SCIENCE AND EDUCATION

THE Leeds Branch of the Association of Scientific Workers organized a highly successful and well-attended conference on "Science and Education" in the Philosophical Hall of the Leeds City Museum on the afternoon of June 9. Dr. W. T. Astbury was in the chair, and the opening address on "The Educational Policy of the Association of Scientific Workers" was given by Sir Robert Watson-Watt, immediate past president.

Sir Robert said that the only valid objective of a political system is a fuller life for each individual citizen, and that such intermediate objectives as a flourishing export market are merely means to that main objective. Since the export market is necessary to the fuller life, we want, in its interests as well as for other reasons, more technicians, more technology, more scientific workers and more science. But our greatest real need is for more culture, and he hoped that there will be no self-consciousness or shamefacedness in our campaign for culture as the greatest human necessity. It is perhaps fortunate, but only incidental, that more culture is essential to the attaining of more and better science and technology, and thus to a better export market.

To get better men of science their education must be changed, and it cannot be changed sufficiently without changing the education of every pupil and student in the country. In the education of the man of science we must include more principles and fewer facts, since the available facts are now tending to crowd the principles out of our courses. In the education of every student we must include more science and not less of the humanities. The disease which has ravaged our modern world is a disease of malnutrition. Diseases of malnutrition contain two major factors, defects of intake and defects of assimilation. The world's intake of scientific facts and technical products is not, as is sometimes foolishly suggested, excessive; but the intake has grossly outrun our assimilative activity, our appreciation of the inter-relation of the facts and our ability to apply the products beneficently. How can we improve assimilation? Sir Robert said he had been profoundly shocked to hear the Minister for Education in the late Government—a highly successful and progressive Minister for Education—tell a university audience that he "had not much use for mathematics and science" and that "the essential element in our education must continue to be the classics, because the classics tell us how people behave and how they will always behave". A very little store of the humanities of mathematics and science would have safeguarded Mr. Butler from this vicious extrapolation. Even if it had failed in that, it would have carried him to the natural conclusion of his thought process, which is that if people go on behaving as they have been doing, they will deprive themselves of any opportunity of behaving at all.

We must change our education: but where to begin, with the Minister or with the infant pupil? The former is an unpromising and laborious undertaking; the latter is a promising but slow-maturing one, which we must begin now. The quickest result will come from educating our educators, and that can only be done in the one place where true education can be given to true educators, the university.

Sir Robert then summarized briefly the salient points in the policy for education published by the Association of Scientific Workers: For the university, full access for all who can show a reasonable prospect of benefit, a doubled intake overall, a trebled intake for science, a trebled staff overall, capital expenditure of thirty million pounds in the next ten years, annual expenditure rising to the order of fifteen millions within five years, a national academic council, planned facilities for special schools avoiding alike complete monopoly and over-dispersal of the special facilities. For the national institutes of technology, which must be strengthened and extended to comparability with the best American models, integration into the university structure without confusing the frontiers between the basic sciences and the higher technologies. For the technical colleges, an upward levelling of status and facilities, and regional association around the regional university as an intellectual and educational focus. For the young peoples' colleges, a very great measure of autonomy to the student body, of self-government by the student for the student. For the part-time student, in the sixteen to eighteen age-group, half of the forty-four hour week devoted to daytime—and largely whole day—education, principally the education of the social conscience. For the post-primary pupil, a leaving age of 15+ as a most urgent interim measure, of 16+ at the earliest practicable epoch, and standardization at 16+ to facilitate uniformity of entry levels in the higher institutions. For the primary pupil, absorption of the common bases of scientific method through the pupils' own activity under the guidance of teachers who have themselves learned those bases for themselves. At all stages an intimate co-partnership with industry by the direct participation of those engaged in industry as members of council, as lecturers and as researchers.

Mr. H. Benfield, president of the Leeds Teachers Association, spoke on "The Place of Science in Primary Schools". Emphasizing the importance of basing education on the pupil's own activity and experience, on the encouragement of curiosity, the spirit of inquiry and wonder, he urged that nature study is the best initial approach to science, with progress from the collection of wild flowers through the primary school garden (left as nearly natural as possible) to the study of animals. The aquarium is a valuable means of overcoming urban limitations on this range of subjects. The pupil should learn to observe accurately, to record systematically—in pictorial form at first—and should not be launched in the primary stage on the formal study of a branch of science or of any organized science in detail.

Mr. E. J. Rose, Science Masters' Association, spoke on "The Teaching of Science in Secondary Schools", dealing with the age-group 12–16, with an advanced 50 per cent in the 16–18 group in present circumstances. Quoting the threefold justification for the place of science in a course the main aim of which is to provide an environment for the fullest development of the individual personality, the utilitarian or vocational, the disciplinary and the cultural, he said that while we stand high in literary and artistic performance, the highest glory of Western civilization is in its science. It is this glory, the glory of inquiry, which has to be revealed in the pupil's mind. Interpreting the syllabus for general science prepared by the Science Masters' Association, he re-emphasized the need for making full and continuous use of the pupil's own inventive capacity, the importance of the sentiment which grows up around any subject in the pupil's mind, the importance of adequate

demonstration work, but not at the expense of practical work by the student himself. He showed the need for improved facilities, for laboratory assistants, for equipment of the kind now plentiful in Service training (episcopes, epidiascopes, projectors and so on), for laboratories larger and more numerous than those of the present paper plans. Finally, he called for direct contact between the science teacher and the worker on the frontiers of science, so that the teacher might absorb and re-transmit the spirit of science.

Mr. J. Maddison, chairman of the Leeds Scientific Film Society, discussed "Teaching by means of the Scientific Film". He too stressed the practical problems of the film in education, the need for ample supplies of projectors and of copies of films, on a scale never yet reached in Great Britain. State production and use in war-time of instructional and informational films has shown the solution of these problems, by giving direct experience on a large scale in the economical making and utilization of such films, always a somewhat expensive business. That there are only 2,000 projectors, many unsuitable and many unserviceable, in British schools now is in part due to the apathy of teachers; that suitable films are scarce is due to the fact that there is no money in making educational films; the pre-war distribution of such films, costing £2,000 to make and £6–£7 per copy, was largely an aid to the sale of projectors.

The film must be a normal tool of teaching technique, and not a 'stunt' irruption into the classroom. It can be used as an incidental illustration to the lesson, as the central feature of the lesson, with other illustrative material grouped around it, or as an invaluable aid in the difficult task of keeping revision alive. The wider purposes of broadening the pupil's outlook, and awakening him to the excitement and drama of scientific outlook is better served by the use of the film in the main school hall, outside the classroom. The inadequate use of the film in adult education is largely governed by the economic factors common to juvenile and adult classrooms, but the commercial film theatre has its place in conveying the spirit and drama of science through the feature film, of which some dealing with continental scientific workers have been very good, though one dealing with a great English man of science was not a success. We need more projectors, more films, more skilled use and more research on the relation of the film to the learning process.

Prof. S. Brodetsky, ex-president of the Association of University Teachers, spoke on "Science and the University". He pointed out the close identity of the policies enunciated by the Association of University Teachers and the Association of Scientific Workers in relation to science and the universities, and suggested that closer co-operation based on this identity of view would be productive. He does not, however, believe that science in the university can stop short of the application stage; "Almost every branch of human activity is a branch of applied mathematics, if you look at it in the right way"; science produces the performance which is based on that application, and education in science cannot therefore be limited to principles. He commented on the relative failure to use the universities fully in the war effort; he regards the present tendency for "the Government to have its own private scientists" as an undesirable one.

There is a growing conviction that the university course is far too restricted and degrees far too specialized. A four-year course, apart from the specialized work, is desirable, and should be directed towards understanding of the safe and cultured life, the development of human thought, with application to the principles of government, economics, medical methods and so on. The thinker, the poet, the man of science, the politician, must not be separated and compartmented; they should learn together that there is no such thing as a branch of learning which is not exciting, fascinating and thrilling.

Dr. P. D. Ritchie, of the Association of Teachers in Technical Institutes, dealt with "Part-Time Technical Education". In the qualifications which the part-time student should bring to part-time education, he puts "a near mastery of written and spoken English" first, ability to transfer thought to symbolism second, ability to transfer to another language third, and knowledge of scientific method only fourth. He believes that we should aim at higher institutes equal to or better than the Massachusetts Institute of Technology and the Zurich Polytechnic, and that the great range of unrelated *ad hoc* courses offered at the technical college level should be brought to a closer relationship leading to a recognized label such as an external B.Tech. degree.

Prof. J. B. Speakman, head of the Textile Department of the University of Leeds, thinks that "The Education of the Technologist" must be carried out in an atmosphere of research, and thus essentially in the university and nowhere but in the university. Part-time education, he said, is a barbaric survival from the industrial revolution. The industries get their leaders largely from the elementary schools, and these leaders have never had contact with the research method which can transform crafts into applied sciences distinguished in their own right. Technological education must provide the men who would understand this process and would become the business men of the future.

Mr. C. V. Bellamy, member of the local executive of the Workers' Educational Association, spoke of the obstacles to success in the proper placing of "Science in Adult Education". The average worker fears science and is nervous of his own ability to tackle anything so complex; there is a shortage of competent tutors—"not every university lecturer or schoolmaster is successful with classes of people tired after a day's work"—and facilities are inadequate, equipment being frequently limited to that which can be borrowed and carried by the tutor himself.

Mr. C. B. Bradley, from a long experience in the administration of education, emphasized the importance of a realization—not always achieved—by members of local authorities that their responsibility to the pupil must take precedence over their responsibility to the ratepayer. "The scene of the struggle for educational progress has now shifted from Parliament to your own Local Authority." The school building of 1870–75, very frequently still in use, is deplorably unsuitable; in buildings and equipment alike it is impossible to exaggerate the bad conditions that prevail in hundreds of elementary schools still in being in all parts of Britain.

The Leeds Branch of the Association of Scientific Workers hopes that in a month or two it may hold a second conference, which will discuss the specific action that should be based on the very comprehensive and stimulating survey of the whole field which was achieved in this first conference.

ROBERT WATSON-WATT.