

A COMPARISON OF SCIENCE CURRICULA IN
EUROPEAN AND AMERICAN SCHOOLS

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The following attempt to parallel science education in America and Europe is made by one who has lived in Europe for twenty-eight years, who is entirely a product of European education and has been an instructor in an American college for the last three years.

In order to familiarize ourselves with the rough outlines of the European school system we shall pursue a French and a German boy on their educational careers from the first grade up to the happy point when they will be able to present themselves for the doctor's degree in one of the sciences. The picture thus obtained will hold good for a large number of countries as there is a striking resemblance between the educational systems in force on the continent. The schools of Great Britain, however, having their own distinctive traits, have been left out of this discussion.

A French child enters the grades at six, continues in them until the age of eleven when he or rather his parents and teachers have to make an important decision. Shall he go on to the higher elementary school from which he will graduate at thirteen in order to take up a wage-earning job or to continue in a vocational school, or shall he become a member of the select minority who are given a thorough training in the "lycées" or "collèges," the secondary schools of the country?

The child whose career we are pursuing will do well to transfer to the secondary school at this point. For this is the school from which he should graduate in order to enter the university, and obtain the doctor's degree. Should he fail to enroll in the secondary school at this time he would not necessarily be barred from access to higher education, but he would find it increasingly difficult to make the transfer at a higher age. It is a significant fact, however, that only about one-tenth of the pupils enrolled in the lower elementary schools go through the secondary schools, while about nine-tenths limit their education to the opportunities offered by the other branch of the system. (Fig. 1.)

The French secondary school extends over seven years between the ages of eleven and eighteen, and offers a choice of two curricula in the lower four-year cycle, and of three curricula in the two-year cycle. The seventh year offers an option between the "Classe de Philosophie," and "Classe de Mathématique," laying emphasis respectively on the literary studies, and mathematics and the sciences. Once a certain curriculum is chosen by the student, a definite set of sub-

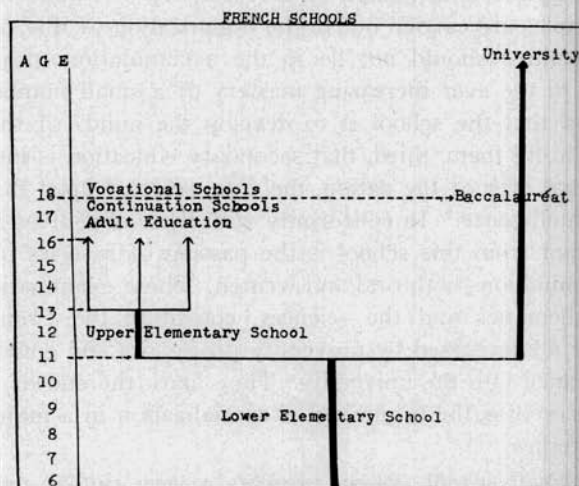


FIG. 1. Diagram illustrating the French school system.

jects is prescribed; the number of electives is negligible. It has been said that the European student has to get his education "Table d'hôte" whereas the American youngster has the privilege of studying à la carte. If the number of weekly recitations continued throughout the year is totaled in each subject for the entire seven years, the time allotment for every subject calculated on the basis of an average curriculum, is as follows:¹

Subjects	Number of Recitations	Per cent of total curriculum
French	29	19.3
Foreign Language	51	34
History	16½	11
Geography	5	3.3
Mathematics	25½	17
Sciences	20	13.3
Philosophy	3	2
Total hours* per week.....	150	100

¹ For further details see I. L. Kandel, "The Reform of Secondary Education in France," 1923, and "Educational Yearbooks," 1924—, published by International Institute of Teachers College, Columbia University.

As the efficiency of a school cannot be measured by the mere number of weekly recitations, the teaching process, too, deserves consideration. The French have been traditionally proud of their secondary school, and have striven to maintain the quality of instruction on a very high level. The instructors are selected by a competitive examination after having completed several years' work in the university. The curricula are frequently revised and overhauled by action of the government on recommendation of the Ministry of Public Instruction. Three principles are carried out in the organization of this school, first that the incentive should not lie in the accumulation of points and credits, but in the ever increasing mastery of a small number of subjects, second that the school is to develop the minds of the student, rather than to fill them, third, that secondary education is intended for the intellectual pick of the nation, the *élite*, selected upon the merit of a superior intelligence.² In conformity with these objectives a requisite for graduation from this school is the passing of a series of comprehensive examinations both oral and written. These examinations which include mathematics and the sciences, constitute the French baccalaureate, are administered by university professors and entitle the student to entrance into the university. They mark the end of secondary education as well as the beginning of specialization in a major field of the higher studies.

The German school system presents a very similar picture. All pupils stay in the grades between the ages of six and ten, when they arrive at the crossing of the roads. In Prussia about 88 per cent continue in the upper grades later to enter trade, vocational, and compulsory continuation schools, about 12 per cent are regarded by the parents and teachers as the intellectual "gentry," and venture into the secondary schools where they are put through a most rigid training characterized by uncompromising Teutonic thoroughness. To cater to the diversity of interests this field of secondary education is covered by not less than ten different types of schools each one having a definitely prescribed curriculum. The majority of these schools extend over nine years between the ages of ten and nineteen, and give prolonged concentrated training in a limited number of subjects. The place of science in the curricula of these schools is illustrated in Table I. Out of a total of two hundred fifty-three hours representing the sum of all the weekly recitations, continued throughout the year, for the entire course of nine years, mathematics receive between eighteen and thirty-five hours, or from 13 to 16.9 per cent of the total curriculum, sciences comprising biology, physics, and chemistry, receive from 7.1

² Quoted in part from an address by M. Paul Appell, Rector of the Sorbonne.

to 13.8 per cent, the actual number depending on the type of secondary school.

The German boy or girl may graduate from this school at the age of nineteen on passing the "Examination of Maturity" which, as in France, entitles him to enter the university, and being controlled by the universities, carries with it the admission to the institutions of higher learning.

Let me briefly outline the study of chemistry at a German university. At the very beginning of his work, the student selects his major and combines it with two minors which must be closely related to his major. A chemist will take courses in mathematics, physics, and mineralogy, but no other subjects outside of chemistry. (Some universities require a few courses in philosophy for the Ph. D.) His liberal education is officially closed at the age of nineteen with graduation from a secondary school. University education finds its sole purpose in professional training. While the young man was under a strict discipline in the secondary school, he enjoys, and frequently suffers from an almost unlimited amount of freedom in the university. There are no credits, honor points, quizz sections, or tests, but lectures at which attendance is voluntary, laboratory work of a definite content without a definite time schedule, and a few comprehensive and cumulative examinations. The rate of progress depends on the individual ability of the student. On an average, I estimate that the student will have finished his preparation in organic and inorganic, analytical, and physical chemistry at the beginning of the fourth year, and then will concentrate on the field in which he intends to work out his thesis. It will take him about three semesters to complete the dissertation so that during the tenth semester or the latter part of the fifth year, frequently at an age of twenty-four, he may obtain the Ph. D. provided that his thesis was approved and he passed a final examination in the major and minor subjects.

What does the comparison between the American and continental school systems demonstrate?

Owing to the fierce competition of European life and the exigency of stringent economy the aspirant to the highest degree in science is compelled to specialize early, he commences his scientific preparation at an age when the American youth has no reason to think or worry about his future. Consequently the European can, if he pairs industry and ability, reach the highest professional degree at an earlier age than does the average American. At nineteen the German boy has at least a reading knowledge of two foreign languages, he has been through a continuous, methodical course of training in mathematics,

including algebra, plane and solid geometry, trigonometry, analytics, and the elements of calculus; he knows the fundamentals of physics and chemistry. This intensive training is attainable only through the segregation of the pupils on the secondary level. There is no counterpart of the American high school on the continent. Over against one high school which in America educates the vast majority of the population, and consequently is burdened by a multiplicity of aims and objectives, Europe sets a differentiated system of secondary education with a variety of diverse schools each one of which aims at a well-defined purpose, serves a specific end. The great majority of the people do not expect to obtain any professional training in the university, therefore, they stay away from those secondary schools which prepare their pupils for university entrance by a difficult condensed course of training.

TABLE I.

TABULATION OF THE TIME SCHEDULES OF SIX TYPES OF GERMAN SECONDARY SCHOOLS.

	A	B	C	D	E	F	Total in per cent	
							Min.	Max.
Religion	18	18	18	18	18	18	7.1	7.1
German	37	35	31	35	37	44	12.2	17.3
Latin	40	53	41	16	..	..	00.0	20.9
Greek	32	36	..	..	..	..	00.0	14.2
1st Mod. Language.....	32	15	20	44	40	46	5.9	18.1
2nd Mod. Language.....	..	..	27	23	22	13	00.0	10.6
History	17	19	20	22	22	25	6.7	9.8
Geography	12	12	13	13	14	18	4.7	7.1
Mathematics	33	33	36	37	43	37	13	16.9
Sciences	18	18	25	23	35	30	7.1	13.8
Drawing	10	10	18	18	18	18	3.9	7.1
Music	4	4	4	4	4	4	1.5	1.5
Total	253	253	253	253	253	253		

Letters signify types of schools:

- A Reform-Gymnasium
- B Gymnasium
- C Real Gymnasium
- D Reform-Real-Gymnasium
- E Ober-Real-Schule
- F Deutsche Oberschule

The European continent has nothing to place side by side with the American college. The unique experience of college life with its subtle values, so eminently educative for the future citizen, is not duplicated in the continental university. There the student is prematurely forced into the narrow path of specialization; except in his seminar work he lacks guidance, lacks encouragement, and those beneficial influences which tend to mold him into a good citizen.

* Compiled from the official decrees of the Prussian Ministry of Public Instruction. For further details see I. L. Kandel and Alexander, "The Reorganization of Education in Prussia," 1927.

Should I be permitted to express my very personal opinion on the comparative merits of the two systems, I should say that they must necessarily be different since they have to be adapted to different economic and sociological conditions; that the American Liberal Arts College is superior to anything that continental education has to offer; lastly, that the American public high school could do a still greater service to the nation if it gave more attention to the needs of the exceptionally gifted students of the intellectual cream of the nation from whose ranks will be recruited the scientific workers of America.