

## Physics—A Service Course

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A recent survey of a large number of the colleges and universities in this country indicates that over 18% of the students taking the general courses in physics are pre-medics. A similarly large percentage are engineers. Arts students furnish the largest group but come chiefly from schools which do not offer strictly pre-professional courses. Students who take physics as a part of a major in chemistry, physics, and mathematics furnish only 16% of the whole. The conclusion drawn from such a survey is that something should be done to attract more students into physics. It is the purpose of this discussion to point out that this attitude, common as it is, is essentially wrong. General college physics is largely a service course and the content of such a course should be determined accordingly even if tempted to listen only to the enthusiasms of educational technicians in determining the content of a course, and to emphasize the spectacular at the expense of the pertinent.

Clearly since general physics is almost entirely a service course, there is great need to control the content to meet the demands of the professions requiring the subject. Distinctly important but certainly secondary are considerations of interest in presentation. Such studies as have been made indicate that the professions all desire that high standards be maintained in physics to the end that professional standards be bettered. Applied physics will continue to be taught, and properly so in professional training, as parts of courses such as physiology, anatomy, and surgery in medical schools for the prospective physician and in departments of electrical engineering, mechanics, etc. for the engineer.

In discussing what might be done to improve courses in general physics the following suggestions are made. Physics should stress vigorously the existence and nature of the elementary and fundamental laws of nature. For physics, of all the sciences, is uniquely able to do this. The student must also be trained in application of these laws in the simplest cases if he is to appreciate their relationships in his more complex and professional courses. It is the training in application of fundamental laws which survey courses so generally lack and for this reason their use in pre-profession training seems highly questionable.

Most students preparing for a profession look on physics as a hurdle since it is a required course. Instructors may well indulge in propaganda in teaching to overcome such prejudice by giving specific illustrations of the use of physical knowledge in the professions. But physics might help also to guide the inept away from the professions. This could be done by working out suitable tests and examinations in cooperation with the professions. Tests to discover the students' ability to think as well as learn can be devised and could be used effectively in connection with traditional grades, lessening the clamor for grade points and stressing more definitely special ability as well as knowledge and training. Some experiments conducted in the general physics course required of pre-medics at the University of Illinois

indicate the great possibilities of carefully designed examinations in discovering native ability and aptitude in students. Multiple choice questions are often unsatisfactory. Simple problems and definitions discover the painstaking student who can learn, but who is lacking in imagination and will never make a successful diagnostician. A third type of examination which is particularly effective in uncovering independent reasoning power and ability involves questions which to answer require that the student be able to combine and use the fundamental laws and principles learned. The conclusions drawn from giving all three types of examinations over a period of years is that no grading system is adequate, but that many students pass a course having accomplished quite different things and whether they be candidates for a professional school might very properly be further tested by examinations designed by professional schools cooperating with departments of physics who teach the required courses.

Further improvement might be made by giving courses in physics especially designed for each professional group. But most schools cannot do this and since the laws of nature are after all the same, whether being studied by prospective engineers or doctors, the solution of this phase of the problem seems rather to be to offer one or at most two courses in general physics and to aid the student in mastering the material by illustrations and problems drawn from professional experience in the fields of the students' interests.

One further fact must be remembered. To teach a student, the instructor must have training far broader than that covered by the material to be taught. The instructor in physics must have specialized in that subject. The group who specialize in physics is very small and of this number industry is now employing the best. There is need then to discover and encourage students who are taking these service courses in physics and who have special aptitude for the subject itself. For these few men must furnish the future teachers of the subject, and the spectacular has little place in their training.

Judging by the growth in number of courses advertized to be easy and by the number of texts stressing the stunts of physics rather than the science, it is time to recall vigorously that general courses of physics are almost entirely service courses. As such they should suit the needs of the professions served, all of these professions desiring to better their standards. Further, these general courses might well be supplemented by special examinations designed in cooperation with each profession to test for special scientific ability and used in connection with grades to determine who should be allowed to proceed in a given career. Finally these service courses must discover and initiate the training of the future teacher of the subject. No-where here do we find a need for the easy and purely qualitative course, and teachers of physics should never apply the test of interest before that of pertinency to any material to be presented.