

* Special Papers. *

ON THE DESIRABILITY OF BEGINNING THE HONOR SCIENCE COURSE IN THE FIRST YEAR AT THE UNIVERSITY.*

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To a proposition affirming that the Honor Science Course of the University should be commenced in the First Year, it would be a very easy and a very natural thing for the scientific enthusiast to say, "Yes, certainly, the Honor Course should be commenced immediately on the student beginning his University career." On the other hand, one devoted to mathematics or languages might with equal propriety remark that the second year is quite early enough to begin Science work, and that the first year should be left free for the study of those subjects which have so long been regarded as essential in the earlier part of higher education.

Before forming an opinion, however, as to the desirability of making any material change in the University curriculum in the Science department, a number of attendant circumstances and conditions will require careful consideration.

To draw attention to a few of these conditions and to briefly discuss them must be my duty to-day.

1. As regard should be had to the relative progress of educational work in various directions, one of the matters which I think should engage attention will be the present position of scientific study in the University, and the teaching of those subjects in the secondary schools

The day was, and not far in the past either, when the Science work of a College course was to be got out of books; and, as is generally the case under such circumstances, a few cheap books, and bad, because they were cheap, were usually sufficient to furnish the so-called knowledge. Of course the outcome was the inevitable one, the stream never rose above the fountain, and the knowledge was as cheap and as poor as the books. So long as the only object aimed at was the passing of a written examination upon the work prescribed, without reference to the practical part of it, the results were of necessity of no lasting value, leading neither to maturity of thought, nor to regularity, nor even to manual dexterity. The legitimate issue of this was that in the High schools study of Science in any form was unknown. Rightly enough these institutions put their strength on that which was counted of value, and which brought them credit in the University; and this was entirely mathematics and languages, the latter mostly classical. I have little doubt that the master who would have dared to spend a few hours in the month with his pupils in studying the flowers about the yard, and the other material things with which they were constantly coming in contact, would have been set down as a crank, worse than useless, because wasting time, and his place would soon have been filled by some one strong on declension and syntax.

The popular meaning of the word Education has undergone a change within the last fifteen years, and nowhere is that change more noticeable than in that stage of a pupil's progress lying between the Public school and the University. I shall have something to say further on about the causes of this, but just now I wish only to impress the fact that a great change in higher education has come about in the very latest times. Hardly a dozen years have gone by since the introduction into Ontario of modern and better methods in the study of Science, and the more extended course in that department in the University. Following that, as a matter of necessity, came the advancement in the High schools. There, to some extent at least, book-work has had to make way for practice; memory has partly yielded place to observation and inference; *reading* has developed into *doing*; and the student, when possible, studies not a description of an object, but the object itself, thereby acquiring his ideas of it at first instead of at second hand. I need not dwell longer on this new phase of things; we all know about it, we are all coming daily in contact with it, and we all practice it more or less. One thing I should mention though, and that is, this change is a very recent one, in fact, can scarcely be called completed yet. That we

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are about to discuss such a subject as that of which I am speaking shows that in regard to Science-teaching, our system is in a transition stage. The programmes of the last generation have been altered; we are no longer fully satisfied with the mental training derived from the study of the classics. We have so far departed from the old standards that we endeavor to cultivate others of the powers of the mind than those called into play by the learning of the languages. At present we are trying to make larger men, to educate over a wider field, and, as we think, in a better manner. Even in Linguistic studies there has been somewhat of a revolution, both in the matter and in the manner of the work. Moderns have largely replaced classics, and I think that the practical usefulness of the former, in this latest stage of the world's civilization, has had much to do with bringing about the change. He who loses sight of the constantly increasing utilitarian character of modern education drops out of the count what I believe is a very powerful factor in producing the revolution.

But apart from the mere replacement of one set of languages by another, there has been a remarkable alteration in the methods of study. Now, there is much of the scientific method—note the term—comparison, observation and reasoning are called into play. A grammar, a dictionary and a good memory no longer form the complete equipment of one who is to make of himself a Latin, a French or an English scholar. The very fact that there is an Honor Course in Science and that there is any reasonable hope or possibility of introducing changes tending to make it more thorough or more extensive, taken in connection with such an altered system as I have mentioned, all point in the direction of that newer education to which I have referred, and of which the study of the Natural Sciences forms the most aggressive element, if I may be allowed to use the term aggressive of an abstraction.

2. Another matter for careful consideration, and one closely allied to that just spoken of, will be the present condition of Science-teaching in the Collegiate Institutes and the better class of High schools, the ability of these to do the required preparatory work, and the effect that will be produced upon them by the extra demands which must of necessity follow the adoption of the suggested change in the curriculum.

You are all familiar with the results brought about by the requirements of the Education Department along the line of Science-teaching within the last few years. Now the equipment must be reasonably good, there must be appliances for practical work; and wherever there is a master who is doing his duty this practical work is being well done. I do not think I am overstating the case when I say that in from thirty to forty of the secondary schools of Ontario to day there is ample means for obtaining a fairly good and thorough training in elementary Science. I use the word training in preference to any other, because in this department the work is essentially different from that in the others, and means much more than that popularly conveyed by the term Education, since to make a successful man of Science manual dexterity and the gift of taking advantage of circumstances must go along with mental ability. I think that in quite the number of schools I have mentioned, students may be taken over the work in Chemistry included in the study of the more pronounced properties of the commonly occurring elements, and the qualitative determination of some of their characteristic compounds, the principles of nomenclature, replacement and combination, and the simpler parts of chemical physics. My own opinion is that this work can be done more profitably in the High schools than in the University, and that the function of these schools should be to give the student that grounding in the elements which will enable him to read understandingly ordinary text-books on the subject, and comprehend the lectures to which he will listen during the first few weeks of his College course. There is probably not one man in the room who does not remember how unsatisfactory his first term's work in Chemistry or Physics was in the University. The lack of acquaintance with the technical terms employed by the Professor, the difficulty of forming new conceptions required by the new subject, the want of time and opportunity to get wrong impressions put to rights, led to the loss of the greater part of this first term, so far as any real advancement in the subject was concerned. This was no fault of the teacher, nor of the student; but of the system which compelled the

learner to get his preliminary notions of the subject under wrong conditions. To understand this you have but to recall what I said a few lines back about the entire absence of any scientific work in the High schools, and the entire lack of any preparation for these studies after matriculation. Consequently I think it would be well to encourage, as far as may be thought wise, the taking up of these subjects before leaving the High schools and Institutes, because there is then more time at the master's disposal for supervision of work, and much more, both of time and opportunity, for the learner to study principles and work out details.

In Physics we have fortunately got away from that baneful influence that kept men from one examination until the next working out problems in Mechanics, so conditioned with fantastic variations that they bore no relation to nature or natural things. That subject, like Chemistry, is now essentially experimental, and in every good school in the Province the appliances either are or should be quite sufficient, in the hands of a master capable of rightly using them, or directing students in their use, to give a class an effective grounding in elementary Physics, especially the simpler problems connected with light, sound, heat, electricity, mechanics and hydrostatics. After such a course, a student prepared for matriculation and taking the Science option ought to be familiar with the causes, conditions and relations of many of the natural phenomena occurring about him.

If within a period of five or six years our schools have become adapted to doing the Science work so well and so thoroughly as I have pointed out, they could, I think, without serious derangement, stand the pressure, even if a little better work, either in quantity or quality, were required. It is questionable, however, if, with the state of general education as it is in Ontario, it would be wise to ask for a Science matriculation much in advance of that required from Second Class teachers who take the Science option. Be this as it may, the fact should not be lost sight of that no student need now be at the disadvantage and loss of time experienced by those of former years on account of entire ignorance of the Science subjects when entering the University. Every matriculant can have such a preparation as will enable him easily to take up at once the work in the College lecture-room and laboratory.

3. This is, perhaps, the proper place to glance at the subject from the University side. As in the secondary schools, so in the higher institution, no department has made any such advances within the last few years as has that of Science. Where I believe three men formerly did the work and did it easily, there are now employed at least thirteen, with almost a certainty that more will be wanted in the near future. The appliances for work have increased quite as rapidly and quite as extensively as has the staff, and all this progress has been in answer to the demands made by the necessities of our higher education in later years. I have spoken of the quantity of increase, but the quality of it deserves quite as much notice. Without in any way disparaging the work of former men in former times, I might ask you to think for a moment if what is now required from an Honor man in Chemistry as compared with that required fifteen years ago. Consider the department of Biology and Natural History, and what has to be done there now. Compare the work in Physics with what it was even ten years since. Call to mind that the department of Applied Science is entirely the growth of a few years past; and I think we may safely conclude that in the Science section has been the great educational growth and expansion of late times, and this expansion is still going on as vigorously as ever. The question here suggested for an answer is, Has the curriculum of studies kept pace with this development so as to get the best possible results out of these changes, and, if so, is it desirable to make further alterations in the same direction, looking for progress in the future as there has been in the past?

4. Another point for consideration will be the tendency of modern education. It seems as if we had passed the age of mere learning and had entered on that of education and training. The day of authority has gone by and that of investigation has succeeded. Not only in schools and Colleges is this spirit displayed, but abroad in the world. Take an example or two. We read about comparative religions and about the origin and development of creeds. Men skilled in the history of Law