of science and mathematics in a balanced education. This estimate of its duties appears to account for the limited view which detracts from some portions of their work. We recognise the right of the committee to formulate opinions directly contravening the principles of Prof. Perry, but it should be made clear that the committee has considered the methods advocated by men of no little experience and judgment with whom it disagrees. Again, there is a half-heartedness in some of the proposals which suggests that the committee has not yet advanced to the position taken by leading writers more than twenty years ago. For example, no reference whatever is made to graphs, and the official dictum of the Mathematical Association still stands "that it is undesirable (at the preparatory stage) to lay stress on the *practical employment* of graphs in solving equations or other problems." [The italics are in the original, *vide* Reports of the Committee of the M.A., p. 29 of the 1908 issue.]

The discussion was preceded by an eloquent benedictory address from Prof. Forsyth. He quoted Faraday's advice to Tyndall to work out any experimental result so far as possible, "so that the mathematicians may be able to take it up." Much good would accrue to the training of schoolboys if scientific results could be so left that mathematicians, even mathematical schoolboys, could "take them up." Prof. Forsyth also quoted from the regulations for the Mathematical Tripos to show that settled thought at Cambridge is in harmony with the spirit which animated the joint committee whose report was before the meeting. He pleaded for patience in early years of growth—"go gently, and you will go safely; go safely, and you will go far." It was plain from the speeches of Mr. Godfrey and Mr. Jackson that the committee had exercised much restraint, and that it had deliberately erred on the side of caution in the changes which were recommended.

Sir J. J. Thomson said exactly what was wanted. He amused the meeting by his description of the student at Cambridge who wanted a kind of physics that would not give a headache to a caterpillar, and of the delight and surprise of the mathematician at finding in the laboratory that the formulæ on which he had been working for many years bore some approximation to truth. He hoped the effect of the report would be to increase the belief of mathematicians in applied mathematics. In schools, mathematics and physics should go together almost from the beginning. It was necessary to make men believe in their mathematics. Was it necessary that mathematical masters should teach so little mathematics?

We have dwelt upon some of the weak points because, in our view, the present condition of mathematical teaching in schools calls loudly for reform, in which the Mathematical Association should take the lead. But it would be utterly unfair and untrue to describe either the report or the meeting as less than a success. Prof. Forsyth paid a well-merited tribute to the committee for the careful inquiries it had instituted and carried to completion, and for the practical character of its proposals. The meeting was crowded, and there was no hint of opposition to the work of correlation. The following resolution was passed without dissent and with heartiness:—"That this meeting is in sympathy with the attempt embodied in the present report to correlate more closely the teaching of mathematics and science."

The principal feature of the Science Masters' meeting was the president's address, entitled "The Future of Science in our Schools—their Complete Re-organisation a Necessity." Prof. Armstrong said that the men most competent to take charge of the schools in the future would be the science masters, it being their business to study method and to be practical, therefore to solve problems and to lead. Referring to compulsory Greek, he declared that Oxford insists upon lowering the moral tone of entrants upon university life by enforcing a test which is known to be farcical and futile, known to be one which spoils young lives in preparatory schools; and doctors of divinity in charge of our schools smile blandly at such proceedings.

The teaching of science in our schools should consist primarily of instruction in the art of inquiry. Our failure to make science teaching effective is due to a misunderstanding of what an experiment is. To speak of *showing* an experiment is a negation of terms—actually, a demonstration is given. Moreover, we begin too late; the child's desire to observe and experiment, to reason on the basis of observations made and from the results of experimental inquiry, must be fostered in every way. Mr. Lyttelton, in "Schools and Schoolboys," proposes that there should be no "science proper" in the earlier years of school life. "My contention," said Prof. Armstrong, "is that there should be little else than *proper science*; but then my definition of science is 'the business of knowing.'"

In order to develop the right attitude of mind in our pupils, we must despecialise our science teaching as well as our curriculum as a whole. Work must begin with practical arithmetic, dealing with materials of natural origin and ready to hand. The natural history of the garden pebble may provide the first steps in geology, physiography, and physics. When common materials have been studied—mainly from the physical point of view—it will be time to lay the foundations of chemical belief, and the rusting of iron (leading to combustion) and the study of limestone (leading to acidic and alkylic oxides) provide a good approach. The conception of structure should be developed by the thorough study of alcohol (leading to food and its functions). Plant life, and, later, human anatomy, should be studied, nor should Darwin's work be neglected. Every person of intelligence must be able to appreciate common natural objects and phenomena. Since the work must be done by the boys themselves, a revolution in school procedure will be needed, and science masters should be revolutionaries.

Our space does not admit further excerpts from this comprehensive address. We endorse many, but not all, of Prof. Armstrong's opinions; we give him credit for rendering to the association the service most needed at the present hour. Nothing can better promote educational efficiency than to force schoolmasters into a position of preparedness to give a considered judgment upon the *broader issues* involved in the organisation of curricula and methods—what to teach, why to teach it, and how. If teachers cannot become professionally articulate, these questions will be decided by amateur or professional organisers without their guidance and with disastrous national results.

The programme of the meetings was as follows:—

January 12, Mathematical Association:—President's address, by Prof. H. H. Turner; (2) Mr. C. Godfrey on different methods of teaching algebra for different classes of students; (3) Prof. P. J. Harding on elliptic trammels and Fagnano points; (4) Mr. W. J. Dobbs on an inexpensive balance; (5) Rev. J. J. Milne on the geometric interpretation of homographic equations and their application to loci; (6) Mr. T. J. Garstang on alternatives to Euclid's parallel postulate.

Mathematical and Science Masters' joint meeting:—(1) Address from the chair by Prof. Forsyth; (2) report on correlation of mathematical and science teaching, presented by Mr. C. Godfrey and Mr. D. Berridge.

January 13, Science Masters' Association:—(1) President's address, by Prof. H. E. Armstrong; (2) Mr. J. R. Eccles on simplification of symbols in physics text-books; (3) Mr. L. Cumming on advisability of teaching all boys the elements of geology and biology; (4) Mr. W. E. Cross on laboratory equipment and design; (5) Mr. F. M. Oldham on the teaching of oxidation and reduction.

There was an exhibition of apparatus and books. The apparatus of leading firms displayed steady improvement in working qualities, and received considerable attention. Sir E. Ray Lankester is the president-elect for the year 1911.

G. F. D.

NORTH OF ENGLAND EDUCATION CONFERENCE.

THE conference which met on January 6–8 in the buildings of the University of Leeds, under the presidency of Sir Nathan Bodington, Vice-Chancellor of the University, was the eighth of a series of meetings which have been annually convened in the larger centres of the north of England. There was a large attendance of teachers, administrators, and members of education committees, the total falling little short of 2000 persons. The publishers' exhibition in connection with the conference

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was frequented throughout each day, and the papers which were read were followed with interest by large audiences, and gave rise to a number of animated discussions.

Prof. Sadler opened on the morning of January 7 with an examination of "The Relation of Elementary Schools to Technical Schools, Day and Evening." An abridgment of his paper appeared in NATURE of January 13, so it is unnecessary to make more than a brief reference to it here.

Some of the chief difficulties in the way of further education for children from primary schools were traced by Prof. Sadler to the snapping by the factories of the educational tradition associated with the old apprenticeship system. Too many English parents now think that a child's education ends when he leaves the elementary day school, while our employers and foremen have lost the sense of responsibility for the further education of the young people in their employment. Substantial reform can only be attained after a completion of the change in public opinion now in progress, and by the re-enlistment of the great employers to the cause of continued education. As regards the legislative measures that will eventually be required to extend the powers of local authorities in dealing with technical continuation classes, and to secure regularity of attendance, Prof. Sadler advocated the recommendations of the Consultative Committee of the Board of Education.

Mr. James Baker contributed to this discussion an account of the system of continuation schools in Austria, from which it appears that apprentices to a great variety of trades are bound to attend regularly the industrial schools of their townships after leaving the elementary schools at the age of fourteen, and that employers are bound to allow the necessary time for such attendance.

Mr. J. H. Reynolds urged that the half-time system demanded by employers must be postponed until after the children's fourteenth year.

On Friday afternoon, January 7, Mr. Max Muspratt, J.P., C.C., opened the discussion on cooperation between employers and education authorities. He cited (as Prof. Sadler had also done) the example of certain large firms (Messrs. Brunner, Mond and Co., Northwich; Messrs. Lever Brothers, Port Sunlight; and the United Alkali Co., Widnes) the directors of which bound all their young employees to attend evening classes up to the age of eighteen or nineteen, the firms paying the fees. This system of friendly compulsion is rendered possible by the fact that the large works in question practically monopolise the labour market in their respective areas; but in the larger towns, owing to the difficulty of bringing the hundreds of offices and firms into line, the only solution is to give powers to local authorities to start some form of compulsory attendance at evening schools up to the age of sixteen for office boys and apprentices. In Liverpool the big engineering shops, *e.g.* of the Dock Board and the White Star and Cunard lines, offer a variety of inducements to apprentices to continue their education, and a similar beginning has been made in a variety of other trades (building, painting, plumbing, &c.).

Mr. V. A. Mundella described the scheme under which the Associations of Shipbuilders and Engineers of Sunderland cooperate with the Sunderland Technical College in the training of engineering apprentices.

Mr. R. Wallace, of the Wallsend Shipway and Engineering Company, and vice-chairman of the Wallsend Education Committee, said that any attempt to educate the masses beyond their capabilities would not benefit them, and would be a waste of the nation's resources. They were dissatisfied with elementary education, and with good cause. What they needed was skilled handicraftsmen.

On the morning of January 8 Mr. J. C. Medd opened the discussion on "Education Abroad and in England," and we hope to find space for an abridgment of his paper in another issue. Mr. Medd considers that the facilities for technical and scientific instruction are as great in England as in Germany, but the German has the advantage in the better quality of the pupils who attend those colleges and schools. In elementary education there is a great need for more practical instruction, some relaxation of the regulations as to building and equipment for manual instruction and domestic science, and the introduction of a system of supplementary courses.

Mr. Otto Siepmann attributed the high average excellence of elementary education in Germany partly to the thorough six-years' training which intending teachers receive in the training colleges, and partly to the fact that the field from which the teachers are drawn is not denuded of its most gifted scholars by any "educational ladder" which leads to other spheres of activity. In the secondary schools, also, individual prominence is sacrificed to raise the common average. All subjects are done in form, and practically the whole form is promoted from one stage to the next. Thus a particular aptitude for a special subject is never developed at school, but the German system ensures for every boy a sound general education. At the universities all this is changed, and the freedom which students are allowed in the choice of subjects, the general lack of supervision and of interim examinations, react favourably upon their work. They carry into life an active interest in some branch of knowledge, which they frequently pursue as long as they live.

Limitations of space prevent any reference to the discussions on art subjects and physical training, and allow merely brief reference to two other topics.

Miss Burstall admitted that the young people who now leave our secondary schools are to a large extent lacking in self-reliance and the power of independent work. She attributes this result to the pressure of the examination system, which forces the teacher, almost in self-defence, to do for the children half the work of gaining, arranging, and applying knowledge. Independent work by the scholars requires more time, which can be got only by reducing the number of subjects studied in any one year. The first thing to aim at, therefore, is to lighten the pressure of examinations.

Mr. W. B. Steer urged that much could be done to encourage independent habits of study by substituting silent reading, followed by keen questioning, for the ordinary reading lesson. At present excessive teaching leaves scant time for learning. Mr. E. E. Unwin spoke of the leisure-hour work and other forms of independent study practised in Bootham School, York.

On "The Relation of the State to the Training of Teachers of Domestic Subjects, and their Relation to the University," Prof. Smithells urged that the time had come for incorporating the training schools of cookery and other domestic subjects in an improved scheme for the general training of teachers, and for treating this important branch of work with less parsimony than hitherto. The domestic training schools should form an integral part of the women's training colleges, though not necessarily in the same building. At the same time, there was no reason except that of expense why a fuller curriculum of training in branches of knowledge relating to these subjects should not be provided in our modern universities, which already function as day training colleges for teachers seeking a more extended knowledge and the attendant degree in arts or science.

Miss M. Atkinson spoke of the introduction in London King's College for Women of two courses in domestic science, one for undergraduates and the other for post-graduate students. It was necessary in domestic economy to draw a sharp line somewhere between the minimum of hygienic knowledge and domestic skill, which should form a part of the education of everyone, and the specialised technique to be demanded of those who proposed to be experts in the subject; but in regard to the latter class especially, the basis of the training should be real and not sham science. The preliminary studies in physics, chemistry, physiology, and economics should consequently be provided by first-year courses at the university in these subjects, exactly as for students of engineering or medicine.

THE ETHNOLOGY OF CALIFORNIA.

THE University of California, continuing its useful work of investigating the ethnology and languages of the now rapidly disappearing Indian tribes of that State, publishes in the third part of the fifth volume of its Proceedings a monograph, by Mr. P. E. Goddard, on the Kato tribe, a branch of the Athapascan race on the Eel River. They have undoubtedly assimilated much of their culture from contact with the Pomos to the south and the Yukis

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