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Science for Citizenship.

FACILE criticism will always find vulnerable points of attack in any educational system. Only a short time ago, much was heard in the popular press of the views of prominent business men on the deficiencies of their office boys. Our educational system was therefore condemned *in toto*; our vast expenditure on education was adjudged complete waste. While such hasty judgments, based only on partial observation and imperfect evidence, may be set aside as carrying little weight, those who come most closely into contact with the products of the elementary school may still feel that all is not entirely well with education in England to-day. It may be granted that as compared with twenty-five years ago, when the Education Act of 1902 came into force, vast strides have been made. A higher standard is attained, a greater degree of accuracy and a stronger grip of the facts is to be observed, together with less tendency to a parrot-like repetition of the form in which the subject matter has been received. On the other hand, knowledge and inference which depend on that elusive quality, the intellectual flexibility and adaptability which for lack of a better term examiners connote by 'general intelligence,' seem rarely to show an advance commensurate with the improvement in specific branches of learning.

It may perhaps seem at first sight unfair that any educational system should be judged by the product of its lower grades—a product, too, of which the raw material is drawn in a large number of cases from sources which in all their conditions—intellectual, social, and moral—are unfavourable and sometimes entirely inimical to the aims and influence of the school. But it must be remembered that, since the beginning of the present century, what is almost a social revolution—still, however, incomplete—has taken place in the personnel of the elementary school staff. No longer do they proceed by the treadmill of elementary school, pupil-teacher centre, elementary training college, and back to the elementary school. The throwing open of the secondary school to the elementary school class, and the extension of university studies in the training colleges, have brought back to the work of teaching in the schools of elementary grade, men and women whose intellectual and social outlook have been broadened by intimate contact with other minds of varied culture, interests, and social antecedents, which in former conditions, as a general rule, they might never have

encountered while in the formative stage of their career.

It is not necessarily a mark of carping criticism to hold—indeed it would be idle to deny—that the qualifications of the elementary branch of the profession are still open to improvement in certain directions; but a great step forward has been taken towards the ideal of those who long ago hoped that the majority of teachers in the elementary school would one day hold a degree, not as a *cachet* in an already honoured profession, but as the outward sign of certain qualities and cultural attainment. What they looked toward in their staff of the future was not a band of specialists, each highly trained in his own subject, but of men and women of wide culture who might introduce into the elementary school a wider outlook and cultivate in the material on which they had to work an intelligence trained to alertness in appreciating the varied aspects of life and knowledge as a function of existence as members of an economic, social, and political community. To this end the secondary school and university courses then seemed the obvious avenue of approach.

It must, however, be admitted that the trend of events has by no means justified expectation. It is not intended here to enter into a detailed criticism of the system of training teachers, but merely to use certain features in that system as illustrating some present tendencies in education as a whole. Those of the older school saw as their ideal a training college in which ultimately a majority if not all of the students would be working towards a degree, in which arts and science would be fairly well balanced, in which different interests, different studies might meet as in a common pool to their mutual intellectual advantage and understanding. The narrowness of the training college, its seminary atmosphere, would thus be alleviated. Circumstances, however, have decreed otherwise, and instead of the numbers being fairly well balanced, science has as a general rule become preponderant. While the Board of Education has continued to examine the greater proportion of the students this has been of less moment. Those who were responsible for the general lines of the examination were well acquainted with conditions in the schools. Inspection by the Board of both colleges and schools secured that training should be carried on with a view to the need of schools for certain qualities and capacities in their teachers. When in the near future the Board will no longer be responsible for

the examination of students in training colleges, however logical its decision may be, and even though it may continue to inspect and take part in the examination of the technical side of training, the divorce between the examining body and the elementary schools will be complete, while, having in view the character of university courses as they are regulated at present, it may aggravate a tendency towards specialisation which is part a symptom, part a cause of the defects of our educational system as a whole.

For many years the training college stood to the elementary school in a relation analogous to that of the university and the public school. For long it was for the brilliant boy or girl in the elementary school practically the only avenue of intellectual advancement. Theoretically, it is true, it led to one profession only, but in practice some made it only a means to an end, taking advantage of the general rather than the professional education, and after a few years left the profession to attain eminence in other walks in life. The academic side of the training college, from being subservient to the technical as it was when training was first instituted, became more and more important, and with the introduction and extension of university work it has tended, and tends increasingly, to overshadow the function of a training college as an institution of which the aim was not primarily academic. It must in fairness be recognised that this has been forced on the training colleges by the educational antecedents of the students, and no one would deprecate that the academic education of the intending teacher should be carried to the utmost limit that his capacity and opportunity allow. But it is a fact that the student who passes from the elementary school through the secondary school to the training college, if he takes up university work, tends to elect for a science degree. It is more than a moot point whether a course leading to a science degree, as at present laid down along highly specialised lines, constitutes the most suitable preparation for the career of an elementary school teacher.

It may perhaps appear that in considering the case of the teacher too great stress has been laid upon what is relatively a small proportion of those who come under a part only of the whole system. But the teacher is a crucial example; in his case the effect is cumulative, and with present changes the tendency of which he is characteristic is increasing. Turn to the secondary school, and the same trend towards highly specialised courses in science is perceptible. In the Report of the

Board of Education for 1926, in dealing with the examination of grant-aided secondary schools, it is stated that while Latin holds its own and Greek shows a decrease, the number of candidates taking chemistry and physics is increasing. Of the number of candidates taking the First Examination in 1926, 40.2 per cent. offered chemistry and 24.7 per cent. physics. In elementary and experimental science the figure was 5.7 only, and in general science 2.5. In the same way, of the 437 advanced courses recognised in 309 schools, 210 were in science and mathematics, 179 in modern subjects, and 37 in classics. It must not be supposed, of course, that we regard the growth of science teaching in comparison with other subjects as unsatisfactory; what we object to is the virtual limitation of science in secondary schools to chemistry and physics, or to botany in girls' schools. Science, up to the standard of the First School Examination, should be of a more cultural, and less specialised, scope: it should be science for all, and not science as preliminary training for a university course.

In training colleges where students are working towards a degree, and in secondary schools, courses are framed with a view to the requirements of a university. Indeed, in some secondary schools the work is of a sufficiently advanced character to justify representations to the university that many students under existing regulations do no more than mark time in their first year of residence. Such an organisation of courses is justifiable only in so far as the aim of the university, the training college, and the secondary school is entirely identical. The university in its science courses aims at turning out men, especially those who seek honours, who have attained a more or less high degree of specialisation. But the aim of the secondary school in framing its courses, save for the exceptionally gifted intellectually or the favoured few whose means allow, should be to turn out pupils who are fitted to take their place as citizens intellectually equipped for the average life of the community. Still more does this apply to the elementary school. *A fortiori*, the teachers should be fitted by their own training to educate their pupils to that end. It is by no means clear that such highly specialised courses as chemistry and physics, still less perhaps biology or physiology, framed with a view to the requirements of a still more highly specialised university course, are the best media through which school and training institution can best perform their function. With

teachers themselves trained in highly specialised courses, we are in danger of a circle as narrow in its way as that of the older type of training.

Of the importance of science in any modern system of education there can here be no question: but there is danger of a certain confusion of thought. The value of the practical application of science was fully brought out during the War; it has been apparent in many of the problems which have arisen since the War; while scientific men have repeatedly and justifiably urged upon the public and the Government the fundamental importance of the promotion of scientific research for all departments of the administration and life of the community and the British Empire. This insistence upon the value of science, aided by a confusion between instruction in science and a technical training, has obscured its true function as an element in the training of the average individual in preparation for his duties as a member of the community. Now that science enters so widely and so intimately into every department of life, especially in all questions relating to health and well-being, it is essential that both the individual who ultimately through the vote will control policy, as well as those by whom that policy will be framed and carried out, should have a general knowledge of the scope and aims of science, as well as of scientific method and the mode in which science envisages and attacks its problems. It is, however, beyond question that it should be a general knowledge on broad lines: a specialised training in some highly technical branch of science is neither needed, nor indeed is it desirable. The educationist need feel no alarm.

As a medium of culture, the history of scientific discovery opens up to the imagination vistas of man's endeavour which place it in the front rank of humanistic studies. Through a general familiarity with the methods of scientific observation and experiment in the various branches of research, may be developed a critical attitude in judgment, a power of observation, and a capacity for orderly arrangement; while a knowledge of the questions with which science as a whole is concerned in the past, present, and the future, fosters the broad outlook which, in combination with these qualities, is essential in successful dealing with the problems of life. We doubt, however, whether much of the science teaching in schools, either primary or secondary, could be regarded as science for citizenship instead of science for specialists; and we should welcome a movement which would broaden its scope and change its character.