Pioneers of Science Education

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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, including our first subject, Maria Edgeworth, have an Irish connection.

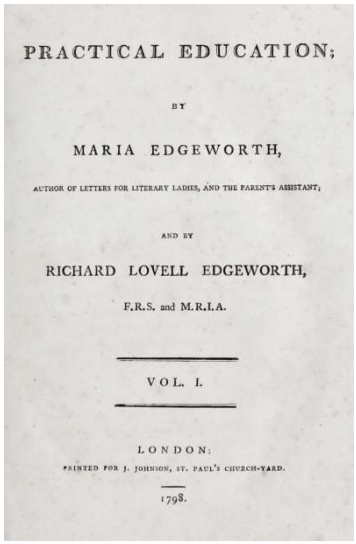
1. Maria Edgeworth (1/1/1768-22/5/1849) 'Practical Education'

Maria Edgeworth by John Downman 1807 (aged 39)

Maria Edgeworth was the daughter of Richard Lovell Edgeworth of Edgeworthstown, Co. Longford, an Anglo-Irish family, the third child and first girl in a family of 22. She was born and spent her early life and education in England, but at the age of 14 in 1782 she moved to the ancestral home in Ireland. Her father, Richard Lovell Edgeworth, had been living in England and was a member of the influential Lunar Society of prominent scientists and industrialists. In Ireland she helped to bring up and educate the tribe of young Edgeworths (Richard had 22 surviving children with four wives) and was also involved in the village schools that the Edgeworths set up. She stayed there for the rest of her life, although she made extended trips to England and the continent.

The House in which Maria Edgeworth Lived, now a nursing home (Lovett, 1888)
Edgeworth House, Edgeworthstown, Co. Longford

She was well known as a novelist (*Castle Rackrent, Belinda* etc.) and also as a children's author, and was probably the best known female novelist in the early 19th century, who influenced, among others, Walter Scott and Jane Austen. Maria was known as a literary lady from her successful novels but Martin Brück has pointed out, she was a scientific, literary lady (Brück, 1996). Her main claim to fame in her day and since has been as a writer, but Scantlebury and Murphy (2009) have highlighted her role as a pioneer science educator. Maria was also known, together with her father, Richard Lovell Edgeworth, as an educational reformer and innovator. She can be considered as a pioneer of science education from her book, written with her father, on *Essays on Practical Education* (1798), in 2 volumes, which went into 3 editions and is usually referred to as *Practical Education*, which defended the place of science in elementary education and its importance for both girls and boys. She had earlier defended the education of girls in her book *Letters for Literary Ladies* (1795) and with her father, promoted moral education in *The parent's assistant* (1796). *Practical Education*, however, is where the Edgeworth's educational views are given fullest expression, based on extensive observation and experimentation and practice by the Edgeworth parents, Richard and Honora, and Maria.



PRACTICAL EDUCATION;

BY

MARIA EDGEWORTH,

AUTHOR OF LETTERS FOR LITERARY LADIES, AND THE PARENT'S ASSISTANT;

AND BY

RICHARD LOVELL EDGEWORTH,

F.R.S. and M.R.I.A.

VOL. I.

LONDON:

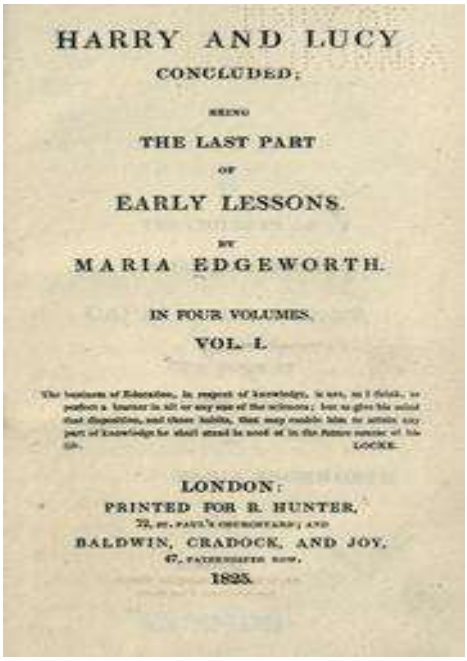
PRINTED FOR J. JOHNSON, ST. PAUL'S CHURCH-YARD.

1798.

Title page of the first edition of *Practical Education* (1798)

Although her father and one of her brothers contributed to the book, and it drew on observations made by her step-moth Honra, Maria was the main author and in it she takes a child-centred approach to education, promotes the education of girls, and an inquiry and discovery approach to teaching science, seeking to develop independent thinkers. Scantelbury and Murphy (2009) have pointed out that her contribution to science education has been neglected, eclipsed by her literary achievements. In 1991 De Boer wrote (De Boer, 1991): *"Revisiting the work of Maria Edgeworth from the perspective of science education rather than literary criticism provides science educators knowledge of the life, times and works of a historical figure in the field. Maria Edgeworth is also an important pioneer in the communication of science directly to children in books which are set at their level and intended for interest and enjoyment, as well as learning of science. It is surprising therefore, that neither Maria, nor her father are cited in historical accounts of science education."*

She and her father were also responsible for a series of children's books featuring Harry and Lucy, which sought to introduce science and technology in the form of fiction. *"The Edgeworth's ambition was to write the history of realities in an entertaining manner; they held that it was better for purposes in education, and more suited to the tastes of children, than improbably fiction."* (Zimmern, 1898, p. 41) Helen Zimmern, an early biographer, went on to say: "It was Miss Edgeworth who really inaugurated for England the reign of didactic fiction. Though never losing sight of her aim, she also never lost sight of the amusement of her young readers. She rightly apprehended that only by captivating their senses could she conquer and influence their reason. Her children's tales, written with motion and spirit, were told in the simple language of the young." (Zimmern, 1898, p. 42)


HARRY AND LUCY

CONCLUDED;

BEING

THE LAST PART

OF

EARLY LESSONS.

BY

MARIA EDGEWORTH.

IN FOUR VOLUMES.

VOL. I.

LOCKE.

LONDON:

PRINTED FOR R. HUNTER,

AND

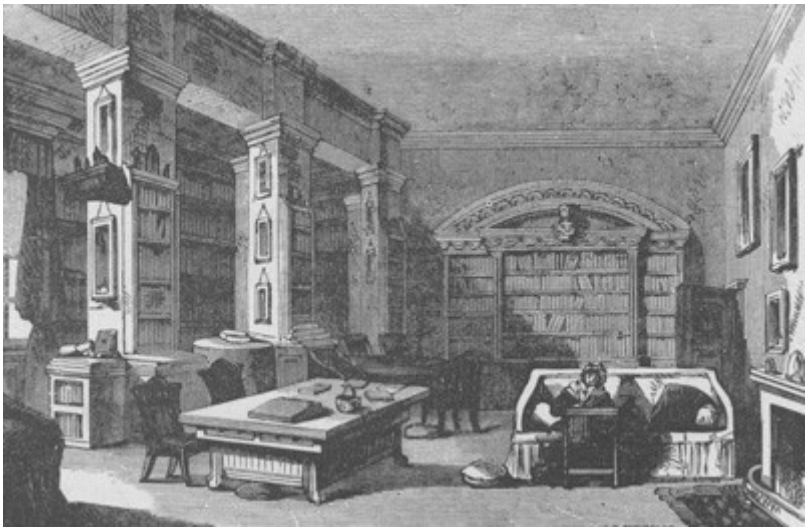
BALDWIN, CRADOCK, AND JOY,

1825.

Title page of Harry and Lucy Concluded (1825)

Her father was well known in scientific circles in England and Ireland, and was one of the founding members of the Royal Irish Academy (RIA) in 1785. Richard Edgeworth was a prolific inventor and innovator. Through him Maria met scientists such as Humphrey Davy, Thomas Beddoes (her brother in law), John Herschel, David Brewster, the well-known author

Jane Marcet and Mary Somerville. She herself was elected an honorary member of the RIA in 1842 in recognition of her literary work, one of the first women to be honoured in this way; the first was Mary Somerville a few years earlier. In many ways Maria was carried along in the slipstream of her father's interests and they worked closely together. Sydney Smith referred to them as 'The firm of Edgeworth and Co,' (quoted in Zimmern, 1898, p. 39) due to their close working relationship. She became his 'right-hand man' in efficiently managing and administering the estate. When he died in 1817 she was left alone, and bereft, to continue his educational legacy and her own literary career.



The Library in which Maria Edgeworth Wrote (Lovett, 1888)

In the preface of *Practical Education* (vol. 1, p, iv) she wrote: *"To make any progress in the art of education, it must be patiently reduced to an experimental science .."* Later on she outlined their educational philosophy:
"In drawing out a list of experiments for children, it will therefore be advantageous to place them in that order which will best exhibit their relative connexion ; and, instead of showing young people the steps of a discovery, we should frequently pause to try if they can invent. In this our pupils will succeed often beyond our expectations ; and, whether it be in mechanics, chemistry, geometry, or in the arts, the same course of education will be found to have the same ad vantages. When the powers of reason have been cultivated, and the inventive faculty exercised ; when general habits of voluntary exertion and patient perseverance have been acquired, it will be easy either for the pupil himself, or for his friends, to direct his abilities to whatever is necessary for his happiness."
Edgeworth, M & Edgeworth, R.L., (1811) *Practical Education* Vol. 1 ,3rd edition, London: J. Johnston & Co., p.40
https://books.google.ie/books?id=1goBAAAAYAAJ&printsec=frontcover&redir_esc=y#v=onepage&q&f=false

Science played a key role in their curriculum, along with mathematics and the humanities, and they made no distinction between boys and girls. They emphasised hands-on, discovery learning and relevance to everyday life. They also practised cooperative and peer learning, where the older children helped teach the younger ones. The family became a test-bed of their ideas and they also put them into practice in several village schools that they opened in Edgeworthstown.

As an example of their approach to teaching science, Box 1 contains an extract from the chapter on Chemistry from Practical Education, vol. 2, which it should be remembered was designed for parents to use in the home instruction of their children.

Box 1 An extract from the chapter on Chemistry in *Practical Education*, vol. 2 (http://www.hotfreebooks.com/book/Practical-Education-Volume-II-Maria-Edgeworth--2.html)

Extract from Practical Education, vol. 2, ch. XVIII on Chemistry

When a lump of sugar is put into a dish of hot tea, a child sees that it becomes less and less, till at last it disappears. What has become of the sugar? Your pupil will say that it is melted by the heat of the tea: but if it be put into cold tea, or cold water, he will find that it dissolves, though more slowly. You should then show him some fine sand, some clay, and chalk, thrown into water; and he will perceive the difference between mechanical mixture and diffusion, or chemical mixture. Chemical mixture, as that of sugar in water, depends upon the attraction that subsists between the parts of the solid and fluid which are combined. Mechanical mixture is only the suspension of the parts of a solid in a fluid. When fine sand, chalk, or clay, are put into water, the water continues for some time turbid or muddy; but by degrees the sand, &c. falls to the bottom, and the water becomes clear. In the chemical mixture of sugar and water, there is no muddiness, the fluid is clear and transparent, even whilst it is stirred, and when it is at rest, there is no sediment, the sugar is joined with the water; a new, fluid substance, is formed out of the two simple bodies sugar and water, and though the parts which compose the mixture are not discernible to the eye, yet they are perceptible by the taste.

After he has observed the mixture, the child should be asked, whether he knows any method by which he can separate the sugar from the water. In the boiling of a kettle of water, he has seen the steam which issues from the mouth of the vessel; he knows that the steam is formed by the heat from the fire, which joining with the water drives its parts further asunder, and makes it take another form, that of vapour or steam. He may apply this knowledge to the separation of the sugar and water; he may turn the water into steam, and the sugar will be left in the vessel in a solid form. If, instead of evaporating the water, the boy had added a greater quantity of sugar to the mixture, he would have seen, that after a certain time, the water would have dissolved no more of the sugar; the superfluous sugar would fall to the bottom of the vessel as the sand had done: the pupil should then be told that the liquid is *saturated* with the solid.

By these simple experiments, a child may acquire a general knowledge of solution, evaporation, and saturation, without the formality of a lecture, or the apparatus of a chemist. In all your attempts to instruct him in chemistry, the greatest care should be taken that he should completely understand one experiment, before you proceed to another. The common metaphorical expression, that the mind should have time to digest the food which it receives, is founded upon fact and observation.

Why has she been forgotten?

The question may be asked as to why the educational work of the Edgeworths, and Maria in particular, have been forgotten? Maria's own reputation, particularly as a novelist, has eclipsed that of her father, but in their day they were well-known in both scientific and literary circles in Ireland, England and in Europe. There are several reasons for this. She was a woman in an age when women had secondary roles in society, manly as wives and mothers, and she was mainly seen as a successful novelist, which probably obscured her educational work. She and her father belonged to the Anglo-Irish gentry and lived in an out-of the way place in the Irish countryside, so they were on the periphery of Irish society, which itself was on the periphery of Europe. More important perhaps was the fact that their ideas were seen as radical, progressive and possibly revolutionary, in an age when social revolution was feared, and they did not promote a religious view of education but rather one coloured by enlightenment values, drawn from Rousseau, John Locke and Joseph Priestley. They promoted the value of science in the education of boys and girls from an early age, and this was against the prevailing views in education, which was mainly provided for middle and upper class boys, in mathematics and classics. Science was not to become a core subject in elementary and secondary education in England and Ireland until the second half of the 19th century.

Statue of Maria Edgeworth in Edgeworthstown
http://www.longfordtourism.ie/heritage/literary-longford/maria-edgeworth/

Their contribution to science education

Scantlebury and Murphy (2009) have done a valuable service in rescuing the memory of Maria Edgeworth's contribution to science education, although sadly the article will not be accessible or widely read by science teachers. Other authors have recognised the Edgeworths' contribution to education.

"Based originally on Lockean principles and incorporating a century of natural philosophical ideas, Practical Education was the first educational work to fully configure an experimental and holistic method of 'discovery' in education." (Doddington and Hilton, 2007, p.6)

This is Jürgen Oelkers assessment of their contribution to child-centred, active learning. (Oelkers, 2006)
"One field of reform was education, which Richard and Maria Edgeworth understood experimentally as a process of practical experience, or "trials of dexterity and activity." Their treatise, Practical Education (Edgeworth and Edgeworth, 1798), appeared in 1798. It advocated that the methods of observation, experiment, and inventive spirit should guide learning, which is seen as an explorative process. What later came to be called "discovery learning" was described probably the first time in concise teaching terms. Teaching is not "filling in" something, the child has to find it out an thus must be "active." The same holds for the importance of playful learning in the child's world of experience, to which the Edgeworths also counted children's books and a 'rational toyshop' of educative playthings. The principle advocated by the book was a pragmatic one; whatever promoted children's learning was good. A number of members of the large Edgeworth family contributed to the book, including some of the older children, so that here the term "childcentered" can be taken quite literally (see The Works of Maria Edgeworth, 2003). The Edgeworths' treatise was highly influential at the close of the eighteenth century."

The Edgeworths promoted hands-on, discovery learning, and the value of learning through play, in an age of dry, didactic book learning. Listen to what they say to their critics:
"When a pedantic schoolmaster sees a boy eagerly watching a paper kite, he observes 'What a pity that children cannot be made to mind their grammar as well as their kites!' A man of sense will see the same sight with a different eye; in this pernicious love of play he will discern the symptoms of a love of science, and, instead of deploring the natural idleness of children, he will admire the activity which they display in the pursuit of knowledge."
(Edgeworth & Edgeworth, 1798, p. 30)

We should also not forget her children's books which aimed to introduce science and technology to children through stories. Maria said in one of her letters (quoted in Zimmern, 1898, p. 46):
"My father long ago foresaw that the taste for scientific as well as literary knowledge, which has risen so rapidly and spread so widely, would render it necessary to make some provision for the early instruction of youth in science, in addition to the great and successful attention paid to classical literature."

Martin Brück concluded his article thus:
"Maria Edgeworth is of course principally a literary figure. But she deserves to be remembered for her enlightened educational ideas, maintaining girls to be of equal mental aptitude with boys, and placing science on a par with literature as a branch of culture. As her father's disciple she was very much ahead of her time in stressing the importance of applied science in a young person's curriculum." (Brück, 1996, p. 54)

Maria Edgeworth was inevitably a child of her time and social class, with circumscribed views on the role of women in society, but she was nevertheless a pioneer in science education – promoting active learning and inquiry through hands-on science, related to the

real experience of children, and promoted equally for boys and girls. She deserves not to be forgotten, especially in her own country.

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In the next article I will look at the life and work of Rev. Richard Dawes, apostle of 'The science of common things.'

Biographical details

Dr Peter E. Childs retired from the Department of Chemical and Environmental Sciences at the University of Limerick in 2009. He started Chemistry in Action!, the magazine for chemistry teachers in 1980, and inaugurated the annual ChemEd-Ireland conferences in 1982. He remains active in curriculum development and science education research, and has been involved in several EU-funded science education projects, namely SALiS, TEMI and currently ARTIST. He is also interested in the history of chemistry and science education, industrial archaeology and issues of science and faith.