

## Felix Klein (1849-1925): Symbiosis of History, Teaching & Culture

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In 1925, at a holiday course for mathematics teachers, the representative of the Prussian Ministry of Education promised to *continue in the spirit of Klein and to convey to the youth the eminent cultural significance of mathematics and its applications*.

Based on recent studies, it is possible to explain the hitherto little-noticed link between the fields of history, teaching and culture in Klein's teaching and research projects and the international effectiveness associated with them. This symbiosis can be seen as part of Klein's goal (see Klein to Darboux, 1871) to reform mathematics education and bring mathematics into the consciousness of broad circles as a necessary component of culture. The associated group of measures included:

I) *The establishment of regular holiday courses* (= further education courses for teachers who were working at secondary schools), for the first time in 1892 (in 1909 for the first time for female teachers). In 1893, he himself had sit in on some secondary schools' classes and examined which topics were valuable for further education [source: correspondence with Robert Fricke]. The topic chosen for 1894 (the three classical geometrical problems that cannot be solved with compass and ruler alone) established Klein's expert status for teaching issues, nationally and internationally. His associated booklet (Klein 1895) was immediately translated into French, Italian, English and Japanese by mathematicians who eventually became the driving force for reform in their own countries, some internationally.

II) *A new examination regulation for math teacher candidates in 1898, which for the first time included a teaching qualification in applied mathematics*. Klein had achieved this through the support of the Prussian Ministry of Culture and that of industrialists with an interest in science. The examination regulations were the basis for new lectures and seminars, in which Klein also integrated the history of mathematics.

III) *The inclusion of mathematics (plus its teaching and history) in the large-scale project (60 vols.) Culture of the Present* (by the historian Paul Hinneberg). Klein had recognised the opportunity to make the importance of mathematics for general education and culture accessible to wider circles; he edited a mathematics volume (1912-14) as part of the cultural project. At the same time, Klein managed *Abhandlungen über den mathematischen Unterricht* (5 vols., 1909–16), and prepared an (ultimately unfinished) volume of *History, Philosophy, Didactics* as part of his *Encyklopädie der mathematischen Wissenschaften mit Einschluss ihrer Anwendungen*. This work is reflected in Klein's research-oriented teaching.

We see Klein's recognition as an expert in mathematics education in his membership of the Comité de Patronage of the journal *L'enseignement mathématique* as well as in his positions in the well-known reform bodies in Germany and internationally. It is less well known that Klein, as the "Foreign Minister of Mathematics in Germany" (A. Fraenkel), fought tenaciously after the First World War to ensure that the main aspects of the Meran Reform were incorporated into a new Richert Reform (1925) in Prussia.

Archive of the Technical University Braunschweig, Nachlass Robert Fricke.

Bibliothèque de l'Institut de France, Faculté des Sciences de Paris, MS 2719 (Lettres de Felix Klein à Gaston Darboux)

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