William Oughter Lonie - St Andrews educational reformer

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William Oughter Lonie (1822-1894) was appointed Mathematics Headmaster at Madras College, St Andrews, Scotland in 1846. Thomas Brown was a pupil at the school at the time and remembered the day of his appointment (see [7]):

When the Rev William Martin was promoted from the Mathematical Mastership of the Madras College to the Chair of Moral Philosophy at Aberdeen, Mr Lonie was appointed to fill the vacancy. I remember sitting one day in the Latin class, when Provost Playfair entered in company with a young man whom he introduced to Dr Woodford, and the whisper circled round the class that this was the new Mathematical Master. It was not long before he made his mark. His methods were not stereotyped or formal. He did not insist on the dry and rigid demonstrations of Euclid. He dealt with mathematics not as an exercise of memory but as an effort of intelligence and reason.

In this paper we shall look in §1 at Andrew Bell, the founder of Madras College, in §2 at the Madras College, in §3 at W. O. Lonie's career, in §4 at his teaching methods and philosophy, in §5 at the work of James Walker, one of his pupils, and finally details of the later part of Lonie's life and career in §6.

1. Andrew Bell, the founder of Madras College.

Andrew Bell was born in St Andrews on 27 March 1753. His father was a barber. Bell attended St Andrews University where, his professor wrote, "in mathematics and natural philosophy he was here excelled by none." He emigrated to America in 1774 where he was a tutor to various families in Virginia. He returned to St Andrews in 1781, bringing two boys to be educated at the University. He was ordained a priest in 1874 and served as a minister in Leith, near Edinburgh. In 1789 he went to India where he became a lecturer in mathematics and physics in Madras. In India, he also became a chaplain to the East India Company. He tried to improve the state of children by improving the school education, teaching himself in schools. There he developed his monitorial system where the master would teach the older children who would in turn teach the younger ones. His health broke down in

1796 and he returned to England, now a rich man, where he vigorously promoted the monitorial system. He passionately promoted his system and also passionately argued for a better education for the poor. Bell, who had a number of ecclesiastical appointments, was considered a leading expert on education and consulted by many. Bell's system became popular and was adopted by many schools throughout England, Scotland and Wales. In particular, two schools in St Andrews adopted the system.

Let us say that the monitorial system was not a great educational system but it became popular for two reasons. Firstly the existing educational system was so poor that almost anything would have been an improvement. Adopting the system meant that children were learning throughout the whole day where in the old system children were idle most of the time. His arguments that each pupil should find their own level and that there should be encouragement rather than corporal punishment certainly had merit. Secondly, Bell's skill in promoting the system led many to adopt it. In 1819 he was elected Prebendary of Westminster Abbey in London. He died on 28 January 1832 and was buried in Westminster Abbey. On his tomb, erected in 1838, are the words:

... the Eminent Founder of the Madras System of Education, who discovered and reduced to successful practice the plan of Mutual Instruction founded upon the multiplication of power and division of labour in the moral and intellectual world, which has been adopted within the British Empire as the National System of Education of the children of the poor in the Principles of the Established Church.

2. The Madras College.

In the early years of the 19th Century, St Andrews had two schools, a Latin school and an English school. When Andrew Bell was 77 years of age, he acquired two sites on South Street for a new school. The Madras College (St Andrews) Trust originated in a Declaration of Trust dated 14 July 1831. It "bequeathed certain funds and estates for educational purposes." The fund of £120,000 was to be administered by the Madras Trust: the Provost, two ministers of the parish church and the professor of Greek in the university. They were told to build:

... substantial, commodious and handsome school rooms and school houses for your English and Latin schools.

The Latin and English schools were the property of the Town Council but they agreed to hand them to the Trustees.

The Trustees decided that other things in St Andrews were more important and planned to build an observatory and improve the public water supply, keeping £70,000 for the new school. When he learnt of these plans, Bell, who was very ill by this time, was furious. He cancelled his original bequest and instead gave the Trustees £50,000 for the school, £10,000 for the Bell Fund, and the rest went to encourage Bell's monitorial system in six other places, London, Edinburgh, Leith, Glasgow, Aberdeen, and Inverness.

When the Madras College was founded there was no single headmaster - the senior masters of each department were known as Headmasters of their Departments. They were largely independent and received fees from the pupils. The Trust set up by Dr Bell in 1831 was run by four Trustees, Robert Haldane the first minister of Holy Trinity, George Buist the second minister of Holy Trinity, William Haig the Provost of St Andrews, and Andrew Alexander the Professor of Greek at St Andrews University. The Trustees co-ordinated the essentially independent Departments into the Madras College. In 1859 the Trustees of Madras College (at this time the Provost of St Andrews, two St Andrews Ministers, and the Sheriff of Fifeshire) issued the following advertisement for the school:

The peculiar advantages which distinguish this Educational Institution, consist in the appointment of a Head Master, with a complete Staff of Assistants for each department of instruction. English, Writing, Arithmetic, Classics, Modern Languages, Mathematics, and Drawing, are each superintended by a Master, whose professional training has been specially devoted to the subject which he teaches. By this arrangement, Parents are enabled to secure for their Sons a First-class Education, either Classical or Commercial. Special Classes can also be attended in preparation for the Army or Navy, and Oxford Examinations, and for Farming and Engineering pursuits. The extreme moderation of the Fees, and the proverbial healthiness of St Andrews, form additional claims to the consideration of Parents and Guardians.

3. W O Lonie, Mathematics Master at Madras College.

William Oughter Lonie sometimes used the name William Oughterlonie. His father, also named William Oughter Lonie, was an engineer and his mother was Agnes Morrison. He attended school in his home town of

Kinghorn, Fife, where he was taught there by the Rev John Davidson. Lonie said, many years later (see [4]):

Drinking at such a fountain, I would have been a very dull boy indeed if I had not drawn some little inspiration.

On the same occasion, in 1881, he recalled the first school prize he won at the school in Kinghorn (see [4]):

I had a desire for sympathy - it upset me. Still as the first excitement went away and I began to enjoy my holidays amid tree and bud and leaf and flower, I thought of the joy in my mother's face and the intense pleasure in my father's. By gaining this prize I had brought into the home I held so dear a new atmosphere, an atmosphere of happiness and goodwill, and I resolved to preserve it by working more earnestly in the future than I had done in the past.

He attended the University of St Andrews, matriculating in 1836 when he was barely fourteen years old. In 1837 he was a Kinghorn bursar. The courses he took were the following:

1836-37 Junior Latin, Junior Greek
1837-38 Greek Provectior, Mathematics 1, Logic
1838-39 Greek Provectior, Latin Provectior, Ethics, Mathematics 2
1839-40 Latin Provectior, Greek Provectior, Mathematics 3, Physics, Philosophy of the Senses
1843-44 Chemistry

He graduated M.A. on 27 April 1844. Now this record of the courses took looks strange - particularly the gap from 1840 to 1843 and the fact that he seemed to have essentially completed his degree four years before graduating. However, this is explained by the fact that Lonie was training to be a teacher and began working in schools in 1838 in parallel with his university studies. This was standard practice at the time. When he started as an assistant at the Burgh School in 1838 he was only sixteen years old. Following this he was an usher (an old term for an assistant schoolmaster) at an English boarding school. He was, for three months, an interim teacher at a burgh school. Following his graduation he was an assistant to Thomas Duncan, the Regius Professor of Mathematics at the University of St Andrews, for a year. He then spent a year as a resident private tutor before being appointed Head Master of Mathematics at Madras College in 1846. He lived at 5 North Bell Street, St Andrews, close to the school.

4. Lonie's ideas about teaching and education.

Thomas Brown, remembering his lessons in Lonie's classes, writes (see [4]):

His idea of education was not to plant seeds, but to develop the inherent powers and capabilities of the soil, so that the seeds when planted might grow and fructify to the utmost. His lessons were always interesting. His policy was to arouse an interest in the mind of his pupil, to show him that the master was interested in him and in this way to awaken in the pupil an interest in the master. To effect this purpose anything was employed. Did the pupil manifest a faculty in any direction, it was at once seized and utilised. Was it a liking for pictures and some faculty in drawing, or for reading in any particular line, or a love of flowers or other natural objects, it was drawn out and formed a link of attachment between master and pupil. In this way the affection of the pupil was evoked and a foundation laid, for the devotion which characterises all who came under the Doctor's influence. Sometimes a casual reference in the class would set him off, and the hour was spent in a prelection which had little reference to mathematics. These occasions are remembered as the happiest and not least useful and stimulating incidents of the session.

Lonie spoke about his ideas on teaching and education in an interview by the Assistant-Commissioners on the State of Education in the Burgh and Middle-Class Schools in Scotland, 1867-68 (see [1]). His views were sought since, at this time, he was considered to be one of the best mathematics teachers in Scotland. Asked about whether the burgh school system meets the needs of the whole community, Lonie answers:

The Madras College meets the wants of our whole burgh community and more; but the theory of a burgh school should, in my opinion, embrace ... the idea of a distinct demarcation between the department for reading, writing, and arithmetic, as the instruments of a further education, and such further training by classics and mathematics as the most fitting known means to prepare pupils for universities, service examinations, and all middle-class occupations.

Asked about which subjects should be compulsory and which optional, he replies:

My experience in the Madras College and otherwise has impressed me with a very decided conviction that in the stage above the three R's it were best that the burgh, or rather the middle-class department of the burgh schools, had an imperative curriculum of two branches, viz., classics and mathematics, and all other optional. One advantage in the present free choice should not be overlooked, that children, who are, perhaps more frequently than parents, the choosers, are gratified with less irksome work; while this, I believe, is mainly due to our modes of teaching classics and mathematics being, so to speak, too didactic and authoritative; the master being too forgetful of the necessity of inductive teaching towards rules of language and propositions of mathematics, and likewise too forgetful of the constant necessity of deductive applications to matters of universal interest and prospective advantage.

He also believes that parents do not necessarily have correct ideas about the best subjects for their children to study:

Parents are too much inclined, in matters of education, to prefer the more immediate results of knowledge in the shape of such so-called practical subjects as practical mathematics, book-keeping, etc., and accomplishments such as drawing, painting, music, etc. Few appear to believe in training at all, or believe that all knowledge, however disjoined, is, in the acquisition, good training.

Let us also record at this point two further comments about Lonie as a teacher:

When work in mathematics was slow moving Mr Lonie used to stop the class, sing 'Cheer, boys, cheer' loudly and carry on with the lesson.

It is also recorded that Lonie altered the timetable moving his Geometry class from 12 noon to 6 am.

Here are some further comments on Lonie as a teacher, taken from speeches at a dinner given in his honour on Friday 22 April 1881 in the Royal Hotel, St Andrews, close to Madras College (reported in [4]):

Dr Lonie may be regarded as a pioneer reformer in his own walk of life. He has no faith in the "tawse" as an educator, and, notwithstanding the lack of order and authority many would suppose this would entail, no one could take even a cursory glance through Dr Lonie's classroom without being struck with its joyous air of freedom, its remarkable

absence of what he himself terms "boy-repression" and the manifold indications of vigorous hard work. Accepted notions of teaching by dint of rigid military discipline are unceremoniously discarded, and the Doctor fearlessly works out his own propositions that a boy should be as much at liberty to walk up and down in his classroom as the tradesman is in his workshop. Herein lies largely the secret of this teacher's success, and the explanation of the fact that his name is still fondly cherished by many old pupils scattered all over the globe.

As this dinner, Lonie spoke of his hopes for education in the future:

I would have you bear in mind that it is a hard thing for these little boys to sit 6 or 7 hours a day on a bench, and begin again to a task of 2 or 3 hours at night, while the great sun is calling on them all the while to enjoy themselves, and the birds are singing and all nature alive and inviting them to her great temple rather than to the small confined temple of the classroom. I hope that the day is not distant when every scholar will have free scope for his young powers, and the liberty to stand up and put questions inviting discussion.

5. James Walker's Fair Book.

In the archive of Madras College there is a jotter of a schoolboy who was taught by Lonie at the College in 1852. On the front of the book is 'FAIR BOOK, JAMES WALKER'. It is unclear whether the material in this book was put there immediately after the rough working had been done elsewhere or whether this book was only created some time later. The first alternative seems the most probable. After one page which is joined to the cover of the book, there is an insert of many pages bound separately. It is clear that this is an insert rather than part of the original book which has come loose. It is not clear, however, whether these pages represent material covered before, after, or at the same time as the material in the rest of the Fair Book. Part of the difficulty is that the material in the Fair Book itself does not always advance in difficulty, and sometimes after quite hard problems, simple ones of the same type will appear. Also the material in the Insert contains problems similar to some in the rest of the book.

The first page of the Fair Book is headed 'Tonnage of ships'. After a lovely sketch of a three masted sailing ship, the first problem is written.

If the length of the keel of tonnage be 100 feet and the extreme breadth of the ship 35 feet. Required tonnage by common rule.

Although no 'common rule' is specified, the solution tells us that the rule gives the tonnage as x.y^(3/2)/94 where x is the keel in feet and y is the extreme breadth. The calculation is done using six-figure logarithms. We have inserted 'log' but the text does not.

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log 100   = 2
log  35   = 1.544068
log  17.5 = 1.243038
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            4.787106
log  94   = 1.973128
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651.5     = 2.813978
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Although no words appear in the solution, we see that the tonnage, found from log tables, is 651.5.

On the second page (back of the first page) there are two similar problems.

If the length of the keel of tonnage be 80 feet and the extreme breadth of the ship 27 feet. Required tonnage by common rule.

If the length of the keel of tonnage be 96 feet and the extreme breadth of the ship 33 feet. Required tonnage by common rule.

Throughout the book six-figure logarithms are used. Today we might criticise a pupil who uses a calculator to work out 2 x 25. Walker often uses six-figure logarithms to compute this type of trivial arithmetical calculation. It is unclear from the solutions given whether pupils have been taught understanding of the methods for solving problems or whether they have simply been given a list of instructions like an algorithm which we might today program into a computer.

Geometry is taught in a practical way under 'Land Measuring". For example:

Let AB or AC be 100 links, and BC 136 links, what is the angle BAC.

Walker takes a half of 136, then uses the sine rule to obtain half the angle at A. As in all his calculations, he uses log Sine A = log 10^10 sin A in his calculations. He should get 42°50 but (by a copying error)

gets 45°50. He then doubles this to get the correct answer of 85°40 (confirming that the above was only a copying error and that he had it correct in his rough working). Much of the calculations involve working with the system of units in use at the time. For example:

What is the area of a triangular field, the three sides of which are 628, 760, 456 links.

Heron's formula is used: area = (s(s-a)(s-b)(s-c))^(1/2) where a, b, c are the sides and s = (a+b+c)/2. Walker doesn't say he is using Heron's formula, nor does he mention a formula. He just carries out the calculations with the given numbers. Six figure logs are used to calculate the area as 143000 square links. This is then divided by 100,000 to get acres. The decimal fraction is then multiplied by 4 to obtain roods (4 roods to 1 acre). The decimal fraction is then multiplied by 40 to obtain square poles (40 square poles to a rood). Then the decimal fraction is multiplied by 30 1/4 to obtain square yards (30 1/4 square yards to a square pole). Answer: 4 acres 1 rood 28 square poles 24 square yards.

Many of the problems have a military connotation. For example:

How far could the Baltic fleet be seen from the Sidlaw hills being 2000 feet high.

The formula used is d = ((2r + h)h)^(1/2) where h is the height above sea level and r is the radius of the Earth. The diameter of the Earth 2r is taken to be 41777360 ft. A modern value, for comparison, would be 41851509 ft (at least that is the equatorial value). The distance to the Baltic fleet is worked out in miles (by subtracting the log of 5280), giving 54.74 miles.

What is the first velocity of a 10 inch shell, weighing 90 lbs, when fired with a charge of 4 lbs of powder.

Calculation carried out with six figure logs.
Walker computes $\sqrt{(8/90)} \times 1600 = 477$.

What is the greatest range of a 42 lb iron ball, when discharged with a velocity of 2000 feet per second, and the elevation necessary for producing that range, the diameter of the ball being 6.75 inches.

Although most of the solutions contain no words, interestingly later in the book Walker writes a little more about the problems. For example:

The base of a right-angled triangle is 300 and the sum of the other sides 1000, what are these sides.

Here he writes
Let x = the hypotenuse
1000-x = other side
x^2 = 300^2 + (1000-x)^2
x^2 = 9000+10000000-2000x+x^2
2000x = 1090000
2x = 1040
x = 545 hypotenuse
1000-x = 455 other side.

6. More on Lonie's life.

Lonie married Eliza Craig in Kinghorn on 12 December 1849. On 22 November 1850 their twin sons were born: Alexander Charles Oughterlonie and William Robert Oughterlonie. Tragedy struck the family soon after this and within a couple of years Eliza had died and William Robert had died in infancy. Alexander Charles Oughterlonie had a poetic temperament inherited from his mother and finished his college course with distinction. However, he suffered from heart disease and struggled for years spending his days painting, writing poetry and contemplating questions of existence. Tragically, he died in 1877 aged 26.

Although devoting himself to teaching at Madras College, where he was seen as an educational reformer, Lonie also undertook research. He conducted experiments on the optic nerve, judging depth and distance in monocular vision, and the role of the retina. Lonie's 'Prize Essay on the Stereoscope' won the prize of 20 guineas in 1856 which was presented to him by Sir David Brewster.

Lonie received two notable honours: the University of St Andrews honoured Lonie when they awarded him an LL.D. on 12 February 1870. We have mentioned above the dinner held in his honour on Friday 22 April 1881. At the dinner he was presented with a silver salver and casket containing a cheque for 500 guineas (£525). (Today worth £45,000 using Retail Price Index or £278,000 using average earnings) The money had been collected from his former pupils and former

assistants and the amount raised shows the high regard in which he was held. However, his life ended in great sadness (see [4]);

The weakness of Dr Lonie - who among us has not his faults and failings? - lay in his excessive sensitiveness. This led him to imagine slights and insults where none were conceived or intended. The failing made him sometimes difficult to get on with. It rendered the trials he met with in his life specially sore and oppressive. The loss of his wife was a great affliction; and the death of his only son, a young man of remarkable promise, who was cut off just when a brilliant career seemed assured to him, was a heavy blow. But the crowning calamity was his removal from the post he had long held, a consequence of the reorganisation of the institution. He never got over it. It broke his heart. To his sensitive nature it bore the aspect of disgrace. He looked on it as dismissal because he was considered no longer worthy to hold a position he was conscious of having filled with credit to himself and usefulness to the College and its alumni. He retired to a cottage at Trinity and died within a short time after.

References.

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3. C. Roger, *History of St Andrews: with a full account of the recent improvements in the city* (Adam & Charles Black, Edinburgh, 1849).

4. *St Andrews Citizen* (23rd April, 1881).

5. *The Scotsman* (Saturday, 15th August, 1846).

6. *The Scotsman* (Wednesday, 25th August, 1847).

7. Thomas Brown, Dr W O Lonie, *Madras College Magazine* Vol. XIX No. 3 (June 1908), 48-49.

8. Walker's Fair Book, *Madras Archive* (2014).

9. William Oughterlonie, M.A., LL.D., *The Scotsman* (5th January, 1894), 5.