formerly customary is desirable for a variety of reasons, I am in complete accord. It is a sound educational principle that instruction should begin with the concrete side, and should only gradually introduce the more general and abstract aspects of the subject; an abstract treatment on a purely logical basis being reserved only for that highest and latest stage which will be reached only by a small minority of students. At the same time I think there are some serious dangers connected with the movement towards making the teaching of Mathematics more practical than formerly, and I do not think that, in making the recent changes in the modes of teaching, these dangers have always been successfully avoided.

Geometry and mechanics are both subjects with two sides: on the one side, the observational, they are physical sciences; on the other side, the abstract and deductive, they are branches of Pure Mathematics. The older traditional treatment of these subjects has been of a mixed character, in which deduction and induction occurred side by side throughout, but far too much stress was laid upon the deductive side, especially in the earlier stages of instruction. It is the proportion of the two elements in the mixture that has been altered by the changed methods of instruction of the newer school of teachers. In the earliest teaching of the subjects they should, I believe, be treated wholly as observational studies. At a later stage a mixed treatment must be employed, observation and deduction going hand in hand, more stress being, however, laid on the observational side than was formerly customary. This mixed treatment leaves much opening for variety of method; its character must depend to a large extent on the age and general mental development of the pupils; it should allow free scope for the individual methods of various teachers as suggested to those teachers by experience. Attempts to fix too rigidly any particular order of treatment of these subjects are much to be deprecated, and, unfortunately, such attempts are now being made. To have escaped from the thraldom of Euclid will avail little if the study of geometry in all the schools is to fall under the domination of some other rigidly prescribed scheme.

There are at the present time some signs of reaction against the recent movement of reform in the teaching of geometry. It is found that the lack of a regular order in the sequence of propositions increases the difficulty of the examiner in appraising the performance of the candidates, and in standardising the results of examinations. That this is true may well be believed, and it was indeed foreseen by many of those who took part in bringing about the dethronement of Euclid as a text-book. From the point of view of the examiner it is without doubt an enormous simplification if all the students have learned the subject in the same order, and have studied the same text-book. but, admitting this fact, ought decisive weight to be allowed to it? I am decidedly of opinion that it ought not. I think the convenience of the examiner, and even precision in the results of examinations, ought unhesitatingly to be sacrificed when they are in conflict—as I believe they are in this case—with the vastly more important interests of education. Of the many evils which our examination system has inflicted upon us, the central one has consisted in forcing our school and university teaching into moulds determined not by the true interests of education, but by the mechanical exigencies of the examination syllabus. The examiner has thus exercised a potent influence in discouraging initiative and individuality of method on the part of the teacher; he has robbed the teacher of that freedom which is essential for any high degree of efficiency. An objection of a different character to the newer modes of teaching geometry has been frequently made of late. It is said that the students are induced to accept and reproduce, as proofs of theorems, arguments which are not really proofs, and thus that the logical training which should be imparted by a study of geometry is vitiated. If this objection really implies a demand for a purely deductive treatment of the subject, I think some of those who raise it hardly realise all that would be involved in the complete satisfaction of their requirement. I have already remarked that Euclid's treatment of the subject is not rigorous as regards logic. Owing to the recent exploration of the foundations of geometry we possess at the present time tolerably satisfactory methods of purely deductive treatment of the subject; in regard to mechanics, notwithstanding the valuable work of Mach, Herz, and others, this is not yet the case. But, in the schemes of purely deductive geometry, the systems of axioms and postulates are far from being of a very simple character; their real nature, and the necessity for many of them, can only be appreciated at a much later stage in mathematical education than the one of which I am speaking. A purely logical treatment is the highest stage in the training of the mathematician, and is wholly unsuitable—and, indeed, quite impossible—in those stages beyond which the great majority of students never pass. It can then, in the case of all students, except a few advanced ones in the universities, only be a question of degree how far the purely logical factor in the proofs of propositions shall be modified by the introduction of elements derived from observation or spatial intuition. If the freedom of teaching which I have advocated be allowed, it will be open to those teachers who find it advisable in the interests of their students to emphasise the logical side of their teaching to do so; and it is certainly of value in all cases to direct the attention of students to those points in a proof where the intuitional element enters. I draw, then, the conclusion that a mixed treatment of geometry, as of mechanics, must prevail in the future, as it has done in the past, but that the proportion of the observational or intuitional factor to the logical one must vary in accordance with the needs and intellectual attainments of the students, and that a large measure of freedom of judgment in this regard should be left to the teacher.

The great and increasing importance of a knowledge of the differential and integral calculus for students of engineering and other branches of physical science has led to the publication during the last few years of a considerable number of text-books on this subject intended for the use of such students. Some of these text-books are excellent, and their authors, by a skilful insistence on the principles of the subject, have done their utmost to guard against the very real dangers which attend attempts to adapt such a subject to the practical needs of engineers and others. It is quite true that a great mass of detail which has gradually come to form part—often much too large a part—of the material of the student of Mathematics, may with great advantage be ignored by those whose main study is to be engineering science or physics. Yet it cannot be too strongly insisted on that a firm grasp of the principles, as distinct from the mere processes of calculation, is essential if Mathematics is to be a tool really useful to the engineer and the physicist. There is a danger, which experience has shown to be only too real, that such students may learn to regard Mathematics as consisting merely of formulæ and of rules which provide the means of performing the numerical computations necessary for solving certain categories of problems which occur in the practical sciences. Apart from the deplorable effect, on the educational side, of degrading Mathematics to this level, the practical effect of reducing it to a number of rule-of-thumb processes can only be to make those who learn it in so unintelligent a manner incapable of applying mathematical methods to any practical problem in which the data differ even slightly from those in the model problems which they have studied. Only a firm grasp of the principles will give the necessary freedom in handling the methods of Mathematics required for the various practical problems in the solution of which they are essential.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

A MERCHANT VENTURERS' research scholarship of the value of 50*l*., tenable for one year in the faculty of engineering of the University of Bristol, which is provided and maintained in the Merchant Venturers' Technical College, has been awarded to Mr. Harold Heaton Emsley.

The Child, a new monthly journal devoted to child welfare, will appear in the early autumn, under the general editorship of Dr. T. N. Kelynack. The journal will be suited to the requirements of all engaged in child study or working for the betterment of child life. The publishers will be Messrs. John Bale, Sons and Danielsson, Ltd., 83–91 Great Titchfield Street, Oxford Street, London, W.

THE governing body of the Battersea Polytechnic is arranging considerable developments for next session in the work of the Domestic Economy Department of the Battersea Polytechnic. An entirely new third-year course will be introduced. This course will carry forward greatly the application of science to housecraft. It will consist, in the main, of much more elaborate work both on the theoretical and practical sides in the subjects of physiology, hygiene, chemistry, physics, and biology. It is intended that special attention shall be given to the carrying forward on the scientific side of the processes which underlie the arts of cookery, laundrywork, and housewifery. It is intended, too, that students shall spend some of their time in practical research work upon the various biological and chemical processes in which so much of their work will be done.

THE report of the Hebdomadal Council of Oxford University, entitled "Principles and Methods of University Reform," has been published by the Clarendon Press. Lord Curzon of Kedleston, Chancellor of the University, contributes an introduction on behalf of the council. We hope later to deal with the important proposals contained in the report, but attention may here be directed to the question of compulsory Greek and the suggested entrance examination. The council proposes that Greek shall be no longer a compulsory subject, but that every candidate must, in order to pass Responsions, satisfy the masters of the schools in Latin and in elementary mathematics, and also either in (*a*) Greek or in (*b*) two other subjects, one, and only one, of which must be a modern language. The optional subjects include, besides modern languages, English history, elementary politics, elementary trigonometry, statics and dynamics, elementary physics and chemistry, and the general principles of geography and the geography of the British Isles and Empire. The proposal to make Greek an optional subject is, says Lord Curzon in his introduction, based "mainly on the fact that the non-Greek curriculum is now firmly established, not only in the secondary schools receiving grants from Government, but also, as an alternative course taken by many boys, in the older public schools, which supply a large proportion of the students of the University." The question of compulsory Greek has been purposely separated from that of an entrance examination. The scheme for an entrance examination framed by the council is as follows:—There will be, in substitution for Responsions, an entrance examination, conducted on behalf of the University by the Delegates for the Inspection and Examination of Schools. This examination will include three necessary subjects and optional subjects. In order to pass, a candidate must qualify in the three necessary subjects at one and the same time, and must also pass in two of the optional subjects, either when he passes in the necessary subjects or at some other time. The necessary subjects will be English, to be tested by an essay or a composition on materials supplied, *e.g.* précis or reproduction of a passage read aloud; Latin or Greek; elementary mathematics; two papers, (*a*) arithmetic and algebra, (*b*) geometry. The optional subjects will be practically the same as those suggested for Responsions. Referring to the entrance examination, Lord Curzon points out that, in adopting the view that school studies should be excluded from the curriculum of the University, and that all matriculated students should be required to have received a minimum standard of general education, the council believes the University will be acting in its best interests by helping to maintain a proper standard in the schools which prepare for it.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, August 22.—M. Emile Picard in the chair.—The president announced the death of M. Eugène Rouché.—Paul **Sabatier** and A. **Mailhe**: The catalytic preparation of the phenolic oxides and the diphenylenic oxides. The authors have applied the catalytic properties of thoria to the preparation of phenyl ether and its homologues. The thoria is maintained at a temperature of between 390° C. and 450° C., and the vapour of the phenol passed over it. The yield is good; but if the temperature is raised another reaction, characterised by the elimination of hydrogen, takes place, the oxide of diphenylene being formed. The reaction applies to the cresols and xylenols.—J. **Guillaume**: Observations of the sun made at the Observatory of Lyons during the second quarter of 1910. Observations were possible on fifty-four days, and the results are recorded in tables showing the number of spots, the distribution of the spots in latitude, and the distribution of the faculæ in latitude.—M. **Schaumasse**: Observations of the Metcalf comet made at the Observatory of Nice with the bent equatorial of 40-cm. aperture. The comet appears as a nebulosity of the tenth magnitude, with a well-marked condensation.—Michel **Fekete**: A theorem of M. Landau.—C. **Maltézos**: The real image of Purkinje.—L. **Fondard** and F. **Gauthié**: The composition of carnations with flexible stems and rigid stems. Three American varieties of carnation with rigid stems, and one French variety with flexible stems, have been analysed, and the differences in the stiffness of the stems found to be accompanied with distinct differences in composition.—Ed. **Hesse**: *Trypanoplasma vaginalis*, a new species found as a parasite in the vagina of the leech.—E. **Roubaud**: A Bombex preying on the Glossina of Dahomey. This wasp is one of the very small number of species known to capture the mosquito.

CALCUTTA.

Asiatic Society of Bengal, August 3.—Manindra Nath **Banerjee**: A system of Indian scientific vocabulary. This paper attempts to give Sanskrit equivalents for a number of European scientific terms, mostly on the basis of phonetic resemblance. With the help of dictionaries and grammars, the Sanskrit words are made to yield the meanings warranted by their European originals.—Panchanan **Neogi** and Birendra Bhusan **Adhikary**: The preparation of phenyl-nitro-methane by the interaction of mercurous nitrite and benzyl chloride. The present work is in continuation of Rây and Neogi's work on the preparation of aliphatic nitro-compounds by the interaction of mercurous nitrite and alkyliodides. The authors have prepared phenyl nitrite and alkyliodides.—D. **Hooper**: Materia Medica Animalium Indica. A classified list of substances of the animal kingdom used in Indian medicine, with notes on their origin, history, uses, and chemical composition. The list is compiled from several works on Indian materia medica, with original observations of the author.

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