INTERPROVINCIAL CONVENTION.

[In the report of the High School Section, in last number, a reference to the paper on "Physics," by Principal E. Mackay of the New Glasgow High School, was inadvertently omitted. The following is an abstract of Mr. Mackay's paper, and its practical suggestions will be of great interest to teachers and students.]

Physics in the High School

The science of physics investigates a class of phenomena underlying all nature. It is therefore of prime importance that the methods of teaching here employed should be of the soundest; for, sound or unsound, their influence may permeate all subsequent scientific study. Leaving out of consideration minor varieties, methods of teaching physics may be regarded as two—the lecture method, and the experimental method. The characteristic of the former is that the pupil first gains his knowledge of a physical law from his text-book or teacher, and afterwards sees its exemplification in experiments performed by the teacher; of the latter that the pupil performs for himself a series of experiments leading up to the law. Take, for illustration, any physical law—that of electrical resistance, for instance. When the lecture method is pursued, the pupil first makes himself acquainted with that law as stated in his text-book, and is then expected to watch the teacher, as with the aid of a galvanometer, a battery and a few coils of wire, he illustrates its truth. A knowledge of the same law obtained by the experimental method requires each pupil to perform for himself some such series of experiments as the following:

A battery, a galvanometer and a number of conducting coils are first supplied the pupil, and the character of the experiments he is to perform explained to him. He takes a coil of iron wire of known length and diameter, and connecting it in circuit with the battery and galvanometer, he notes the deflection of the magnetic needle produced by the current. He next connects up in a similar way a coil of copper wire of the same dimensions, and again notes the deflection; it is greater than before, denoting a greater current. He infers that the resistance of a copper conductor to the electric current is less than that of an iron one of the same dimensions, and hence that resistance varies with the substance of the conductor. If time permit, he may satisfy himself of the truth of this conclusion by substituting for the copper, coils of the same size of various other conducting substances. Taking next, say the copper coil, the pupil cuts it into two equal lengths, and connecting up each half in succession, he notes the deflection in each case. The deflections are the same, but greater than the deflections previously noticed for the entire coil. This experiment he repeats a few times, and, taking the mean of the deflections observed, he sets it down as the true deflection. If the galvanometer be one from the angle of deflection of which the real or relative strength of current may be calculated, he now finds, by comparing the current in the half-coil with that in the original, that the former is approximately double of the latter, or the resistance of the former half that of the latter. He therefore concludes, allowing for errors in experiment, that resistance is directly proportional to the length of the conductor. In a precisely similar way the pupil now compares the currents in conductors of the same length and substance, but of varying diameters. He is thus finally led to sum up the results of his experiments in the statement that the resistance of a conductor of uniform thickness to the passage of an electric current varies with the substance of the conductor, is directly proportional to its length and inversely to the square of its diameter.

The distinction between the two methods is thus apparent. The lecture-method requires the pupil to obtain a knowledge of nature through the medium of his teacher or text-book. The experimental method permits him to question nature for himself. Teachers and text-books have undoubtedly an important place in our present educational system. But the primary source of knowledge is nature, and both teacher and text-book occupy usurped places when they stand between the pupil and nature. The experimental method of teaching physics, therefore, since it alone admits of living contact with nature, is the only method which insures a knowledge of the science at once adequate and abiding.

The individual experimental work required of this method suggests a practical difficulty—insufficiency of apparatus. The difficulty is frequently over-estimated. That pupils may work simultaneously does not imply that each is supplied with apparatus of the same kind. It will usually be found quite unnecessary to duplicate apparatus. Suppose, for example, that working accommodation can be provided for the simultaneous work of a dozen pupils, a number sufficiently large for the teacher to properly superintend. Then, in preparation for each day's work, the apparatus required for a single experiment is placed in readiness for each of the twelve pupils. The general character of the experiments to be performed is first discussed; then each pupil takes his place at one of the pieces of apparatus. When he has finished his experiment he writes out its details in his text-book, and exchanges