

# PROPOSALS FOR REFORM IN THE TEACHING OF MATHEMATICS AND SCIENCE IN THE NINE-CLASS HIGHER SCHOOLS OF PRUSSIA.\*

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At the annual meeting of the *Gesellschaft Deutscher Naturforscher und Aerzte* in Breslau in 1904, after a long discussion on the teaching of mathematics and science a commission was appointed to consider the question further and formulate some propositions for reform. At the first meeting of this commission in Berlin, December, 1904, a mathematics-physics and a chemistry-biology subcommission, were appointed. The report of this commission consists of a general statement of its work, followed by detailed reports of the subcommissions—(1) on the teaching of mathematics, (2) on the teaching of physics, and (3) on the teaching of chemistry together with mineralogy, and zoology together with anthropology, botany and geology.

The commission agreed upon the following general propositions:

"1. The commission desires that in the higher schools there should be given neither a one sided language-history nor a one sided mathematics-physics training.

"2. The commission recognizes that mathematics and science are of as much value as means of instruction as are the languages, and holds fast to the principle of general culture in the higher schools.

"3. The commission declares that it was absolutely necessary that the higher schools (Gymnasien, Realgymnasien and Oberrealschulen) should have equal rights and privileges and desires that this may be fully accomplished."

(On November 26, 1900, a decree of the Emperor was issued which declared that the education imparted in the Gymnasien, Realgymnasien and Oberrealschulen was to be considered of equal value. Until this date the leaving certificate of the Realgymnasium and of the Oberrealschule did not entitle the possessor to admission to the university.)

## I. REPORT ON THE TEACHING OF MATHEMATICS.

Mathematics, it is stated, needs an adaptation to the modern problems of the schools. Especially should the instruction seek to strengthen the ability to grasp space concepts, and to train the pupils in the use of the notion of functionality. Some of the subject matter in the present curriculum which is not essential should be omitted (all artificial and pedantic proofs and operations, divisions of complicated polynomials and so on).

The abstract may in part be replaced by the concrete.

The teacher should have freedom in choosing the method of presenting a subject, apportioning the work, and so on.

"The goal of the instruction in mathematics during the last three years appears to be three fold:

"A methodical survey of the logical order and connection of the mathematics studied in the school; an ability to grasp mathematical

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concepts and to apply them in individual problems; finally and above all the discernment of the value of mathematics for an exact knowledge of nature, and for modern culture in general."

The mathematical curriculum which is proposed introduces many minor changes. Graphs, which are not mentioned in the old curriculum are introduced in the fifth year. In arithmetic, problems from the daily life are to be used. In algebra the use of many problems from geometry and physics, especially from mechanics, is recommended. Possibly the elementary notions of the calculus may be introduced to a greater extent than at present.

(There is a review of this part of the report in the *Zeitschrift für Mathematischen und Naturwissenschaftlichen Unterricht*. 2 Heft, 1906.)

## II. REPORT ON THE TEACHING OF PHYSICS.

### 1. Problems of physics teaching.

The teaching should furnish not only a body of knowledge for use in life, and prepare the pupils to give a true description of what they have observed, but should also give them an insight into the laws of natural phenomena.

### 2. Number and distribution of hours of instruction.

At present the number of hours of instruction in physics in the Gymnasien is two hours per week in the three upper classes, and in the next two lower classes two hours per week for one and one half years including some instruction in chemistry. The commission recommends three hours per week in the upper three classes. In the Oberrealschulen and Realgymnasien the commission recommends three hours per week in the five upper classes, an increase of one hour per week during two years.

### 3. Method of instruction.

"Physics has been handled largely as a mathematical science. The instruction has lain and yet lies in the hands of those who are in the first place mathematicians. Until recently in the examinations for teachers of physics, much more weight has been laid on a knowledge of mathematical physics than on a knowledge of the empirical side of physics."

Hence, "Fundamental proposition I. In the instruction physics is to be handled not as a mathematical science but as a natural science." "An injury not less great than that arising from a one-sided mathematical presentation of physics comes from an opposite cause, namely, when the experimental side is emphasized exclusively, and through the presentation of numerous and brilliant experiments a clear grasp and thoughtful elaboration of the subject is lost."

Hence, as fundamental proposition II. "Physics as a material for instruction is so to be handled that it may serve as a model for all instruction in the domain of empirical knowledge."

"Finally it is not sufficient that the pupils should see from a distance the experiments performed on the teacher's table in the class room. 'Man lernt selbst beim einfachsten Experiment erst umsichtig, logisch

und kritisch beobachten und handeln, wenn man es selbst ausführen muss.' Hence the pupil should have the possibility of close contact with objects through experiments."

Hence, "Fundamental proposition III. For the training of pupils in physics, systematically arranged exercises in observing and experimenting are necessary."

4. *The curriculum in general.*

5. *A proposed curriculum.*

6. *Comments on the curriculum.*

7. *Practical exercises for the pupils.*

In some Realanstalten such exercises have been arranged for hours outside of the regular instruction hours; in some cases the pupils were required to attend, but in general all the pupils took part in the exercises even though attendance was not compulsory.

### III. REPORT ON THE TEACHING OF CHEMISTRY TOGETHER WITH MINERALOGY, AND ZOOLOGY TOGETHER WITH ANTHROPOLOGY, BOTANY, AND GEOLOGY.

The commission recommends that at least two hours per week should be given to chemistry and mineralogy in the three upper classes; and that two hours per week should be given to the other sciences in all nine classes. This part of the report covers sixteen pages.

It is to be hoped that this report of the commission will be widely read in America. It shows that the movement for reform in the teaching of mathematics and science in Germany has much in common with the similar movement in the United States, and is a valuable contribution to the reform literature of the present day.

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### PHYSICS CLUB OF NEW YORK.

The thirty-seventh regular meeting of the Physics Club of New York was held in connection with the annual dinner of the Club on June 2 at the Hotel Albert, with President Albert C. Arey presiding. After the dinner, which was attended by thirty-two club members and invited guests, much routine business was disposed of. An invitation was received from the Physics and Astronomy section of the New York Academy of Sciences to hold a joint meeting with them at some time during the coming year. This invitation was accepted and the President was authorized to arrange for the meeting. The notice of publishers of SCHOOL SCIENCE AND MATHEMATICS that the price of club subscriptions would have to be raised to \$1.25 per year was considered and the Treasurer was instructed to continue the club subscription at that rate.

The principal address of the evening was given by Prof. C. R. Mann of the University of Chicago on "The aims, tendencies, and effects of present physics teaching." A full report of this address, which was extremely interesting and instructive, we hope to publish in SCHOOL SCIENCE AND MATHEMATICS. The position taken by Prof. Mann was that the present method of physics teaching is, in general, too abstract,