

THURSDAY, JUNE 25, 1914.

MATHEMATICS AND CIVILISATION.

Die Kultur der Gegenwart. Edited by P. Hinneberg. *Die Mathematischen Wissenschaften*, unter Leitung von F. Klein. Part iii., section i. Fascicles i., ii. (i. H. G. Zeuthen: *Die Mathematik im Alterthum u. im Mittelalter*; ii., A. Voss: *Die Beziehungen d. Mathematik zur Kultur d. Gegenwart*, and H. E. Timerding: *Die Verbreitung mathematischen Wissens u. math. Auffassung.* Berlin and Leipzig: B. G. Teubner, 1912-14.) Price 3 marks each.

THESE three monographs are agreeably different, as well as complementary; and even where they overlap, the variety of treatment is interesting. The first section is the most detailed and (comparatively) technical; its author, as might be expected, gives an excellent and well-balanced account of Greek and medieval European mathematics. Something more might have been said about the earlier Indian inventions; only a very brief paragraph is devoted to China, and apparently nothing is said about Japan.

Mr. Voss's article is extremely interesting and well-arranged. He shows how mathematics have influenced, and been influenced by, technical crafts, physical theories, and philosophy; and he has the courage to make high, but legitimate, claims for a science which seems to be as unpopular in Germany as it is with us. He points out that mathematics is pre-eminently a creation of the spirit of man; that it is his least restricted field of activity; and that we are under a moral obligation to cultivate it. It is very refreshing to find these truths stated with such decision and clearness; and no one who is convinced of them should neglect a seasonable opportunity of repeating them. The popular attitude towards mathematics is exceptionally unfair. The ordinary man does not despise a physician, or a judge, or a divine, because he himself is ignorant of medicine, or law, or theology; but it is very rarely that he regards mathematics as anything more than a set of rules for calculation, or mathematicians more than computers at best, and at worst harmless cranks who waste their time on puzzles, quite useless to the practical man. The most exasperating folk of all are those who have to use mathematical formulæ for technical purposes, and adopt towards the science which serves them, while they do not understand it, a sort of silly, patronising attitude, such as that of a good-natured merchant to one of his junior clerks.

To put the main argument in a form which may appeal to a man of common sense, we affirm, with-

out fear of refutation, that the history of culture is a history of intellectual development, in which the main feature is a change of habits of thought; instead of vague fancies, irrational dogmas, crude superstitions, we are gradually acquiring clear concepts, consistent theories, and some sort of ethics worthy of the name. Towards this wholesome change nothing whatever has contributed so much as the study of pure mathematics; its inclusion, for instance, in a school curriculum is amply justified by its power of exposing intellectual dishonesty—what Smith minor calls “fudge”—to the practice of which we are all more inclined than we should like to admit.

To take an illustration of what we mean. In the second Book of Samuel (ch. xxiv.) it is stated that David's sin in numbering his people was punished by a heaven-sent pestilence which killed 70,000 men. Christians having adopted the Jewish Canon as an inspired document, the prejudice created by this story was so great that no Christian census was taken before 1700 A.D.; and no trustworthy census dates before the first year of the nineteenth century. Even now there are people who resent the census, and by making false entries do their best to make it untrustworthy; but there must be few who really think an act of simple enumeration sinful, and a good many who understand the value of the census for insurance purposes, at any rate.

The interest of Mr. Timerding's essay is of a more pedagogic kind. Among other interesting things we may note the references to Jacobi, his mode of teaching, and views about intuition (pp. 128-30); “blackboard physics” (p. 137); and especially the account of recent changes in mathematical teaching in Germany. Near the end of the article the author makes a statement which (with due reservations) we are inclined to challenge. He maintains that in technical schools (*fachliche Schulen*) the aim of mathematical teaching is “entirely different” from what it is in the general schools; adding, in effect, that the attention of technical students should not be diverted from such applications of mathematics as they are likely to have to make. We believe, on the contrary (and not without experience), that technical students (such as engineers, or accountants, or draughtsmen), can be interested, rather more easily than ordinary students, in the principles of mathematics, by taking them in the right way. This, we believe, is by beginning with definite numerical examples of the kind they will meet with in their profession, and then proceeding, by an inductive method, to the general formulæ and theories which solve all such problems. In this way, an engineer becomes interested in electricity,

or thermodynamics, as the case may be, an accountant in the theory of errors, a draughtsman in projective geometry. By adopting the opposite course a very great risk is run; that of stifling the speculative instinct of a really gifted pupil. Suppose Hertz or Heaviside or Helmholtz had been debarred from all but "technical" sources of information! No doubt the teacher will occasionally talk over the heads of half his class; but if he does not do this too often no great harm is done. And the chance of securing for humanity a real thinker is such a glorious one that nobody who understands the meaning of such a success will hesitate for a moment in advancing so far as he can, and so far as he dare, from the vulgarity of technique to the culture of theory. G. B. M.

PSYCHOLOGY AND CHILD HYGIENE.

- (1) *Human Behaviour: a First Book in Psychology for Teachers.* By Prof. S. S. Colvin and Prof. W. C. Bagley. Pp. xvi+336. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1913.) Price 4s. 6d. net.
- (2) *Inductive versus Deductive Methods of Teaching: an Experimental Research.* By W. H. Winch. Pp. 146. (Baltimore, U.S.A.: Warwick and York, Inc., 1913.) Price 1.25 dollars.
- (3) *How I Kept My Baby Well.* By Anna G. Noyes. Pp. 193. (Baltimore, U.S.A.: Warwick and York, Inc., 1913.) Price 1.25 dollars.
- (4) *Minds in Distress.* By Dr A. E. Bridger. Pp. xi+181. (London: Methuen and Co., Ltd., 1913.) Price 2s. 6d. net.

(1) **I**N their text-book on "Human Behaviour," Prof. Colvin and Prof. Bagley have endeavoured to formulate the main principles of psychology in terms of conduct. For the immature and inexperienced teacher they believe that a "functional" viewpoint is the more helpful. The topics they have selected are those most closely related to the practical work of the school-room. Memory, habit, instinct, feeling, emotion, attention, economical learning, higher thought-processes—these are discussed far more fully than is usual in teachers' text-books. The treatment is throughout concrete. Each principle is formulated with a lucidity that is almost dangerous; and enforced with a wealth of illustration that is almost too convincing—drawn as it is from classroom practice or from everyday life more often than from the psychological or educational laboratory. Experimental work is by no means ignored. But detailed references to it are rare in the text and rarer in the bibliography. The "immature and inexperienced teacher" might easily gain the impression that a few simple and uncontrolled ob-

servations, followed by many clear and plausible inferences, are the surest guide to final generalisations upon the most complex problems of human and animal behaviour. Of its class, however, this book is undoubtedly one of the best.

(2) Mr. Winch's book upon "Inductive versus Deductive Methods," is the second he has contributed to Professor Whipple's admirable series of Educational Psychology Monographs. It is a record of a series of experiments, carried out in five London schools, to test the relative value of the two methods in teaching. When tested upon new material, it was found that in all the schools the children taught inductively did better than those taught deductively. When tested upon the old material that formed the medium of what they had been taught, the children did differently in different cases. In three of the schools they did better when working by the "deductive and memoriter" method. In other cases, especially where the children were older, the inductive method proved equally successful; and there were indications that, when the test was applied after a long interval, it was even more successful. The subject-matter of the investigation was geometrical definition; and although laboratory and introspective controls were perhaps of necessity omitted, in other respects the work may well serve as a model for further investigations dealing with other subjects of the school curriculum.

(3) Like the Journal that he edits, Prof. Whipple's series of monographs proposes to include problems of child hygiene as well as child psychology. Mrs. Noyes' contribution is the story of how she kept her baby well during the first two years of its life. As a record of physical health during this period, and as a statement of the means used to maintain it, her work is more complete than any that has yet been published. Once more we are presented with an excellent model for future observations. With a number of records as thorough as this, we should at last have a sound basis for a scientific description of the physical development of young children.

(4) Dr. Bridger's treatment of his subject is of a different character. In his book "Minds in Distress" he maintains that the origin of functional nervous diseases depends upon two fundamental principles: first, "that mental comfort depends upon a state of balance between two main factors," namely, "common sense" and "new impressions"; secondly, "that there are the 'masculine' and the 'feminine' types." Loss of balance in the "masculine" type results in such disorders as neurasthenia; loss of balance in the "feminine" type, in such disorders as hysteria. In a chapter on "Mental Formulæ" he gives, in quantitative