

ing a conception of a line, take a surface from a cube, or in its absence take a sheet of paper. It has two sides or surfaces. These meet at the edge and form a *line*. It is supposed that the pupil has seen from a previous lesson that a surface has no thickness, and from the preceding illustration he sees that a line may be regarded as the boundary of a surface; he is thus led to conceive of a line as length without breadth. Some teachers may prefer such an illustration as the following: Suppose two surfaces in juxtaposition, the one coloured red and the other green, it is evident there would be a *region* belonging as much to the red as to the green surface; such a region is called a line.

The classification of surfaces and lines may be taught, the fundamental idea being that of direction, *e.g.*, by moving the finger along a straight edge, the *direction* will not be changed, and if moved round a ring, or the edge of an ink-well, the *direction* will be changed *continually*. Parallel lines will be seen as lying *side by side*, and all tending to points at *any distance*, which, wherever assumed, are at the same distance from each other.

The idea of angle might be developed in accordance with these conceptions of straight and parallel lines being conceived as expressing the *difference in the direction* of two lines that tend to a point at a *finite distance*. The hands of a clock or watch, each hand being supposed to be indefinitely thin, or to be a *material line*, may afford a very good illustration. When one hand overlies the other, both hands are directed to the same point and no angle is formed; let one of the hands be turned, the smallest amount of turning will cause a difference in the direction of the hands; this difference is the angle between the two hands.

2. *Construction.* When such conceptions have been gained as form a necessary groundwork, the pupil should proceed to represent them. The simplest operation, and therefore the first to be taken, is merely to place the surfaces cut from the cubes or any other suitable surfaces on a piece of paper and pass the pencil round them. The lines thus drawn enclose the surface, but do not, as pupils who are not allowed to work out definitions often imagine, found the surface. (How many pupils who have even demonstrated several books of Euclid are surprised to learn that the top of the table they write upon is a parallelogram!) When he has had a considerable amount of practice in drawing figures by the eye, he should be required to test their correctness, thus stimulating him to make them exact, and preparing him for appreciating some systematic contrivance in their construction. When he is thus prepared, let him be taught to construct figures by an exact method by means of scale and compass. To bisect a line, to erect a perpendicular, to bisect an angle, or describe a hexagon, are exercises which with a little practice he will be enabled to do readily and accurately. Such constructive exercises will not only lead to very clear geometrical conceptions, but will invest the subject with that kind of interest which will induce the pupil to seek further knowledge.

3. *Logical Demonstration.* By means of such exercises as the preceding, the pupil will have observed certain relations arising out of certain conditions. His attention may now be more particularly called to these relations and conditions as an immediate preliminary to the logical demonstrations. Let him by experiment or measurement find out that the square described upon the hypotenuse of a right angled triangle is equal to the sum of the squares described on the other two sides, and his curiosity naturally prompts him to enquire why it is so. Let him find out the relations between the diameter and circumference of a given circle, and he will be induced to enquire if the relation holds good in all cases. Let him compare two triangles that have two sides of the one equal respectively to two sides of the other and their included angles equal, and he will be led to see that it is impossible for these triangles to

differ in any respect. As an illustration of the last proposition, take an exercise similar to the following:—Upon a sheet of paper draw two straight lines from the same point so as to form an angle A. Cut out the angle, and by placing it upon another sheet of paper and tracing the sides with a pencil make an angle equal to A. Mark off from these sides two lines respectively equal to two given lines and join their extremities. A triangle will thus be formed having an angle equal to A, and the sides which contain this angle respectively equal to two given lines. In the same way make another angle equal to the angle A, and from the sides mark off two lines previously given and join their extremities. In drawing these triangles no regard was paid to the lines joining the extremities, but it will be found by comparing the triangles that these lines are equal, and that the triangles are equal in every respect.

By continuing at such exercises until a large number of geometrical facts are established, the logical demonstrations will not only present no obstacle, but will be naturally sought for as necessary supplements. A teacher who complains about the want of interest his pupils take in Geometry will find that it is owing in most cases to inadequate conceptions of the facts about which they are to reason. Any branch of knowledge may be made repulsive or interesting from the method pursued in teaching it. If pupils are induced to become active discoverers instead of passive recipients, they awake to a consciousness of inborn power which not only gives interest, but inspires with a courage that must lead to success.

If some such method as has been described is adopted in the first stages of Geometry, the pupil may be introduced to Euclid's Elements, if no other text is used, with the sure hope that he will readily master its successive propositions and appreciate their value.

Wormell's Modern Geometry, which is the prescribed text-book for the schools of New Brunswick, is constructed on the foregoing principles, and will be found of great value to a teacher who aims at rational methods of instruction. It contains also an Appendix giving a tabular view of the correspondence of its propositions with those of Euclid, by Dr. Jack, President of the University of New Brunswick. It might be noted here that the University accepts at its Matriculation examination the first twelve chapters of Wormell's Geometry as a substitute for the first four books of Euclid. Though a large part of Dr. Jack's professional duties relate to the purely abstract form of Mathematics, he is keenly alive to the necessity of commencing the subject of Geometry in a concrete form, and has rendered Dr. Rand, Chief Superintendent of Education, valuable service in introducing the Modern Method into New Brunswick.

The Modern Method of commencing the subject must be universally the method of the future. There is no doubt that many strong-minded teachers, who can only deal with children as immature and inferior men, will for a time continue to hold out against methods suited to children's ways of seeing, feeling, and thinking, but the influence of foreign countries will compel them to yield. The foreign consensus against the use of Euclid as a text-book in schools is something striking. Mr. Matthew Arnold, in his Report on Foreign (Continental Europe) Education, says, "Our (English) geometry teaching was in foreign countries sufficiently condemned when it was said that we still used Euclid."

PAST AND PRESENT RELATIONS OF TEACHERS TO EACH OTHER.

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In the earlier periods of our educational history, or even twenty-five or thirty years ago, such a thing as a Teachers' Association or