Letters

Education of Science Teachers

The letter from William W. Porter II [*Science* **128**, 1156 (1958)] is an excellent illustration of how to promote resistance to the ideas one advocates. Educationists are told that their courses are completely worthless. Since they continue to offer these courses and even urge students to take them, it follows that either they are stupid or they are hypocrites. Neither of these accusations is, of course, uncommon.

Furthermore, we are asked to treat with respect arguments such as, "the world's great teachers, from Buddha, Aristotle, and Jesus Christ down to include most of our finest contemporary teachers, never had *any* courses in an education department." I cannot seem to recall exactly what university courses Buddha, Aristotle, and Jesus Christ *did* take and therefore cannot adequately evaluate the implied recommendation that public-school teachers prepare themselves in a similar fashion. However, with an ignorance of the facts which I suspect is equal to Porter's, I can assert that he is wrong about the contemporary group. I can maintain that most of our finest contemporary teachers have taken education courses and are teaching in our public schools, unrecognized and unrewarded.

It is stated that the President's science adviser is barred from teaching in the public schools. This is not strictly accurate. Most states offer provisional certification, and few, if any, school districts would turn down Killian if he would but apply. It may be noted that "mere money and salary increases" are almost certainly necessary, albeit not sufficient, conditions for an increase in the number of high-school teachers that are of this caliber.

Again, Porter seems to overlook the fact that the student receiving a general secondary teaching certificate from the University of California, to take his example, has (i) completed an undergraduate major in his subject field, (ii) been recommended by the department concerned, (iii) spent two semesters as a graduate student, and (iv) taken, as a rule, only 17 to 19 hours of education courses, which is only slightly more than one of his ten semesters of work. If his liberal arts background is deficient, perhaps the liberal arts departments need investigation.

The summer-school situation is typical of many universities and occurs for a variety of reasons. Among them may be noted: (i) the feeling among considerable numbers of teachers that they will learn more in education courses than in other courses; (ii) the relative rarity of liberal arts (especially science) courses appropriate for high-school teachers who have already completed undergraduate majors but who do not have the time, interest, or ability to undertake courses designed for prospective research workers; (iii) the suspicion among the students, not entirely unfounded, that if they take courses other than those in education, their interests and problems will be ignored and they may have to listen to sneers at themselves, their colleagues, and their profession. The frequency with which they encounter this attitude during the regular sessions is sufficient to dissuade a number of potentially able teachers from entering the profession each year.

It should be noted that the major premise of the educationists has been conceded by Porter, by the many others who have written similar letters and articles, and by those who attended the AAAS Parliament of Science. Obviously, we all agree that the problems of education need lengthy, serious, and mature consideration. It follows that teachers in training as well as those not as directly involved in public education should spend some time on this task.

Up to this point I have been, almost willy-nilly, reacting against the statements in Porter's letter. In so doing I have made statements almost as contentious and unfair as those against which I have railed. The sad thing about all this is that there is much truth in Porter's indictment. For example, almost all the educationists I know agree that certification requirements are sometimes arbitrary, rigid, and excessive. Also, the active participation of all departments of the university in teacher education has been fervently sought for years by many educationists. It appears that in several fields, notably mathematics, progress is being made. Finally, many of us agree that political action will be necessary, since, unfortunately, our influence is actually small. In short, there is enough agreement so that we *could* work together.

I would say to all who feel as Porter does (a majority of those at the Parliament of Science, it seemed to me) that we, the educationists, are glad that you are becoming seriously concerned about the public schools. Constructive, forward-looking criticism, suggestions, and, above all, participation in action are welcomed by us. You will find that most of us agree with you about the necessity for a thorough liberal arts preparation for teachers. You will disagree with us about the necessity for education courses. However, if you are willing to put in sufficient time and effort, you may well become convinced that the tremendous amount of study and research we have done in psychology and education in the past 50 years has produced a body of

knowledge with which teachers should have some acquaintance. After due consideration, you might even concede that there are some things that teachers should know as members of an important profession, as public employees, and as part of one of the most important of all American institutions.

DONALD ROSS GREEN
Division of Teacher Education,
Emory University, Atlanta, Georgia

I find that I must disagree most thoroughly with Porter on every point that he makes concerning the education of science teachers for the secondary schools. He makes statements which are either patently false or are not applicable to the situation. However, these arguments of his (which are not new) are not my present concern.

From my experience in three institutions which train science teachers and carry on in-service programs to upgrade the quality of teachers, I find a number of factors at work which make teacher training less adequate than it should be.

The first of these factors has to do with the manner in which liberal arts and graduate science courses are taught. Demonstration and other illustrative materials are prepared out of sight of the student. The source of teaching films and other audiovisual materials is not revealed. As a result, the student, while he learns the content, does not have an opportunity to learn how to teach this same material. Some instructors, in fact, seem to regard the precise method of preparing a particularly effective demonstration as a professional secret to be kept from the students.

A second point of considerable difficulty has to do with the scheduling of content courses. While schools of education typically offer a number of courses in the late afternoon, on Saturday, and in the evening for the convenience of teachers, such courses on the level desired in the subject areas are seldom encountered. The same problem occurs for students when they are practice-teaching. The lecture-laboratory pattern of most science courses, coupled with the problems of transportation that student teachers encounter, serves to keep them from taking content courses. As to summer-session courses, I would like to suggest to Porter that it is hardly reasonable to compare the offering of the entire education department to that of only a few content areas. I must assume that history, economics, sociology, English, literature, and foreign languages, to name a few, were also taught at the University of California at Los Angeles in the summer of 1958. I am certain that science and mathematics teachers were but a minority of those enrolled in the university last summer and that the number of education courses was not, in fact, disproportionate.

In closing I would like to suggest to Porter and others who feel as he does that they observe student teachers in the schools and see for themselves what the problems and deficiencies of the beginning teachers are. They will find their educationist colleagues eager to help them visit the schools.

PETER DEAN
Wayne State University,
Detroit, Michigan

Porter's complaint, in general, is that a college graduate with a major in science cannot begin to teach at once.

Neither can a young man with a major in—let us say—chemistry begin practice as a physician or a dentist, be admitted to the bar, get a license to preach, set up an architectural or engineering office, join the musicians' union, or solicit clients as a public accountant.

Neither can a young woman with a major in—let us say—biology register as a nurse for hospital or private practice, apply for a dietician's post, or even open a beauty shop.

These young people are specialists, but they are not professionals. Professions, of which teaching is one, require certification to protect the public from amateurs and the untrained.

The reason there are so many different courses in education (as Porter counts them in a certain institution) is that there are so many different kinds of teachers. An elementary teacher (kindergarten through third grade) needs specific information and experiences which are different from those helpful to an intermediate teacher (fourth through sixth grades). Teaching at junior and at senior high-school levels involves by no means the same topics, texts, or techniques. Therefore certain fundamental courses are given first, then, in the department of education, specialization begins, just as in a medical school. Of greatest value before graduation are the many weeks of practice teaching required, analogous to the medical student's bedside courses and actual hospital experiences.

Porter's letter is another among the hundreds of published objections to the professional education of teachers which date back to 1839, when the first normal school was established, at Lexington, Mass., with 25 young women as students. The eloquence of Horace Mann outweighed the opposition before the Massachusetts legislature at that time. The professional training of teachers has its opponents, and also its defenders, today.

HANOR A. WEBB
245 Blue Hills Drive,
Nashville, Tennessee

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The first comment by Donald Ross Green is meaningless because I did not make the statements or accusations he is refuting. My argument was directed toward getting rid of the arbitrary regulations—not the educationists themselves and their courses. Even Green concedes farther on in his letter that almost all educationists he knows "agree that certification requirements are sometimes arbitrary, rigid, and excessive." Toward the end he refers to the body of knowledge resulting from study and research in the past 50 years, but what is he concerned about? Surely sound scholarly education courses based on that research and knowledge would survive on merit without artificial support by excessive and arbitrary legal requirements.

I stated essentially that most great teachers of the past and present never had any courses in an education department. Green states that "most of our finest contemporary teachers have taken education courses." Ignoring a possible quibble over the word *most,* both statements are correct, but taken together they lead to the conclusion that education courses are not vital to the making of good science teachers; they may help and often do help, but their contribution is auxiliary and not dominant. The trouble is that an important segment of educationists won't play the auxiliary role of helping educated people to teach others. They insist on dominating the whole stage. They are appalled at the suggestion that the experts in the field of science should have an important voice in deciding who shall teach science.

My statement that capable teachers are barred from public schools by present requirements ignored provisional certification. So granted: the superior scholar and teacher is not technically barred but may teach provisionally. This only proves that under present law in most states the President's science adviser can get provisional certification—the provision being, of course, that he bone up at night and in the summer in the education department until his "deficiencies" are made up! It is still a sorry situation that merely emphasizes the importance of reducing excessive requirements. To meet the requirement in education courses is hard for the student who considers teaching late in his academic career. He is in a jam for time. The graduate student likewise is out of luck. He looks at the "provisions" of the provisional certificate and decides to do something else; he is, in effect, barred from teaching in the public schools.

These ridiculous situations could be solved through legislation recognizing science-department certification as acceptable in lieu of the standard education-department requirements. A science-department faculty is made up of capable, conscientious people who can accept responsibility. After working with a student for several years, they know his capabilities and needs. If he needs the presently required education courses, they will make him take them, but if not, they won't waste his time, and he will be a better teacher for it. Science faculty members *are* professional teachers as well as scholars.

Of course Green is right in believing that on intellectual grounds there is enough agreement so that all could work together. But, unfortunately, many educationists lack the sincere constructive attitude which is evident in Green's letter. Power-hungry, they resist any interference with their present almost complete control of secondary education. I'm afraid the answer lies in political action by a public awakened by sputnik to the existence of the problem and gradually becoming aware of the causes. Conference amounts to an intellectual Munich. From a position securely entrenched in law the educationists negotiate against the educated community armed with an umbrella.

It is all very well to know where to find props for demonstrations, how to use film libraries, and how to locate audio-visual materials, but the science faculty is a better judge of how much education-department time is necessary for picking up these incidentals than those who lobbied the present rigid and arbitrary requirements onto the statute books years ago or the present-day educationists who resist change of those old-fashioned laws.

I didn't whitewash the liberal arts departments. If there are places where rescheduling is necessary to meet the needs of the teaching profession, then by all means let's have rescheduling.

The attempt by Webb to restate my premise as merely a complaint that "a college graduate with a major in science cannot begin to teach at once" indicates inability to refute my argument for repeal of present laws under which that same graduate still cannot teach in the public schools after adding a Ph.D. and ten years of successful teaching in universities or private secondary schools. The new graduate with one more year and enough education-department courses can teach at once—he can get the certification that is denied the superior scholar and experienced professional teacher. Teaching quality is thus downgraded by applicable but obsolete regulations. Laws that create such inequities should be repealed or drastically revised.

WILLIAM W. PORTER II
244 South Gramercy Place,
Los Angeles, California