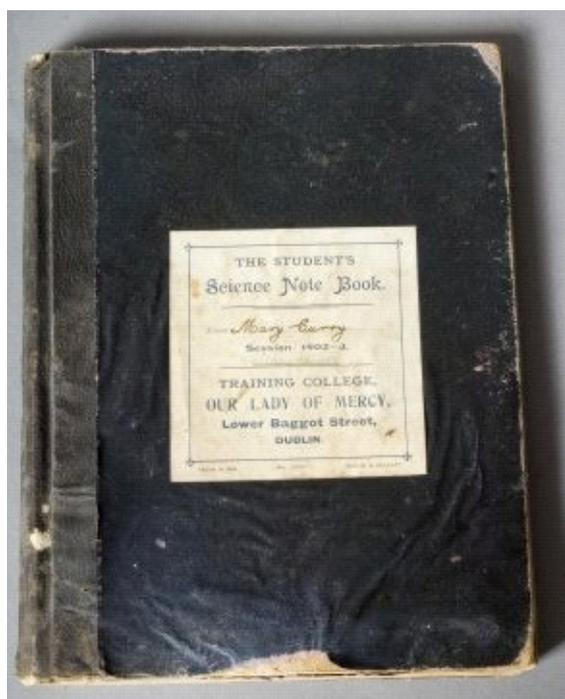


Figure 3: Notebook by Mary Curry Training College, Our Lady of Mercy, Dublin, 1902-1903 containing 55 numbered experiments.

http://www.clarelibrary.ie/eolas/claremuseum/acquisitions/olom_college_dublin.htm

Armstrong gave his former student an accolade in 1902 when he gave an address at the BA meeting in Belfast. It was during this same meeting that Armstrong had gone down to Cork to visit Br Burke (PoSE #6).

"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 race 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. Of course the development of a true policy must come about slowly; we must not be too impatient of results but give every encouragement and all possible support to those engaged in the work. It is before all things necessary to remember that the school is a preparation for life, not for the inspector's visit; in the future the inspector will act more as adviser and friend, let us hope, than as mentor.

... 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.' (Armstrong, 1903, pp 89-90)

Quane (1999, pp 55-56) in Box 1 gives a short summary of the course adopted for Elementary Science, based on Syllabus H adopted by the London School Board. It can be seen that this is a very demanding syllabus for national schools, teachers and pupils, with no tradition of teaching science. I have included the appropriate age ranges for the different Standards, and it can be seen that this overlaps with today's junior secondary cycle.

Box 1

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

3rd Standard. (10-11 years) *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. (11-12 years) *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. (12-13 years) *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. (13 years and up) *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.*

Initially the venture was successful and many teachers were trained in the new methods and schools equipped to teach science but after 1906 it faltered. The team of teachers who had been training teachers was disbanded, apart from two people plus Heller, thus making it impossible to train the whole cohort of teachers in the new methods, and teachers inevitably returned to the didactic teaching they were familiar and confident with. Later on Rural Science became more important especially in rural schools and by 1923 elementary science became an optional rather than a compulsory part of the curriculum. Its place in Irish primary schools never recovered until the 1971 curriculum and later the 1999 revised curriculum. (Gallagher, 2007; Quane, 2003) Heller continued as a Senior Inspector in the new Department of Education of the Irish Free State until his retirement in 1933 but the place of elementary science in national schools never recovered its status. Just as in England, the heuristic crusade in science education faltered and died in Ireland.

The way heurism was introduced into the national schools from 1900 (and also into intermediate and technical schools) was the equivalent of a short, sharp shock. Heller said when he was a headmaster in Birmingham:

"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 doing so both must inevitably become ineffective."(Heller, 1898)

In its time it was the envy of other countries and in the 1909 Annual Report Heller (1909, p. 173) could say:

“A Committee of the British Association, appointed in 1904 to inquire into the courses of practical instruction most suitable for elementary schools, after considering a large number of schemes from various English authorities, recommended the courses of instruction in operation in Irish National schools, as satisfying the aims and methods that should guide scientific instruction.”

To implement curriculum change requires sufficient financial resources to retrain teachers and provide classroom and laboratory resources, as well as involving teachers in the process. As early as 1901 the new heuristic scheme was under attack from teachers.

“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.”

Irish Teachers’ Journal, March 1901, p. 6 (quoted by Quane, 2003)

Walsh (2016, p.4) gives a good summary of the reasons for the failure of the 1900 Revised Programme, and sadly it would seem that these lessons on curriculum reform have yet to be learned.

“Overall, the Revised Programme fell short of the educational revolution it had aspired to invoke. It was heavily influenced by international jurisdictions and was not sufficiently contextualised for implementation in the Irish context. The supports put in place lacked sufficient cohesion and intensity to instigate change. Moreover, issues around teacher training, insufficient funding, the physical condition of schools, poor attendance rates and the lack of popular support for the reforms also hindered implementation. Key stakeholders were not kept informed or instilled with a sense of ownership of the revisions, an omission considering they were the means to translate the theory of the programme into a practical reality. While conceptually well devised, the Revised Programme lacked a strategic implementation policy and failed to provide an appropriate support infrastructure to ensure successful implementation.”

Heller was totally committed to Armstrong’s heuristic crusade and paid this tribute to his mentor in 1916.

“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 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., through 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.”

The Central: Journal of the Old Students of the College. Vol. XIII. Birmingham: Percival Jones. 1916, p.20. Appendix 7, p. 129. Quoted in Gallagher, 2007, p. 28

He was involved in the Education Section of the British Association for the Advancement of Science (BAAS) from its inception in 1900 by Armstrong and colleagues. In 1932 he was President of the section and gave the presidential address in York (Heller, 1932). In fact the address was given by his wife following an accident and his continuing ill-health led to his retirement from the Department of Education in 1933. This concluded a long and eventful life in education, largely dedicated to promoting inquiry-based science education in England and then in Ireland.

Conclusion

W. Mayhowe Heller was a student of Henry Armstrong's and imbibed and implemented Armstrong's ideas in his own teaching and in his direction and inspection of Irish science teaching in national schools from 1900 to 1933. In 1932 in his presidential lecture to the British Association he said this about Armstrong:

"One name beyond others stands out as its advocate where science is taught - Prof. Henry E. Armstrong - originator of this Section of the Association, To his advocacy of training in scientific method the advancement of science in schools owes whatever progress has been made. His trenchant criticism has been supplemented by copious constructive suggestion. Therein he stands, almost alone, among the small band of scientific men who, during the past fifth years, have helped us to put purpose and method into our work. Like other great reformers, the full appreciation of his tireless efforts may not be reached even in his long lifetime." (Heller, 1932, p. 215-216)

In this same address Heller could say at the end of his career in Ireland:

"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." (Heller, 1932, p. 211)

Quane (2003) summarises the failure of inquiry-based teaching to take off in Irish primary schools.

"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."

This experiment in introducing heurism in elementary science teaching was ahead of practice in the U.K. and when science was replaced by an increased emphasis on Irish language and culture in national schools, it was largely forgotten from 1934. Science was included in the 1971 curriculum, but in the main was not taught, and was made more explicit in the revised 1999 curriculum. Gallagher (2007) has shown that the content of the 1999 curriculum was essentially the same as the 1908 curriculum (Gallagher, 2007, pp 180-182). One has to conclude what a wasted opportunity to embed science in the Irish school curriculum from the national schools upwards. It failed due to lack of funding, insufficient training of teachers in content and methodology, lack of resources and facilities in schools. This all sounds very familiar and one must conclude that the lessons of how to introduce a new curriculum successfully have not been learned. Heller did his best but his efforts were not supported and in the end were over-ruled by the literary and cultural emphasis in the newly independent Ireland.

This article has been a brief summary of Heller's work in Ireland and you are recommended to read the thesis by Julianne Gallagher (available online) and the articles by Gerry Beggan (1983) and Thomas Walsh (2016) if you want more detail and for the way science education developed in Irish national schools. Unfortunately Michael Quane's theses (1999 and 2003)

[L.2.2.3.11&e=-----100--1-----2%22william+P+barker%22--"e=-----100--1-----2%22william+P+barker%22--](#) Accessed 17/6/19

The Irish Teachers' Journal, (1900), November, p. 3), quoted in Quane (2003)

Walsh, T. (2005) 'Constructions of Childhood in Ireland in the Twentieth Century: A View from the Primary School Curriculum 1900 – 1999', *Child Care in Practice*, 11(2), pp. 253-269

Walsh, T., (2016), '100 years of primary curriculum development and implementation in Ireland: a tale of a swinging pendulum', *Irish Educational Studies*, pp 1-16