Letters

Education of Science Teachers

The recent exchange of letters on the education of science teachers [*Science* **129**, 744 (1959)] has shown clearly that a major point of disagreement between educationists and their opponents concerns the utility of education courses. On the one hand, the educationists assert that teaching is a profession which requires special, professional training; on the other hand, many people feel that anyone who knows his subject well can teach it satisfactorily. In practical terms, the question is: Can a college graduate teach as well, in his major subject, as a graduate with the corresponding degree in education? And, more generally, what mixture of education courses and "content" courses will produce the best teacher?

Both sides have produced arguments to support their views, but there has been very little objective evidence to support either view. What evidence there has been is one-sided, rather than comparative. Thus, the educationists ask, "Can 50 years of research in education be ignored?" while their opponents point out that education courses are widely regarded by undergraduates as easy to pass and negligible in content. What is needed in order to remove the controversy from the realm of mere verbal sniping to that of informed and intelligent debate is a body of facts on the effectiveness of teachers who have been trained in different ways.

A direct way of obtaining this information would be to compare the scores, on a nationally administered series of tests, of two groups of students: those whose teachers majored in education and those whose teachers majored in the subject concerned, without taking any education courses. Such tests already exist, and teachers of the second type are already at work with temporary accreditation in many places. Thus it might be possible to obtain the desired information from statistics or other information which already exists; on the other hand, it might be necessary to set up an extensive experiment, selecting teachers and students with appropriate backgrounds in order to free the comparison from systematic effects which might distort results obtained from the existing data. (For example, if poor students tend to take education courses because they are "easy to pass," this must be allowed for in comparing the intrinsic utility of education *courses* with that of "content" courses for training of teachers; but if we are interested in the relative effectiveness of education and "subject-matter" *graduates* as teachers, then such effects should be ignored.)

Until some such study is made, I do not see how the present controversy can be anything more than a difference of opinion which, for lack of evidence, cannot be resolved.

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Luminous Wrist Watches

Joyet [*Bull. acad. suisse sci. méd.* **14**, 367 (1958)] reports that the average man's luminous wrist watch contains 0.36 μc of radium and the average woman's watch, 0.13 μc, both being of the type in which the entire dial is painted. A man wearing such a watch 24 hours a day receives a gonadal dose of about 21.8 mr/yr, and a woman receives about 12.7 mr/yr, as measured by Joyet.

A sample of 224 persons (a group of Government employees in New York City in all of the occupation categories and levels represented) was investigated. Questions were asked and observations were made as to type of watch and wearing habits, with the results given in Table 1.

When Joyet's results were combined with the results for this sample of New Yorkers, it was found that the average gonadal exposure of the 224 persons is calculated to be 3.83 mr per year per person. The fact that very few, if any, persons in the age group up to age 30 or 35 wear watches for the first 10 or so years of life should not be ignored. This would tend to reduce the figure 3.83 to about 2.5 mr/yr. This reduction might be offset slightly by the fact that, of the luminous watches worn, a larger fraction is worn by younger than by older adults. This was a general observation, and findings were not tabulated.

If we assume, then, that the average annual dose is about 3 mr from birth to age 35, the 35-year dose will be about 0.1 r, as compared with the estimate by Laughlin and Pullman of 0.03 r (range 0 to 0.3 r) given in the National Acad-

Table 1. Data on the wearing of luminous watches from a survey of 224 Government employees in New York City.

Item	Men	Women
Total number questioned	148	76
Number wearing watches of all types	114	57
Number wearing luminous dial watches:		
Less than 10 hr/day	0	0
10–19 hr/day	34	2
19–24 hr/day	16*	0

* Only one watch found with luminous points (Joyet's category P).