A Turning Point in Secondary School Mathematics in Brazil: Euclides Roxo and the Mathematics Curricular Reforms of 1931 and 1942

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Abstract

The purpose of this paper is to show how Felix Klein’s ideas concerning the teaching of mathematics influenced a major attempt to reform the teaching of secondary school mathematics in Brazil. We follow the story of this attempt from the late 1920s to the early 1940s, centering on the role Euclides Roxo had in these reforms. Roxo had a crucial influence on the establishment of the content of the mathematics programs for two educational reforms in 1931 and 1942. One can follow how Roxo retreated from his initial positions of 1931, which had adhered closely to Klein’s ideas, to a more conservative position in 1942.

Résumé

Nous montrons comme les idées de Felix Klein sur l’enseignement des mathématiques ont exercé une grande influence sur des réformes de l’enseignement des mathématiques aux écoles secondaires au Brésil. Nous suivons l’histoire de ces réformes de la fin des années 1920 jusqu’au début des années 1940, et nous étudions le rôle joué par Euclides Roxo. Roxo, qui a exercé une grande influence sur les programmes de mathématique des réformes de 1931 et de 1942, et il est possible de voir comme il récule de ses positions initiales, qu’il avait adoptées de Klein, à une position plus conservative en 1942.

Introduction

Felix Klein’s program for the modernization of the teaching of mathematics is well-known. It can be viewed as part of the first international mathematics curriculum reform movement, which was most strongly promoted by IMUK (Schubring, 1989, p. 6; 2003).

IMUK (Internationale Mathematik Unterricht Kommission, Commission Internationale pour l’Enseignement des Mathématiques) was created at the 4th International Congress of Mathematicians, which convened in Rome in April.
1908. The congress appointed a committee composed of Felix Klein as President, George Greenhill as Vice-President, and Henri Fehr as Secretary-General. In 1912, Greenhill was replaced by David E. Smith. When the Commission was reestablished in 1952, its name changed to ICMI (International Commission on Mathematics Instruction) (Schubring, 1989, p. 17; Coray and Hodgson, 2003).

It is little known that Klein’s ideas influenced a major attempt at reform in a country at the periphery, Brazil, which participated in IMUK only in an extremely marginal way. Although the reforms in Brazil were initially strongly based on Klein’s ideas, there was a marked return, after a few years, to more conservative positions.

The reform movement in Brazil was championed by a major figure in the teaching of mathematics in Brazil at the time, Euclides Roxo. Roxo’s attempts at reform provoked strong reactions, and he eventually reverted to more conservative views. It is nevertheless true that some of the changes he introduced in secondary school mathematics teaching were of lasting effect. How his ideas concerning mathematics teaching evolved can be followed through several sources: in a series of newspaper articles, in a book he wrote about mathematics in secondary school (Roxo, 1937), in his several textbooks, and in talks he gave. He participated in two major educational reforms, one in 1931, and the other in 1942. In the first, he was able to impose his reform views, both on the programs and on the corresponding pedagogical guidelines (Rocha, 2001). In the second, we see him withdrawing more and more from his initial viewpoints (Dassie, 2001).

The Setting
Secondary schooling in Brazil underwent a major change in 1837, when the Imperial Government created the Colégio Pedro II in Rio de Janeiro. This city had been the seat of the Portuguese Empire since 1808, the year the Portuguese court had had to emigrate to Brazil after Napoleon’s invasion of Spain and Portugal. The Colégio Pedro II was intended to act as a model secondary school for the entire country. In fact, it established a “de facto” official curriculum, because only schools adhering to its programs could award secondary school diplomas valid for entering higher education (in professional schools, since Brazil did not have universities at the time) (Haidar, 1972). From 1837 to the middle of the 20th century, a long list of distinguished Brazilian intellectuals and scholars taught at the Colégio Pedro II, usually after having been admitted by public examination. During this period, the faculty of the Colégio Pedro II enjoyed a very high social status (Doria, 1997).

From 1837 to 1940, secondary education in Brazil underwent several changes, some of them minor, and others more sweeping. Among these are the programs instituted in 1890, right after the Empire had been overthrown (1889), and the Republic established. This reform was strongly influenced by the ideas of its
promoter, Benjamin Constant, a staunch positivist, and one of the founders of the Republic.

Brazil underwent deep structural changes after the First World War. Industrialization made big advances, partly because of the war. The country needed skilled workers and a middle class consisting of doctors, engineers, accountants, etc, and thus its educational system could no longer exclusively focus on the goal of forming an intellectual elite (Nagle, 1947; Nunes, 1962). At this time, Brazilian educators discussed intensely and searchingly the course of Brazilian education and its role in molding a new society. These concerns and the hopes of a whole decade found expression in the well-known Manifesto dos Pioneiros da Educação (1932) the Pioneers of Education Manifesto, which summed up most of the ideas of several Brazilian educators, many of whom were influenced by Dewey and Montessori, among others (Xavier, 2004; Romanelli, 1991, pp. 128, 129).

The tensions in this changing society may be perceived from the political unrest of the period. There was a failed revolution in 1922, as well as widespread worker strikes. The growing crisis came to a peak in 1930, ending with a revolution which overthrew the “old republic” and founded a new one. This “new republic” created the Ministry of Education, which was initially headed by Francisco Campos, who immediately started a sweeping reorganization of secondary school education, known as “Reforma Francisco Campos”. In 1937, President Getúlio Vargas, one of the leaders of the 1930 revolution, lead a coup d'état. Vargas remained in power until the middle 1940s. In 1942, Gustavo Capanema, who was then the Minister of Education, initiated a new educational reform effort.

We summarize the major education reforms in Brazil from 1837 to 1942 and some related events in the following table:

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>1837</td>
<td>Establishment of Colégio Pedro II in Rio de Janeiro</td>
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<tr>
<td>1889</td>
<td>Fall of the Empire and proclamation of the Republic</td>
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<td>1890</td>
<td>Creation of the Ministry of Instruction, mail and telegraph</td>
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<td>Curricular Reform made by Benjamin Constant, Minister for Instruction, Mail and Telegraph</td>
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<td>1892</td>
<td>The Ministry of Interior Affairs and Justice becomes responsible for Education</td>
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<td>1925</td>
<td>Euclides Roxo becomes head of Pedro II</td>
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<td>1929</td>
<td>Euclides Roxo reforms the mathematics curriculum at Pedro II</td>
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<td>1930</td>
<td>Vargas overthrows the established government and becomes President</td>
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<td></td>
<td>Creation of the Ministry of Education and Health</td>
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<td>Year</td>
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<td>1931</td>
<td>Francisco Campos organizes secondary education—the Francisco Campos Reform</td>
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<td>1937</td>
<td>Vargas establishes a dictatorship</td>
</tr>
<tr>
<td>1942</td>
<td>Gustavo Capanema reorganizes secondary education—the Capanema Reform</td>
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**Euclides Roxo and the *Colégio Pedro II***

Euclides de Medeiros Guimarães Roxo (1890–1950) was an engineer who graduated with honors at every stage of his education. Very soon after he received his engineering degree, he started teaching mathematics at the Colégio Pedro II, where he had completed his secondary schooling. In 1925, he became the school’s director, a post which he retained until 1935 (Carvalho, 2003; Valente, 2003).

Euclides Roxo was a contemporary of Eugênio Raja Gabaglia, Joaquim de Almeida Lisboa, and Cecil Thiré, mathematics teachers at Pedro II. Raja Gabaglia represented Brazil in IMUK (Schubring, 1989, pp 6-8; Valente, 2003). He had a great influence on mathematics teaching in Brazil, partly due to his translations of French mathematical textbooks for secondary education, which were used until the late 1950s and early 1960s. He was very conservative, and his position as the representative of Brazil at IMUK did not summon winds of change for the teaching of mathematics in Brazil (Valente, 2003, p. 53).

Almeida Lisboa was younger than Raja Gabaglia. He had a mercurial temperament and eventually clashed with Roxo on issues related to the reform of mathematics teaching. Another colleague of Roxo was Cecil Thiré (1853–1924). Unlike Gabaglia and Almeida Lisboa, he was more open-minded and up to date with the reform movements of mathematics teaching in several other countries (Valente, 2003, pp. 53, 54, 55). Notwithstanding his interest in modernizing the teaching of mathematics at the Colégio Pedro II, almost nothing seems to have happened to further Thiré’s ideas, even though he was responsible for developing the school’s mathematics programs from 1912 to 1928 (Valente, 2003, p. 54).

We surmise that Euclides Roxo learned about the international reform movements of mathematics teaching from Raja Gabaglia or, more probably, from Thiré. As shown by the many quotations in his newspaper articles about the reform of mathematics and in his book *A Matemática na Educação Secundária* (Roxo, 1937), Roxo read extensively about mathematics, psychology, education and mathematics teaching reform, particularly focusing on Felix Klein’s ideas. He quotes extensively from Klein’s *Elementarmathematik vom höheren Standpunkt aus* (*Elementary Mathematics from an Advanced Standpoint*) (Klein, 1925–1928). As a matter of fact, in the first of a series of 13 newspaper articles he wrote about the

Because of his position as director of the Colégio Pedro II, Roxo was aware of the educational discussions underway in Brazil. He participated in the debates of the Brazilian Academy of Education, in which he headed the secondary school division. He was called upon, as director and representative of the faculty of the Colégio Pedro II, to formulate educational policy proposals for the government. He also had family ties that guaranteed him political backing and support and allowed him to remain at his post as head of Pedro II after the 1930 revolution, even though he had publicly voiced his opposition to it.

It should also be mentioned that Roxo, as head of the Colégio Pedro II, which was the official secondary school of the central government, had direct access to the Minister of Education. Even after 1935 Roxo continued to hold important positions: in 1937 he became the director for secondary education at the Ministry of Education, and in 1944 he was made president of the national commission for textbooks, which examined all secondary school textbooks to determine if they adhered to the official curricula.

Mathematics education in Brazil up to the twenties had, in general, the following characteristics (Haidar, 1972; Beltrame, 2000):

- The subjects of secondary school mathematics—geometry, trigonometry, arithmetic and algebra—were taught in a strictly compartmentalized way, separated by school years.

- Mathematics was not taught in all secondary school years. According to the several secondary school official programs from 1837 to 1929, the distribution of mathematics in the curriculum varied widely: Sometimes it was taught during the first years, sometimes in the middle years, and sometimes in the senior years.

- Mathematics was viewed as a tool to promote the discipline of the mind, an exercise in intellectual training without regard to applications to the everyday needs of society. It was taught as a preparation for university studies, most frequently in the field of engineering.
Euclides Roxo and the Mathematics Curriculum Reform

Euclides Roxo, aware of the international debate on educational reform, saw the need for change in Brazil. But he was not the only one. Many other educators clamored for reform, campaigned for a “new school” which was to focus on the students and their psychology, and on the relevance of education for the aspirations and requirements of society (Xavier, 2004). In short, times were ripe for change, and Roxo was a catalyst for change in Mathematics Education.

In his quest for change, Roxo turned to Klein’s ideas about mathematics teaching. There he found a clearly formulated proposal for mathematics education reform, backed by a distinguished mathematician, and set out in a number of writings.

In 1929, as director of Pedro II, Roxo instituted a profound reform of the mathematics curriculum. He stated his ideas very clearly in the extensive preface of the first volume of the textbook he wrote for use with the new program (Roxo, 1929, 30, 31). After quoting Poincaré on the importance of intuition as opposed to rigor and formalism, he presented Klein’s ideas about mathematics teaching. According to Roxo, who practically quotes Klein, the general objectives of mathematics education should include:

1. Predominance of the psychological viewpoint in the teaching of mathematics (…) one should always start with the living and concrete intuition, and only very slowly bring forward the logical side of mathematics. One should adopt the genetic method, which allows for a slow introduction of the new notions.
2. Keeping in mind the applications of mathematics to the other subjects.
3. Subordination of mathematics teaching to the goals of modern schooling which were to morally and intellectually enable individuals to cooperate within a modern civilization essentially oriented towards practical success.

He continues, stating that from these three main directives followed the recommendations:

a) To fuse arithmetic, algebra and geometry (including trigonometry).
b) To introduce the function concept early, since it is at the core of the modern reform movement for Klein.
c) To abandon the rigid Euclidean method of teaching geometry.
d) To introduce coordinates and analytic geometry very early.
e) To introduce the notions of differential and of integral calculus.
f) To place more emphasis on perspective drawing in the teaching of elementary geometry.
g) To introduce laboratory resources.
h) Finally, to give precedence to one principle above all the preceding ones: the use of the historical method in the teaching of mathematics.

In this preface, he supports his suggestions with frequent references to Klein, quoting him directly. Roxo wrote nine extensive articles, of more than 7000 words each, developing these ideas in one of the most influential newspapers of Rio de Janeiro, the Jornal do Commercio, to justify his reform movement. This series of articles was written between November 1930 and March 1931, and their ideas are essentially reproduced in Roxo (1937). There were another four articles in the same newspaper during the same time-span, which constitute Roxo’s part in his bitter quarrel with Almeida Lisboa, who attacked Roxo’s reform very heatedly, also in the Jornal do Commercio.

The curriculum proposed by Roxo and approved by the faculty of Pedro II drastically changed several characteristics of secondary school mathematics education in Brazil:

- Mathematics was taught in all school years.
- The rigid separation between arithmetic, algebra and geometry was abolished. These subjects were all taught in each school year and were to be integrated or, in the terminology of the time, “correlated.” As a consequence, there was a single textbook for each school year.
- The function concept was introduced very early in the curriculum.
- The adoption of Klein’s idea that deductive geometry should be preceded by an introductory geometry course, which was to enhance intuition and the knowledge of geometrical facts instead of deductive arguments.

Klein’s ideas provided Roxo with the guidelines for his program of reform. A new curriculum, however, needs new textbooks, a problem that always accompanies major curricular reforms. And textbooks need authors with actual classroom experience. Even though Roxo was an experienced teacher, he could not tackle alone the task of writing the textbooks needed for the radically new curriculum he proposed. For this task, he relied heavily on Ernst Breslich.

Breslich had been born in Germany in 1874, and become an American citizen in 1896. He was associated with the University of Chicago for almost all his professional life. He was an instructor, and for a while was the chairman, of the Mathematics Department of the University Laboratory Schools. He died in 1966.

Breslich believed in Klein’s ideas and adhered to them in his several textbooks, which were used, among other places, at the laboratory schools of the University of Chicago, and which saw many editions. He was particularly enthusiastic about what was then known as “correlation,” that is, the integrated teaching of arithmetic, algebra and geometry, and he authored many papers on this subject.

Besides his textbooks, Breslich wrote extensively on secondary school mathematics teaching. In May 1933, he gave a speech at the New York Society for
the Experimental Study of Education (Breslich, 1933, pp. 327–349). In this speech, he stated that “the curriculum must be adapted to the changes in the social order,” and he repeats the description of the reform movement presented by Klein in his *Elementarmathematik von höheren Standpunkt aus*. Since Roxo read Breslich extensively and followed his ideas, it is relevant to quote them. Breslich maintains that “(...) algebra and geometry in the plane should not be taught as separate subjects, but in connection with arithmetic” and that mathematics should be “closely [connected] with other school subjects.” He repeats Klein’s ideas that algebra and geometry be joined by making the function concept the unifying idea in mathematics; and that a psychological arrangement of subject matter should be insisted on. In his speech, Breslich also repeats Klein’s idea that the formal teaching of geometry theorems should be preceded by an informal and practical course.²

Roxo, as he himself stated several times, made extensive use of Breslich’s textbooks as a source of examples, exercises, and as a model for the structure of his own textbooks. In his textbooks he adheres to these ideas and tries to implement them. In fact, in the bitter discussions which followed the new curriculum, Roxo was often accused of plagiarism by Almeida Lisboa and other secondary school mathematics teachers (Fontes, 1930; Novo, 1929, 1934). It is not clear how Roxo learned about Breslich. Rio de Janeiro had, at the time, some very good bookstores, which imported books both from Europe (mostly from France), and from the United States. Even today, it is possible to find in used bookstores copies of mathematics textbooks and books on the teaching of mathematics well known in the 1920s and 1930s. Some of these copies were once owned by teachers mentioned in this paper. In one of his articles against Roxo, Almeida Lisboa boasts that he too had read Breslich’s textbooks, and proceeds to list exercises he claims Roxo had copied, sometimes with minor adaptations.

Why did Roxo rely so heavily on Breslich? Was it lack of time to write a completely new textbook, since he was very busy at the time, as head of Pedro II? Or, was it because he was not or did not feel capable of transposing Klein’s general ideas into a workable textbook? We do not know.

**Euclides Roxo and his Textbooks**

Roxo, as head of Pedro II, planned to establish his reform progressively, so that only students who entered the Colégio after 1929 would follow the new programs. He wrote the first three textbooks of the series he planned for the new programs (Roxo, 1929, 1930, 1931) alone. After the 1931 reform, which made the new curricula mandatory, he interrupted his series, and joined two colleagues, Cecil Thiré and Mello e Souza (another very influential mathematics teacher), in the series of textbooks they were writing, and which were then competing with Roxo’s books. The first two volumes of this series, called *Matemática*, were written by Cecil Thiré and Mello e Souza. Roxo joined them starting with
Volume III, and the series was then called *Curso de Matemática*. It covered the five years of secondary school mathematics.

A perusal of the first two volumes of Roxo’s *Curso de Matemática Elementar*, Roxo’s first secondary school textbook series, shows how far he relied on Breslich, including even the exercises, sometimes with minor adaptations, as pointed out mainly by Almeida Lisboa in his attacks against Roxo’s reforms and textbooks. Actually, Lisboa’s criticism extended far beyond the textbooks—he aimed directly at Roxo’s ideas concerning the teaching of mathematics (Lisboa, 1930):

> Mr. Roxo forgot the real aim of mathematics in secondary school. Its purpose is not a more or less plentiful harvest of isolated and practical knowledge. Mathematics is a discipline of the mind, the unsurpassed and irreplaceable trainer of reason to which youth should be submitted.

He also claimed that Roxo had reduced mathematics to a triviality (Lisboa, 1930):

> (...) It is as though the most eminent architects had defined the rules of elegance and proportion, defined the nobility of style and, in the heart of Africa, a savage tribe presented their poor hut as a result of these modern precepts. I beg my illustrious colleague to forgive me the unpleasant comparison, but I cannot see a more fitting one for his reform of the teaching of mathematics.

> (...) Mr. Euclides Roxo wants to convince us that he based [his reforms] on the international congress and on Klein’s uncontroversial authority, to abolish the teaching of mathematics in Brazil. Mr. Roxo does not even seek really useful applications of mathematics, which would require a wide theoretical knowledge.

Roxo opens the first volume with a lengthy introduction, which is a passionate defense of the modern reform movement. The table of contents shows at once that the book was completely different from the textbooks so far adopted in the Colégio Pedro II. These texts were all jettisoned, and a new style of textbook was introduced in Brazilian mathematics teaching.

As an example for the style of this book, let us mention that Roxo proves the familiar rule \((a + b)^2 = a^2 + 2ab + b^2\) geometrically, putting into practice what he preached, the “correlation” between algebra and geometry. This was a genuine innovation in Brazil. The function concept figures prominently in this volume intended for students around the age of eleven. We find functions given by their graphs, by tables of values and by their analytical representations. This contrasts strongly with the now dominant practice, in Brazil, of introducing the function concept only in the last year, or in the last three years of a seven-year secondary school curriculum.
The accusation, made by Almeida Lisboa and others (see Fontes, 1931), that Roxo was reducing mathematics to a set of rules, trivial applications and an indigestible mixture of different pieces, is not sustainable. For example, in the third volume of his series, Roxo presented a formal Euclidean geometry course, including full proofs. Nevertheless, he broke with the strict Euclidean tradition by placing a chapter on displacements of plane figures right at the start and, later, a chapter on symmetry.

Roxo’s texts broke with a long tradition of textbooks (Beltrame, 2000; Dassie et al., 2001), and it is not surprising that they were strongly attacked. But he also had support from some influential teachers of mathematics. For example, Nivaldo Reis, a teacher of the Ginásio Mineiro, in Belo Horizonte, state of Minas Gerais, wrote a series of articles in the Revista Brasileira de Matemática Elementar, supporting Roxo, but showing concern about the implementation and success of the new programs (Reis, 1931). He stresses that Roxo only followed ideas already known in Europe:

But this transformation of the teaching of mathematics was not the work of Euclides Roxo, as many believe. He only adopted what was known and applied in Germany since the beginning of this century [20th Century].

In his two first books (Roxo, 1929, 1930) Roxo takes seriously Klein’s advice, already put in practice by Breslich in his several textbooks, that a course in deductive geometry should be preceded by an intuitive course, which was to consist of “lessons about things.” He also adheres very closely to Breslich’s attempts at “correlating” subjects, that is, at integrating arithmetic, algebra, geometry and trigonometry. And he tries, also following Klein’s ideas, to make the concept of functional relationship “impregnate the whole curriculum.”

These two books were met with widespread opposition, most of which Roxo tried to answer in several newspaper articles. Some of these articles were devoted to his exposition of the aims of the reform movement, some to answer Almeida Lisboa’s vitriolic critique, other to answer other critics, mainly secondary mathematics teachers.

In the third book of this series (Roxo, 1931(a)), devoted to geometry, Roxo presents elementary Euclidean geometry in a more traditional way. Was he tired of the opposition to his ideas and to his books? We do not think so, because in the preparation of the 1942 reform, promoted by Gustavo Capanema, he initially maintained his reform ideas, though he was forced to back down steadily. By then, he was no longer director of the Colégio Pedro II, and had been seriously shaken by the death of his daughter, and had to compete with the Catholic church and with the army for Capanema’s attention (Horta, 2001).
Euclides Roxo, the Catholic Church and the Military

Roxo was also attacked from another side: the Catholic priest Arlindo Vieira, director of Rio de Janeiro’s most prestigious Catholic school for boys, the Colégio Santo Inácio, owned by the Jesuits. Vieira attacked Roxo’s mathematics program as being encyclopedic, and said that the real formation of the minds of the students would be better achieved by a return to the classics, and that the new mathematics programs were much wider in scope than the equivalent programs in France and Italy. Vieira indicated that the mathematics programs should be largely curtailed to allow more time for teaching Latin and the classics (Viera, 1934(a), (b); O Journal, 1936). Vieira also strongly opposed the introduction of the function concept at an early stage of secondary education. These ideas would find sympathetic ears in Gustavo Capanema, who promoted the next reform, in 1942. In a letter to Capanema of 1941, trying to convince him of the wrongness of Roxo’s ideas, Vieira states that (FGV (b)):

The best and most decisive argument against the ideas of the illustrious educator are the disastrous results of the mathematics programs he instituted in 1931 and which he tries to defend. A survey poll would show that more than 90% of all teachers condemn this unpalatable mixture.

One should not view this as an isolated attack, which reflected only Vieira’s personal ideas. On the contrary, it should be viewed in the context of the Catholic Church’s opposition to the educational ideas that had started to prevail in Brazil in the 1920s and 1930s (Cury, 1988; Horta, 2001). Vieira was part of a “counter-reformation” that fought against the spreading of ideas found dangerous by the Church: public school education, with co-education of boys and girls, and the separation of Church and State in educational matters. The Church walked a tightrope, supporting the strongly conservative government that fought communism, but at the same time opposed the new educational policies promulgated by this government (Azevedo, 1971, pp. 664-670).

It is interesting to note that Almeida Lisboa (1936(a), (b)), whose position was that mathematics was the subject appropriate to develop students’ minds, also attacked Vieira. This is consistent with the ideas Lisboa had already used in some of his criticisms of Roxo.

The military also had strong reservations about Roxo’s reform. Their schools for prospective officers were very conservative, and opposed any change to their well-established methods. For them, the new educational ideas that were discussed in the 1920s and 1930s threatened school discipline, and looked suspiciously liberal (Horta, 2001).
Euclides Roxo and the Teachers of Mathematics
We have already seen that the Church and the military opposed the mathematics curriculum reform made by Euclides Roxo. It was also strongly attacked by many teachers of mathematics.

Up to the 1930s, there were no university courses for secondary school teachers in Brazil. Mathematics teachers in the secondary schools were mostly engineers, including military engineers. The military schools had a strong mathematics curriculum, following the French tradition. Some of their graduates were mathematics teachers at private schools, or even had preparatory schools for young men who planned to take the entrance examinations for the engineering schools, like Sebastião Fontes (Fontes, 1930; Dassie, 2001). These examinations were highly competitive, and required a good mathematical background. So, these teachers had two reasons to oppose Roxo. In the first place, the very conservative mathematical curriculum in the military schools was long-established. Secondly, there was a palpable fear that their students, either in private secondary schools or in the preparatory schools, would not meet the requirements of the entrance examinations, since these teachers felt that Roxo was downgrading the mathematics curriculum.

The civilian engineers in Brazil usually received their education from the Escola Politécnica in Rio de Janeiro, where they had, in general, received a fair to good foundation in mathematics. Their reaction to Roxo’s reform was mixed. Some of them adhered to ideas consistent with Almeida Lisboa’s conception of mathematics as a lofty science of the mind, while some others saw the urgent need for reform (see Novo, 1929, 1931 for an example of such teachers).

Euclides Roxo’s Return to More Conservative Views
The military and the Church were not heard in the organization of the curricula of the 1931 secondary education reform, which was actually put forward by a very conservative Minister of Education, Francisco Campos. The new mathematics curriculum was proposed by Roxo and accepted completely by Campos, without discussion. By contrast, with respect to the preparation of the 1942 educational reform, made under Vargas’s dictatorship, the Minister of Education, Gustavo Capanema, paid close attention both to the Church and the military in the preparation of the curricula and acknowledged their pedagogical guidelines. With respect to the coverage of mathematical topics, he did not entirely follow Roxo’s proposals and accepted several of the objections voiced by the Church and the military, one of which was the opposition to the early introduction of the function concept (Dassie, 2001).

The available documentation shows how Roxo tried to fight the attempts to modify his proposals for the 1942 reform. For example, he strongly opposed Arlindo Vieira’s suggestion that the function concept should be relegated to the last year of secondary school. In a very incisive letter to Capanema (FGV (a)), he states:
As to the general ideas, there was one which I find very harmful to the good teaching of mathematics (…) it is the suppression of the function concept as an axial idea in the teaching of mathematics. Since it was proposed by Felix Klein, this pedagogical principle has been accepted in almost all civilized countries. (…) It is a pity that Brazil should give up the pedagogical conquest made by the acceptance of this principle in the reform of 1931.

Another point Roxo strongly opposed was the idea of having several textbooks for the same school year, for example one for algebra and one for trigonometry, a universal practice before the 1931 reform. In the letter to Capanema already quoted, he writes:

I received the message from Your Excellency recommending that I include in the methodological guidelines for the mathematics programs an instruction that the subjects should be distributed among several textbooks, using any criterion but that of using only one textbook per school year.

Unfortunately, Mr. Minister, I cannot do this, because I am deeply convinced that the only acceptable criterion, particularly for mathematics, is precisely the use of only one textbook per school year.

What did Roxo lose in the 1942 reform, compared to that of 1931? First, the function concept did not “impregnate the whole curriculum,” since it was postponed to the last school year. In the second place, if we compare his first textbook series with the one he wrote together with three other well-known mathematics teachers immediately after the 1942 reform, we see that the “correlation” Roxo fought so hard to see in the mathematics classroom disappears almost completely. Even though each book covers at least two of the main blocks of secondary school mathematics (arithmetic, algebra, geometry and trigonometry), they are presented in separated units in the books, with no real attempt at integrating them.

Concluding Remarks
Euclides Roxo took part in two reforms that were imposed “top down,” instead of evolving “bottom up” (Schubring, 1989, pp. 15-16; Krüger, 2004). This caused widespread resistance, which had to bow under the very authoritarian and centralized political regime instituted by the 1930 revolution, and made even more so under Vargas dictatorship from 1937 to 1945. This resistance gathered its forces for the upcoming 1942 reform, which was heavily debated, and in which Roxo was not the only person heeded by the Minister of Education (Gustavo Capanema), as shown in the files of Capanema’s papers at the Fundação Getúlio Vargas in Rio de Janeiro.

Did Roxo really believe in Klein’s ideas? Did he have a clear program for educational reform, or was he simply parroting European ideas about
mathematics education? We do not think the latter is the case. Roxo explained his ideas consistently for several years. He obviously felt deeply committed to the modernization process.

When Roxo adopted Klein’s ideas, he made adaptations, usually drawing on Breslich, his role model. For example, when Roxo stresses applications, he means strictly elementary applications, like the example much criticized by Almeida Lisboa of how to measure heights using a pencil held at arm’s length, or how to draw a circle using a string and a peg. He never mentions the integration of secondary school education with higher education, although he was aware that, at the time, secondary school education in Brazil was—and largely remains so even today—mainly a preparation for higher courses. In addition, since he used Breslich as model, his emphasis on the integration of geometry and algebra is not surprising, since this was much stressed in Brelitch’s adopted home country, the United States (Schubring, 1989, 1989, p. 19).

Schubring (1989) has remarked that Klein’s “(...) ultimate objective [was the] clarification and redefinition of the transition from the secondary schools to higher education, particularly to the technical colleges.” This objective is completely absent from Roxo’s writings. Even though he was an engineer, with a degree from the prestigious Escola Politécnica—the university-level school of engineering—Roxo was completely cut off from higher education. As a matter of fact, the two faculties, that of the Colégio Pedro II and that of the Escola Politécnica, competed for prestige and influence.

In his 1937 book, Roxo summarized the ideas he had proposed in his newspaper series, and which had been originally published in the introduction to the first volume of his Curso de Matemática Elementar. Even though this book clearly reveals some educational conceptions that are no longer accepted, it has a very modern flavor. In our experience, many young people who read it for the first time are surprised to find in it ideas that are considered very “modern” as, for example, the importance of graphs and data tables, the emphasis on the graphical representation of functions, and the idea that the problems and applications should be meaningful to the students.

Roxo’s ideas were further summarized and refined in his lecture “Mathematics and secondary school” (A Matemática e o curso secundário), of 1937 (Peixoto, 1937; Valente, 2004 (b)).

Roxo consistently fought for a slowly progressive teaching of mathematics, from simple ideas in the first years, to a rigorous presentation of geometry and of notions of the infinitesimal calculus in the last years of secondary school. He also proposed the early inclusion of trigonometry in the curriculum.
In any case, the reforms he instituted had a lasting influence on Brazilian secondary school mathematics, which has retained some of the characteristics of Roxo’s modernizing attempts to this very day:

- Mathematics is taught in all secondary school years
- In each school year, the students use only one mathematics textbook instead of several treatises, one for each branch of school mathematics.
- Compared to the old textbooks, the new series of Roxo, and those of other mathematics teachers tried to take in account the needs and level of maturity of the student, a practice that has been consistently considered and improved.

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Notes
1. All translations from Portuguese into English by the author of this paper
2. Breslich seems to deserve more attention than he received. He is rarely mentioned even in the comprehensive recent studies on the history of school mathematics in the USA. Meantime, he was an influential textbook writer, connected to a young and dynamic institution (the University of Chicago) and played an important role in the transmission of Klein’s ideas to the United States. More information on him is given in the paper of Gonzalez and Herbst in the current issue (editor).
3. It should be mentioned that educational matters were widely discussed in newspapers at the time. Many had a specific section on education and they ran articles on educational reforms. This fits with the cultural atmosphere of the time, when educators sought changes to make school more relevant to the needs of Brazilian society, as already mentioned. This subject deserves detailed study.
4. Of course they influenced the aims of the educational reform, its politics and ideology, but not the specific curricula of the secondary school subjects, particularly mathematics.

References


Fundacão Getúlio Vargas (FGV)/CPDOC. Carta de Euclides Roxo endereçada ao Ministro da Educação e Saúde, Gustavo Capanema. Rio de Janeiro: Arquivo Gustavo Capanema. Documento G.C. 41.09.03 I-10 (série g). (a)

Fundacão Getúlio Vargas (FGV)/CPDOC. Carta de Arlindo Vieira endereçada ao Ministro da Educação e Saúde, Gustavo Capanema. Rio de Janeiro. Arquivo Gustavo Capanema. Documento G.C. 41.09.03 I-II (série g). (b)


