II. – THE PRACTICAL SIDE

application in the theory of the construction of regular polygons with ruler and compasses ; the foundations of algebra and of geometry, the theory of parallels, the non-Euclidean geometries, and certain phases of modern pure geometry. The course will give needed acquaintance with work that is closely related to the fields of secondary and early collegiate mathematics, but problems of teaching will not be taken up.

12. *The Fundamentals of Mathematical Study*. The object of the course is to give students opportunity to get the correct point of view for mathematical study, and correct ways of mathematical thinking.

II. — THE PRACTICAL SIDE

by Dav.-Eug. Smith (New-York).

My colleague, Professor J. W. A. Young, has already written upon this subject taking for his theme the theoretic side. It is, therefore, appropriate to consider what we are doing or failing to do on the practical side, that is, in the way of giving our prospective teachers some practical experience with classes before they are given a license to teach mathematics. Some such statement seems essential for the reason that our friends from Europe, when they visit our schools, commonly express some surprise that so little provision is made for what is certainly so desirable, namely, this same practical training.

In order clearly to understand this failure to provide that which, from the European standpoint, seems a *sine qua non*, it is necessary to consider briefly the economic conditions involved. Perhaps the question would not be worth considering at all, from the international standpoint, were the future conditions in Europe to be the same as those of the past. The results of the great conflict, however, will include some need for readjustment in the supply of teachers, and on this account it may be worth while to mention a few of the economic questions that are involved in the United States, the way in which these questions affect the training of our teachers, and the means which we take to minimize the difficulty of thoroughly preparing these teachers before they are officially employed in our secondary schools.

We have in the United States about 1 $^1/_2$ million students in these secondary schools. To teach these students we require some 75,000 teachers. Custom rather than necessity leads to paying these teachers a low salary in certains parts of the country and a satisfactory salary in other parts, but the average salary is only about $ 900 a year, no residence or other perquisites being given in addition. No man of fair intellectual capacity can afford to teach for such a sum where the opportunities for an adequate income are as good as they are here, for the sum is insufficient

for the support of a family and a higher wage is easily obtainable. As a result, the teaching of such secondary subjects as mathematics tends to fall into the hands of women who have, as a rule, no families to support and who therefore can afford to take a lower wage. But these women, well educated and earnest though they may be, usually do not remain in the profession for life; indeed, the average period of service of all teachers in our secondary schools is only about eight years. As a result it will be seen that we need about 10,000 new teachers every year for this class of schools. As a result of the war, the older countries may have to meet the problem of the shortage of men to a certain degree, at least for a quarter of a century to come and perhaps for a longer period; and with the remarkable change of ideas as to the employment of women that has taken place in Europe, who can predict the changes that may come in the supply of teachers?

Now we have not the facilities for training 10,000 teachers a year for our secondary schools, and still less have we the facilities for supplying an adequate number to meet the annual wastage in our great army of elementary teachers. Conditions have improved remarkably in recent years, the number of students in our universities (using the term, as Professor Young has done, to include later years of our colleges), from which our secondary teachers are so largely drawn, having increased from about 100,000 in 1900 to about 250,000 in 1915; but in spite of all this, we cannot meet the demand for well-trained teachers, nor are we likely to be able to do so for many years to come. On the other hand, many of the communities where poor teaching is the most apparent fail to pay enough to secure their share of our best teachers, with the result that their schools remain below the average standard.

These being the economic conditions, it will be seen that all the more promising of the graduates of our universities, with no experience whatever in teaching, have little difficulty in obtaining positions in our secondary schools. This state of affairs is necessary, it is natural, and, however regrettable it may be, it is bound to continue for many years to come. We simply cannot give these teachers the kind of practical training which is, or has been until this war came on, considered essential in most of the older and thickly populated countries.

We sometimes think that we can, however, provide a few leaders by means of schools of education. Most of our universities have such schools or departments. We fail, however, for two reasons: In the first place, many of our strongest young men and women do not attend these schools; they are suspicious of theory in education, preferring to take all their work in the science of mathematics exclusively rather than take part of it in the art of

teaching. We get many strong students in these schools of education, but they are a mere handful compared with the great body of good teachers. In the second place, we cannot hold the students whom we get long enough to give them any adequate practice, even when we have schools for such practice.

The practical work is, therefore, very slight. Some of our large universities arrange for their students to teach more or less in the public schools of their cities for periods of a few weeks, but this is usually for only an hour or so a day, and it is never looked upon as an ideal plan. Others have schools of observation, often with a little practical work for a few hours or even a few weeks (say an hour a day), but this, again, is not at all satisfactory. In no school of education in America, so far as I know, is there any provision for a student to devote a year, or even a half-year, to doing nothing but teach under the guidance or oversight of a first-class, trained master, nor are we likely to see any such state of affairs as long as present economic conditions continue.

But in spite of these conditions the results are not as bad as might be expected. The problem works out something like this: In every graduating class from our universities there are certain students who, with few if any courses in teaching, have the personality and the natural gifts that assure success in the schoolroom. As a rule, such students secure very satisfactory positions at once, and they usually justify their promise by successful work in teaching. When I consider the great mass of first-class teachers of mathematics in a city like New York, for example, I find that they started in this way. It was the personality which counted, the physical and mental strength, the common sense, the knowledge of their subject, the goodness of heart, and the general sympathy with those whom they were to teach. Then there is the less promising group, those who may succed or may not. These secure positions in the smaller schools or in those schools where the salaries will not attract the more promising graduates. They teach for a year or two, and if they show great promise of success they have no difficulty in securing better places. Here, then, are the real practice schools of America; here is where the great mass of our teachers are tried out; here they teach at small salaries for a year or so, not infrequently supplementing this experience by a year in one of our schools of education, and then take positions of a higher grade in some of our city systems. Most of our larger cities actually require this, admitting no one to teach mathematics who has not had at least two years of experience in teaching and a certain number of course in education (including the subject to be taught) in some university, and no one who cannot pass a thorough examination in mathematics through the calculus.

From what has been said, therefore, it will be seen that, although theoretically we have no provision for extensive practice teaching, we practically have the means for trying out teachers for our better systems of schools. It follows, of course, that our poorer schools must suffer by being made to a considerable extent schools of practice, but under present economic conditions there seems to be no other way to avoid the difficulty. At any rate the plan results in securing some excellent teachers for our best schools, and is not, in general theory, so much different from the one found in the older countries. The chief difference is that, in these older countries, the poorer schools are sure of having fairly good teachers, whereas in the newer countries this is not the case.

The details of the conduct of the practice work in our best schools of education are not significant enough to be worth describing. Unfortunately, our courses in education are so often concerned merely with measurements of pupils' accomplishment, with statistical curves, and with ephemeral theories based upon limited observation, that teachers of such thought-subjects as mathematics are generally suspicious of their value.

CHRONIQUE

Commission internationale de l'enseignement mathématique.

Allemagne. — La Sous-commission allemande vient de faire paraître trois nouveaux fascicules. Deux d'entre eux appartiennent à la série des monographies consacrées à l'enseignement mathématique en Allemagne. L'un, rédigé par M. Lorey, donne un aperçu très complet des études mathématiques dans les universités allemandes depuis le début du XIX^{e} siècle; l'autre, dû à M. Girndt, concerne l'enseignement mathématique dans les écoles d'architecture. C'est par ces deux fascicules que se termine la collection des 38 rapports répartis en 5 volumes.

Le troisième fascicule fait partie des *Berichte u. Mitteilungen*. Dans le fascicule XII, de la première série, M. A. Gutzmer résume l'activité de la Sous-commission pendant la période 1908-1916.

Un dernier fascicule, actuellement en préparation, contiendra la table générale des matières contenues dans l'ensemble des publications de la Sous-commission allemande.