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Conference : Les mathematiques dans les universites 1870-1930
Institut Poincare

Moderator: Marie-José Durand-Richard

2-3 PM : American Mathematics Education

Karen Parshall, University of Virginia

Department of Math History

3-4 PM German-Russian exchanges

Annette Vogt

Math Education in Nazi Germany

4-5 Mathematics Education in Italy

Umberto Bottazzini

I. American Mathematics Education at the University level, 1870-1930

Karen Parshall : Before 1870 there were no universities in the modern sense of the word. The sciences were not represented. The emphasis was basically on a literary education with a smattering of math, what we today would call pre-calculus: algebra, Euclidean geometry, trigonometry, some calculus for advanced students.

The notable exception was Benjamin Peirce, father of Charles Saunders Peirce. In 1845 he developed a course in modern mathematics at the Lawrence Scientific School, associated with Harvard. His experiment did not outlive his stay at Harvard. He died in 1880, and the school reverted to the previous curriculum.

The first enduring innovation came with the creation of Johns Hopkins University in 1876. Motivated by the ambitions of the

Robber Barons, Gould, Morgan, etc., Hopkins, another one of these bastards, invented the modern "research university".

Hopkins comprised 2 faculties : Liberal Arts and Science Research. One observes that the roots of the "Two Cultures" are fixed in the very foundations of modern education.

J.J. Sylvester,(1814-1897) was brought over to the University of Virginia in 1841. He returned to England however after a few years to a tempestuous career. In 1876, at the age of 61, he was lured to Johns Hopkins by the offer of a huge salary for the time, $5,000, "paid in gold". At Johns Hopkins he inaugurated the American Journal of Mathematics. In 1883 he returned to England, ending his days as Savilian professor of geometry at Oxford.

Sylvester was, to say the least, eccentric and more than a little ego-centric. He established no curriculum at Johns Hopkins. Instead he put his graduate students to work on aspects of whatever problems he himself was working on in his areas of Number Theory, Invariants, Matrices, Combinatorics and Associative Algebra. All in all he graduated 25 graduate students. Although ill-equipped to deal with the contemporary mathematics of the time, many of them solved this problem by doing post-graduate studies in Germany in the seminars of Felix Klein, the greatest teacher of mathematics of the 19th century.

Klein's seminars covered the whole field of mathematics. In fact in their presentations, his students were obliged to relate their personal research to all that was going on in the field. Klein's students returned to the US and took up posts at universities at which they organized real curricula. Many of them ended up at the

"land grant" colleges which were founded in 1892. They also obtained posts at the large universities, Yale, Harvard and the University of Chicago.

Harvard 1869-1901. Ultimately all mathematics departments in American universities are modeled on the department in Johns Hopkins. However the sons of Benjamin Peirce, Charles Saunders , who also taught math there at the same time as Sylvester, and Oliver, established programs geared to teaching, not research. For example, the mathematics program at Cornell was set up by Oliver Peirce, who taught there from 1865 to 1880.

Karen Parshall then said a few words about the University of Virginia, established in 1840. It was based on principles laid down by Thomas Jefferson, including strict separation of church and state. There were only 2 or 3 majors, and a tiny percentage of students who studied any math. From 1840 to 1896 there was only one math professor. A second teacher was added in that year.

The profound divide between graduate and undergraduate programs in the sciences dates from 1900. After WWI, 96% of all scientific research was being done at Chicago, Hopkins, Yale, Harvard, COlumbia, Cornell, Pennsylvania and Princeton. The situation has changed little today, except that there are a few more places on the list: MIT, Berkeley for example

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Annette Vogt : The German-Russian connection in the 1ith century, and its consequences for the 1930's.

The influence was entirely in one direction, with Russian students getting degrees in German universities and going back to

Russia. Curiously, in 1917, because of the Bolshevik revolution, all education in Russia underwent a profound transformation, *except in the area of mathematics* . The Nazi regime destroyed mathematics teaching. By 1945 , the number of displaced German scientists exceeded 1200.

The major educational reform   inaugurated in 1810 was directed by Alexander Humboldt. A great many research institutes were established in Germany. These espoused a unity of teaching and research that led to the miraculous period of the 20's. These academies were in Halle, Berlin, Gottingen, Heidelberg, and Munich. Gauss tried, without success to bring Dirichlet and Jacobi to Berlin. After Bismarck however, work in the sciences was concentrated in Prussia. The Privat-Docent system was also set up in Humboldt's time. It had the best of intentions, but has exercised a stranglehold on German education ever since.

Restrictions on Jews: from 1820 to 1840, access to the universities was forbidden to Jews. After then they were open, but from 1908 to 1920 they were forbidden to women. And in 1900, university education was banned to left-wing scientists.

Max Weber wrote a illuminating book on the Privat Docent system which was translated in 1990. I should obtain a copy.

The valuable aspect of German education was not the privat-docent system, but the system of special seminars, of which that of Felix Klein was the most outstanding. This system was reproduced in Russia.

3 groups of students from Russia enrolled in German universities

1. Official exchange students

2. Those who paid their own way, especially Jewish students

3. Jewish students forced to leave and couldn't return. These often found very decent positions in Germany and elsewhere in Europe: Chaim Weizmann, chemistry; Shur, mathematics.

Helmholtz had all 3 categories of students in his classes. Weierstrauss only the 1st group.

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Umberto Bottazzini :

In the period 1870-1930, education in the sciences in Italy was almost non-existent. The geometer Castelnuovo stopped doing mathematics research in his 30's to devote the rest of his life to improving scientific education in Italy. When Mussolini came to power his minister of education was Gentile. Gentile was a philosopher and established a program that put science in the service of an ideology derived from the writings of Fichte, who was contemptuous of scientific inquiry. This changed after the war. Enrico Fermi was obviously an anomaly, but even he was an experimental, not a theoretical physicist. Even today in Italy, the "elite" students are not those in the sciences, which are considered suitable for the second-rate minds, but are channeled into a "classical" education with emphasis on Greek and Latin and the unbroken tradition of literature from ancient Rome through the Renaissance to the modern day.

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