to instruct, really *common* things. If, for instance, in a lesson on the atmosphere, he discourses on the quantity of ozone, it contains at different times, or attempts to describe the delicate instruments used to determine the weight and composition of the air, he will puzzle the poor children and provoke the parents to complain of the time wasted. Let him rather shew that pure air is necessary to life, and the respiration of animals changes the character of it and makes it unfit to breathe, he can then with reason shew the necessity of ventilation and the evil effects of living in overcrowded rooms. Shew that the same element in the atmosphere which supports life, supports flame; that where a light will not burn, a person cannot live, and you may thus teach them to avoid danger from foul air in cellars, wells, or mines by trying (before they venture into a doubtful place) if the air is pure enough to sustain the flame of a candle, or so impure as to put it out. While showing the necessity for pure air to support flame, the children may be brought to see, that if the supply is stopped, the flame must be extinguished, and so if their clothes should accidentally catch fire, the wisest thing they can do will be to wrap themselves up in anything which will keep away the air from them.

By sensible and searching questions on the things about them, we may lead the children to read the book of nature as spread out before them, and to observe with care and reverence the wonders and beauties of creation, and who can tell what use that lad may be to his fellow-men, whose mind was first led, by the simple lessons at school, to study the great principles which govern the universe, or what lives it may be in his power to save by the knowledge of facts of which he might otherwise be ignorant.

On Teaching Elementary Mathematics. (1)

It is much to be regretted that a large majority of the youth of this country leave school utterly unacquainted with the useful and beautiful truths of Algebra and Geometry. For them, these noble sciences do not exist. They are sent into the world not only without that mental cultivation derived from a course of mathematical demonstrations, but without that inferior though still valuable training afforded by exercise in the precise definitions, problems, and rules of these branches of knowledge; entirely unacquainted with geometric forms and ideas; without that practical training of hand and eye imparted by the careful construction of geometric figures; unable to work a common question in mensuration; unable to understand a simple algebraic formula; and hence incapable of comprehending elementary truths in interesting and important subjects of science and the arts. They are deficient in that early foundation which makes it easy to raise an after-structure of scientific or technical knowledge; and, from want of a little rudimentary instruction, are unfit to rise above the lowest grade of work in any of the mechanical arts.

This is not only an individual loss; it is a national loss. There is a vast amount of genius amongst the people, the development of which would be a public benefit. Much of this is lost from want of a little rudimentary instruction in mathematics. It is only genius of the very highest order that can force its way through a thick crust of gross ignorance.

Mathematical information has not been generally diffused, because we supposed that a demonstrative course is essential, and that there is no such course but Euclid's. Many who began that work have been driven from the study by the repulsive ruggedness of the first steps, especially that large class in lower schools where the teacher can give them tittle attention, who have no home helps, not much time for the study, and are mostly left to themselves. Simpler works, adapted to various wants, have not been prepared, because Euclid was considered the one only sovereign and universal remedy for ignorance of Geometry. Publishers vied with each other in producing cheap Euclids; one brings out a half-crown edition, another a shilling edition, and a third publishes it in sixpenny and fourpenny bits. If our faith in Euclid remains unshaken, we may soon expect a penny edition.

But mathematical demonstration is an intellectual luxury which few have time for, and some are incapable of enjoying. Simple results and practical operations are the essential parts, and are adapted to the capacities of all. Numbers can perceive the beauty of a geometrical truth, and take an interest in its practical applications, who cannot go through a demonstration. Every one is pleased to know than the angle in a semicircle is a right angle or that the figure on the hypotenuse of a right-angled triangle is equal to the sum of the similar figures on its sides. All can be taught to construct figures and work rules, and almost all like to perform such operations. We do not reserve the practical parts of arithmetic or algebra till the learner is able to prove every proposition as he goes on. Why must we do so with Geometry? To deprive any one of the pleasure and benefit of knowing interesting geometrical truths and their practical applications, because he cannot learn their proofs, seems about as reasonable as to deny a lover of Nature a fine prospect from a mountain top unless he has time and strength to climb it himself without aid from horse or mule. Let all have a practical course, which can be entered on at an early age. Let the demonstrative course be reserved for the more mature intellect—for those who have time, taste, and capacity for it. The knowing faculties are far in advance of the reasoning powers, and, at an early period, are able to grasp a large amount of interesting, useful, and exact knowledge in mathematical science.

I would suggest, then, that all, in the humblest as well as in upper schools, should at an early age be taught the nature and several leading properties of the principal geometrical figures, the methods of constructing them; a little algebra, so far as to understand the meaning and ordinary working of a simple equation; and the leading rules of mensuration with the methods of expressing them equationally, and copious exercises.

This would implant some knowledge of leading facts and principles in mathematics; by the problems and exercises, train to some skill in the construction of figures and in ordinary calculations in mensuration; familiarize with the subject generally; and lay such a foundation that it can easily be taken up and pursued afterwards. It would give the start to those endowed by nature with talent for mathematics, excite them to an interest in the subject, and show the teacher where such talent was to be found. Also, by familiarizing with geometrical terms and figures, it would prepare the way for a demonstrative course, which would thus be rendered easier to all at the beginning, less repulsive to many. This, as may be judged from what I have remarked above, as to the difficulty caused by the novelty and complexity of geometrical figures, I regard as a point of some importance.

I may here refer shortly to a very valuable part of elementary teaching in mathematics, rather neglected in this country—*Mental Arithmetic.* This is a most excellent exercise. It familiarizes with, and renders expert at, arithmetical operations; it imparts a certain power of mental abstraction and concentration; and it affords easy means of explaining and illustrating the reasons of the rules. A quarter of an hour, three times a week, at mental arithmetic, intelligently taught, is well-spent time.

I would have all early instructed in—

Thorough Arithmetic.
The Simple Equation in Algebra.
The Nature, Properties, and Construction of the Leading Geometrical Figures.
The Leading Rules of Mensuration.

This would suffice for that large class that leave school before fourteen years of age, and serve as a useful introduction for those who are to go on further.

Another class remain at school till sixteen years of age or a little latter, and finish their education there. The majority of these may go pretty far in a demonstrative course of Geometry, if they abandon Euclid and avail themselves of modern improve-

(1) A portion of a paper read before the Royal College of Preceptors, England, by Hugo Reid, Esq.