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ACTUAL TEACHING ASSIGNMENTS CALL FOR BROADER PRE-SERVICE TRAINING FOR CHEMISTRY-PHYSICS TEACHERS

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Full-time physics teachers are rare in Iowa's high schools—information on record with the Iowa Department of Public Instruction indicates that there are only eleven in the entire state. Full-time chemistry teachers are not much more common—the records show that there are 33 in Iowa. The most common combination involving physics includes chemistry, with 62.5 percent of all physics teachers teaching chemistry and 52.5 percent of all chemistry teachers teaching physics. Most of the 240 teachers who teach both subjects teach a third subject as well. Tables 1 and 2 show the numbers of teaching combinations that include chemistry *or* physics and those that include *both* chemistry and physics. Table 3 lists the subjects that are taught in combination with physics and chemistry.

Though the figures in these three tables speak for themselves, it is notable that 58.8 percent of the 601 teachers in the group have three preparations and another 33.1 percent have two preparations. Next to chemistry, mathematics is most frequently found in combination with physics, whereas biology is found in combination with chemistry second only to physics.

Many of us who work with potential high school chemistry or physics teachers in colleges and universities have a tendency to overlook some of the realities of teaching positions that our graduates may have a chance to fill. Most of our teacher education programs for these students seem to be based upon the illusion that there really are teaching positions "out there" for them in which they might spend all or most of their time teaching chemistry or teaching physics. That this is not the case is readily apparent if one looks at the actual teaching assignments of chemistry and physics teachers in Iowa. Do we put these realities into proper perspective when we plan teacher education programs around the traditional chemistry major and physics major?

A survey was conducted in early 1972 to get opinions of teachers of

TABLE 1

TEACHING ASSIGNMENTS INCLUDING CHEMISTRY OR PHYSICS

	Total		*Jr.-Sr. Highs*		*Sr. Highs*	
Assignment	*No.*	*Percent*	*No.*	*Percent*	*No.*	*Percent*
Chemistry only	33	1.5	2	1.5	31	6.7
Physics only	11	1.8	0	0.0	11	2.4
Subtotal–one prep.	44	7.3	2	1.5	42	9.1
Chemistry plus Physics	34	5.7	2	1.5	32	6.9
Chemistry plus one other	79	13.1	14	10.2	65	14.0
Physics plus one other	91	15.1	17	12.4	74	15.9
Subtotal–two preps.	204	33.9	33	24.1	171	36.8
Chemistry, Physics plus one other	206	34.3	60	43.8	146	31.5
Chemistry plus two others	105	17.5	31	22.6	74	15.9
Physics plus two others	42	7.0	11	8.0	31	6.7
Subtotal–three preps.	353	58.8	102	74.4	251	54.1
TOTAL	601	100.0	137	100.0	464	100.0

both physics and chemistry about their undergraduate preparation and their needs for supplementary training. Responses were received from 48.5 percent of all such teachers in Iowa. As shown in Table 4, the physics major was not a popular choice as undergraduate preparation for teaching physics–even in combination with a chemistry minor. The chemistry major with or without a physics minor was considered more appropriate than the physics major even by teachers of physics. More than half of these teachers favored an equal division

TABLE 2

TEACHING ASSIGNMENTS THAT INCLUDE BOTH CHEMISTRY AND PHYSICS

Assignment	*Number*	*Percent*
Chemistry and physics only	34	14.1
Chemistry, physics, plus another	206	85.9
Physical science	58	24.1
"Other science"	36	15.0
Mathematics	32	13.3
Biology	27	11.3
General science	24	10.0
Earth science	24	10.0
All others	5	2.1

TABLE 3

SUBJECTS TAUGHT IN COMBINATION WITH CHEMISTRY OR PHYSICS

	Assignments in combination with Chemistry		*Assignments in combination with Physics*	
	Number	*Percent*	*Number*	*Percent*
Chemistry	(33)	(7.2)	240	62.5
Physics	240	52.5	(11)	(2.9)
Mathematics	51	11.2	104	27.1
Physical science	92	20.1	86	22.4
Biology or life science	108	23.6	33	8.6
"Other science"	82	17.9	46	12.0
General science	53	11.6	36	9.4
Earth science	46	10.1	34	7.4
Non-science	30	6.6	28	7.3
Administration, guidance	20	4.4	18	4.7
Number of teachers*	457	100.0	384	100.0

* Not the sum of the column.

TABLE 4

MOST SUITABLE BACKGROUND FOR TEACHING BOTH CHEMISTRY AND PHYSICS

	Number and Percent of Choices by Teachers of Chemistry	*Physics*	*Chemistry and Physics*
Physics major	3 (2.3)	4 (2.9)	2 (1.9)
Physics major, chemistry minor	6 (4.6)	10 (7.4)	5 (4.8)
Chemistry major	6 (4.6)	6 (4.4)	4 (3.8)
Chemistry major, physics minor	24 (18.6)	22 (16.2)	19 (18.1)
Broad science major	24 (18.6)	25 (18.4)	20 (19.0)
Half physics, half chemistry	66 (51.1)	69 (50.7)	55 (52.4)
	129	136	105

between physics and chemistry as the most appropriate pre-service preparation for teaching both subjects.

These teachers of both chemistry and physics were also asked to rank various kinds of work in professional education as essential, desirable, or unimportant. The figures in Table 5 show that courses in "child development" and "social foundations of education" are not considered desirable or essential by about half of the teachers surveyed. Student teaching in chemistry and physics was ranked as essential by a conspicuous majority.

Various courses dealing specifically with the teaching of chemistry

TABLE 5

RELATIVE IMPORTANCE OF VARIOUS KINDS OF WORK IN PROFESSIONAL EDUCATION

	Percent of Total Responses		
	Essential	*Desirable*	*Unimportant*
Student teaching in chemistry/physics	73.2	25.2	1.6
Tests and measurements	33.8	58.5	7.7
Early exposure to science teaching	41.4	50.7	7.9
General methods of teaching	47.1	40.4	12.5
Psychology of learning	31.9	53.2	14.9
Adolescent psychology	23.0	54.7	22.3
Child development	10.4	41.5	48.1
Social foundations of education	7.1	42.1	50.8

and physics were ranked in a similar manner. Table 6 displays the results of this part of the survey. Such courses, particularly ones dealing with current curricula in physics and chemistry and physical science techniques, were considered to be desirable or essential by at least 95 percent of the teachers. All of the others listed ranked higher than any of the general (not science related) professional education courses.

The implications of the facts and opinions mentioned above for teacher education are important. There is a need to alert prospective chemistry or physics teachers to the kinds of teaching assignments that they are likely to be asked to accept. Conventional teaching majors in chemistry or physics do not take advantage of the common ground between these two disciplines to effect economies of time and integration of subject matter. From the viewpoint of experienced

TABLE 6

RELATIVE IMPORTANCE OF VARIOUS COURSES DEALING WITH THE TEACHING OF CHEMISTRY AND PHYSICS

	Percent of Total Responses		
	Essential	*Desirable*	*Not Important*
Current curricula in physics	55.7	41.4	2.9
Current curricula in chemistry	54.7	42.4	2.9
Physical science techniques	42.1	52.1	5.7
Practicum in teaching of physical science	37.9	55.0	7.1
Audio-visual media workshop	37.1	55.0	7.9
History of science	22.7	68.8	8.5
Seminar in science teaching	25.5	65.7	8.8
Philosophy of science	20.0	70.0	10.0

teachers, the traditional separation of content and methodology should be eliminated. "Professional education" is truly professional when it involves the practice of teaching the content of physics and chemistry.

An overhaul of our pre-service teacher education programs in physical science is long overdue. We owe our students who plan to teach in this area a program that is educationally sound, realistically career-oriented, and tailored for the present and the future.

In 1969 the Physical Science Group of Newton, Massachusetts, received a grant from the National Science Foundation to develop a new four-year program to prepare high school teachers of chemistry and physics. This program is described in the *Iowa Science Teachers Journal*, December, 1972, pp. 14 and 15, by K. E. Borst of Rhode Island College, one of the pilot schools. The first group of five students to complete the program graduated from Southwest Minnesota State College in June, 1973. Whether this program is the final word remains to be seen. At any rate it appears to be a step in the right direction.

NEWS AND NOTES

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Wow! Here it is near the end of winter already.

I would like to share with you a few of the activities I have been involved in throughout this academic year. This past fall and winter I have spent a considerable amount of time working with teachers who have adopted a "new" science curriculum. I have taught implementation inservice courses at South Tama, Ankeny, and Ames community school districts. I am presently teaching a course at Council Bluffs which has a major emphasis on the S-APA program.

Mr. Doug Baker, sales representative for ISCS, and I sponsored an ISCS Awareness Workshop in Des Moines on February 14, 1974. There were 140 participants who attended. It was rewarding to see so many different school districts evaluating the curriculum offerings at the junior high (grades 7-9) level.

In the coming weeks there will be many opportunities for you to attend local, state, and national meetings. Science education is on the move in Iowa. I trust that you will give some of your time and talents to help determine the direction *we* go.