

THE TEACHING OF MATHEMATICS.

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IT is not my intention to-night to discuss at any great length the study of mathematics. Even the most uncompromising opponent admits, nay, is "decidedly of opinion that mathematics ought to be cultivated, to a certain extent, by everyone who would devote himself to the higher philosophy."¹ The common consent of mankind has decided the question in favour of teaching mathematics; disregarding the opposition of those few who, in ignorance and unbelief, regard either the subject itself or the manner of teaching it as unimportant, we, who, rightly or wrongly, have got to teach mathematics are here to take counsel together how we may best do the duty that is set before us. Nor do I propose to consider the quantity of mathematics that ought to be taught, nor the relative importance of these subjects compared with other studies. But I wish to recall your attention to the principles upon which mathematical teaching should be conducted. If I state my opinions positively, perhaps even dogmatically, it is not from any affectation of superiority, but because that is the easiest way of stating them that they may be understood and criticised.

I shall draw my illustrations from the teaching of elementary mathematics, arithmetic, geometry and algebra, because these are the parts of mathematics in the teaching of which more of us have experience, and also because the manner of teaching them is vastly more important than that of the subsequent teaching. If they are not taught well, they will certainly be

taught badly; it is almost impossible to protect a child from all teaching on these elementary subjects. And the higher subjects cannot be taught at all unless the elementary are taught well.

The earliest teaching of arithmetic begins slightly before a child can speak, and is usually carried on far too rapidly as soon as he obtains the use of his tongue. The earliest teaching of solid geometry should begin as soon as a child can play with a box of bricks; of plain geometry a few years later, when he can wield a pair of compasses. This teaching is often deferred too late. The earliest teaching of algebra occurs some years later still, when considerable facility is acquired in the use of the pen, or at least pencil, and when the child, if a boy, has probably come under masculine influence.

Now all teaching, as Aristotle points out, is based on previous knowledge.² Our teaching of mathematics is based on this early teaching which we do not give. It is a strong argument for the improvement of the education of women of all classes that the early education of all children is almost entirely in their hands; the importance of this early education can scarcely be overrated.

All mathematical teaching should be conducted so as to accord with the fundamental laws of pedagogy; of these the one which is the first in importance is this: *The understanding of the pupil is to be employed throughout.* This is a general canon of all teaching; it is especially needful to be observed in mathematics. Pro-

¹ Sir. W. Hamilton, *Edinburgh Review*, Jan. 1836.

² Ethics, Book VI., Ch. 3.