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THE EVOLUTION OF THE STRUCTURAL ELEMENTS OF MATHEMATICS TEACHER TRAINING – CONTROVERSIES ABOUT THE CASE OF BRAZIL

Summary: Training for future secondary school teachers was established eventually in the early 19th c. Since then, the training has included two major constituents: knowledge of the subject matter to be taught and pedagogical-didactic competencies for teaching. These constituents became institutionalised in quite different manners among countries that created public education systems. Based on studies about the emergence and evolution of teacher training in various European education systems, the development of mathematics teacher training in Brazil is analysed here for further structural insight. Having established no teacher education during the 19th c., following the French practice after the Revolution, teacher education became the key intention of the first universities founded in the 1930s. The paper analyses archival findings and discusses the meanings of the conferred diploma, as well as why recent Brazilian publications about teacher training misrepresent the aims and realisations of teacher education.

Keywords: mathematics teacher training, teacher licence degree, role of the bachelor's degree, founding Faculties of Philosophy

Introduction

Although teacher training constitutes the basic issue for any history of mathematics teaching, its history has not yet been investigated systematically for many countries. Neither have international comparisons been made regarding its emergence and development. Given that the establishment and functioning of mathematics teacher education depend upon the social and cultural structures in each country, an international analysis would contribute to revealing the struc-

tural patterns involved. I here attempt such an analysis with emphasis on historical research in Brazil.

Generally, one can assert that any mathematics teacher education depends upon the confluence and interaction of two components of knowledge and competencies: knowledge of the subject matter to be taught and pedagogical-didactic competencies. Both components emerged at different school levels, and their relation constitutes the key variable in the history of mathematics teacher training in the different states.

Historically, teacher training has developed differently and separately for the two major structures as they emerged in Europe during premodern times: for teachers at primary schools and for teachers at secondary schools. Significantly, each of these structures represents one of the two basic components: training for primary schools became paradigmatic for pedagogical-didactic competencies, and training for secondary schools became paradigmatic for subject matter competencies.

The premodern period – from the 16th to the 18th c., up to the French Revolution – shows another significant difference between the two school structures: for secondary schools, there was essentially no institutionalised teacher training at all! You may ask: how could individuals be contracted as teachers? Regarding the then confessionally split structure: at Protestant schools, some student of a philosophical or theological faculty, either a graduate who had not achieved a position as a pastor or who had abandoned his studies – used to be called, or some self-taught person. At Catholic colleges, mainly organised by the Jesuit Order, being formed within the order and showing some capacity to teach was sufficient to be sent to teach at one of their schools¹.

Revealing was the contrast with primary schools, where some forms of teacher training became established during the 18th c.:

It is highly revealing that the first state initiatives for teacher training concerned primary schooling [...]. Since it became increasingly disturbing and counter-productive, from the middle of the 18th century at least, that persons contracted as teachers in primary schools were notoriously unqualified – veteran soldiers were often quoted –, governments in Catholic and in Protestant countries began to care. First institutions for teacher training were founded in Austria, in Northern Germany, in Naples.²

¹ Descartes had passed his school years at the Jesuit college at La Flèche; one does not know for sure the years when Descartes studied at this college and thus when were the few months of being taught from Euclid and about astronomy. But the most probable one to have been this teacher is the novice Jean François having been taught a short time before some mathematics by his superior at Pont-à-Mousson (A. Romano, *La Contre-Réforme Mathématique. Constitution et diffusion d'une culture mathématique jésuite à la Renaissance (1540–1640)*, Ecole française de Rome, Rome 1999, p. 486).

² G. Schubring, *The emergence of the profession of mathematics teachers – an international analysis of characteristic pattern*, [in:] “Dig where you stand” 3. *Proceedings of the Third International Conference on the History of Mathematics Education*, ed. by K. Bjarnadottir et al., Uppsala University, Uppsala 2015, p. 390.

Institutionalisation of teacher training in modern times

It is likewise telling that the first measure taken after the French Revolution for teacher training was again for primary schools: the famous *École Normale* of the year III, of 1795, was established to provide France with a network of teachers for primary schools. As a revolutionary measure, to provide this quickly, this institution was restricted to functioning for four months, and the task of teacher training for secondary schools became addressed only from 1810 onward: creating the *École Normale Supérieure* in Paris³. Its curriculum consisted exclusively of subject matter knowledge. While providing an exam, the *agrégation*, its graduates – the *agrégés* – were eligible for a position at a *lycée*. Given the small number of admitted students and thus of *agrégés* acting as *lycée* or *collège* teachers, France did not establish a systematic mode of training mathematics teachers until the end of the 19th c. Moreover, mathematics was no longer a major teaching subject until the Restoration period⁴.

It is not well known that the first establishment of teacher education for secondary schools at universities occurred at the periphery of Europe, in Portugal. This was part of the decisive socio-political reforms undertaken by the Prime Minister, the Marquis of Pombal. As an element of his Enlightenment policy, he expelled the Jesuits from the entire Portuguese Empire in 1759, making Portugal the first European state to do so. His educational reforms led, in 1772, to a restructuring of the University of Coimbra, the only university in Portugal. There, the formerly marginalised mathematics and sciences were institutionalised in a Faculty of Mathematics and a Faculty of Sciences – the first such ever founded. Those students who were admitted to the last, the fourth year of studies at the Mathematics Faculty received the degree of a ‘baccalaureus’, and those who passed the exams in all the studied disciplines after the fourth year were conferred the degree of a graduated bachelor. These graduates were entitled to teach mathematics at all school institutions. One could obtain a doctoral degree after an additional year of studies and more exams, which entitled its holders to become a university professor⁵. This first founding of mathematics teacher training at a university did, however, not substantially improve mathematics teaching, as after the dissolution of the Jesuit colleges, the state was

³ Actually, this school was called at first *école normale*, too. It was only in 1845 that the ‘supérieure’ was added, to distinguish it from the then created *écoles normales primaires*.

⁴ G. Schubring, *The emergence of the profession of mathematics teachers – an international analysis of characteristic pattern*, p. 391

⁵ C.M. Silva da Silva, *Die Gründung der mathematischen Fakultät 1772 in Coimbra – ein Beginn fachlicher Spezialisierung*, [in:] *Spezialschulmodell versus Universitätsmodell: Die Institutionalisierung von Forschung, ‘Einsamkeit und Freiheit’ neu besichtigt*, ed. by G. Schubring, Franz Steiner Verlag, Stuttgart 1991, p. 52 ff.

unable to establish a system of public education. Rather, some isolated *aulas* (courses) were established in some cities, mainly for the humanities⁶.

While this first founding of mathematics teacher training is known, at least in Portugal, an analogous subsequent foundation in Italy has not been studied by Italian researchers. The University of Naples, the capital of the ‘Realm of the Two Sicilies’, was under Spanish rule from 1735 (the Jesuits had also been expelled from there in 1767). Structural reform of this university, founded in 1224 by the German Emperor Frederick II as the first public university, was undertaken in 1777. A key element of this reform was the founding of two faculties, one for mathematics and the other for natural sciences. Strangely enough, no research has been undertaken about the functions ascribed to these new faculties and their practices, but one can reasonably assume teacher training for mathematics was also instituted⁷.

A firm institutionalisation in Prussia

The decisive establishment of teacher training for secondary schools, and in particular for mathematics teachers, was achieved in the Protestant German state of Prussia. This was part of its comprehensive social, political, and educational reforms from 1810, and for education initiated by Wilhelm von Humboldt. The educational reform was a remarkably systematic and coherent restructuring of secondary and higher education: the *Gymnasien* were reorganised according to neo-humanism – the curriculum based on three major subjects, one of them being mathematics. The new task of teacher education for these subjects was assigned to the likewise reformed Philosophical Faculties, those being the reformed Artes Faculty of medieval times. The new structure of forming teachers through scientific studies of their subject matters had three significant consequences:

- the professors of these disciplines at the Philosophy Faculties, no longer restricted to giving encyclopaedic or propaedeutic lectures, were now able to specialise and to develop mathematics as a scientific discipline;
- the *Gymnasium* teachers, thus prepared for their profession, achieved a high social status, no longer subordinate to the wishes of their pupils’ fathers;
- from that same year of 1810 on, Prussia established a system of state exams to habilitate students of the Philosophical Faculties to become *Gymnasium* teachers. The exam was organised in three key parts:

⁶ J.B.P. de Carvalho, B.A. Dassié, *The history of mathematics education in Brazil*, “ZDM-Mathematics Education” 2012, vol. 44, p. 501.

⁷ G. Schubring, *Mathematics in Naples. An extraordinary case of institutional development*, [in:] *La Historia de la Ciencia y de la Técnica: Un Arma Cargada de Futuro. Ensayos en Homenaje a Mariano Hormigón*, ed. by M.Á. Velamazán et al., Diputación Provincial de Cádiz, Servicio de Publicaciones, Cádiz 2008, p. 148 ff.

- a general qualification in all major teaching subjects, to enable constructive cooperation with school colleagues,
- an exam in the two chosen specialised subjects of study, and:
- an exam of ‘Lehrgeschicklichkeit’ – teaching skills⁸.

One was thus aware that the future teacher needed pedagogical qualifications, besides his subject-matter competencies! In that period, there was no conception of how to acquire such competencies, as the Philosophical Faculty provided no related teaching. The exam consisted of a ‘Probenvortrag’, or pre-view lecture, taught by the candidate to a chosen school class, and the assessment was made by the same exam board that examined the scientific subjects. An example of this exam is provided by Carl Gustav Jacob Jacobi (1804–1851), who applied for the teaching licence for *Gymnasien* in Berlin in 1824. The result regarding his teaching skills is documented as ‘Lehrgeschicklichkeit mittelmäßig’ – ‘mediocre’ – therefore, this exam was a serious one, and not merely a pro forma⁹.

The education ministry soon became aware that more had to be done for the pedagogical qualification of new teachers. From 1826, a preparatory year was established for acquiring teaching practice: after an exam at a secondary school, accompanied by an experienced teacher as mentor.

Additionally, the education ministry created pedagogical seminaries, mainly at some universities, where more intensive preparation for teaching practice was organised; here, the seminaries in Berlin and Stettin were important¹⁰.

Brazil – its educational system

Brazil was held by Portugal as an underdeveloped colony – without a proper educational system – to provide raw materials. This was until 1808, when Great Britain suggested the Portuguese Crown to migrate to Brazil, to escape the imminent invasion by Napoleonic France. Besides primary and secondary schools then created, higher education adopted the French post-Revolution model to create professionalising faculties instead of universities. Schools of law and medicine were established – though not the weakly functioning science and humanities faculties, nor the overarching *Université Impériale*. For a long time, the only higher education institution where the sciences were taught was the Military Academy,

⁸ G. Schubring, *Die Entstehung des Mathematiklehrerberufs im 19. Jahrhundert. Studien und Materialien zum Prozeß der Professionalisierung in Preußen (1810–1870)*, 2nd ed., Deutscher Studien Verlag, Weinheim 1991, p. 40–45.

⁹ Geheimes Staatsarchiv Preußischer Kulturbesitz (Berlin), Rep. 76 VI, Sektion 14, x, Nr. 3, vol. I, die wissenschaftliche Prüfungskommission zu Berlin, 1817–1827, f. 117.

¹⁰ G. Schubring, *Die Entstehung des Mathematiklehrerberufs im 19. Jahrhundert. Studien und Materialien zum Prozeß der Professionalisierung in Preußen (1810–1870)*, p. 121.

founded in 1810 for training military and civil engineers. Therefore, no teacher training was established during the entire 19th c.

How were individuals contracted as teachers at the system of colleges, created from 1837 on, without teacher training or certificates attesting the necessary competencies? For each vacant position at a *colégio*, a *concurso* – a *concourse* or competition – was organised, where a local jury would assess the qualifications of the candidates. Research undertaken on the mathematics teachers accepted in these *concursos* during the 19th c. shows that the great majority had pursued some engineering studies¹¹. One has to consider, however, that a considerable number of the colleges were religious ones organised by Catholic orders, providing *padres* or *freiras* as the teachers.

It is telling that teacher training in Brazil became first established in a manner analogous to Europe during the 18th c.: it was for primary schools that *escolas normais* were founded from 1834. A series of such normal schools developed well in Brazil; the institutions were elevated in several Brazilian capitals to become *Institutos de Educação*, providing a broad programme of teacher training in pedagogy, didactics, and psychology of education.

The emergence of universities and the role of teacher training

There were several attempts from the 19th c. to found universities in Brazil, but they all failed. The first to develop was in 1920, the *Universidade do Rio de Janeiro*. This was the first federal university (renamed by President Getúlio Vargas (see below) as *Universidade do Brasil* in 1937 to evidence its ambition to be the model for all universities in Brazil) and was a simple addition to the already existing professional schools.

From the 1920s, the *escolanovista* movement emerged, demanding the modernisation of education. One of its urgent aims was to establish public teacher training for secondary schools. As a result of this movement, two genuine universities were founded with teacher training in the Philosophy Faculty: The USP (*Universidade de São Paulo*) in São Paulo in 1934, and the UDF (*Universidade do Distrito Federal*) in Rio de Janeiro in 1935. Both were institutions of the federal states of São Paulo and Rio de Janeiro (then its Federal District).

The fact that teaching of mathematics and physics at the polytechnic schools in Brazil had thus far only been given as a service function had the remarkable consequence that there were no scientists in Brazil who could be called for these new faculties!

¹¹ A.C. Ferreira, *A Faculdade de Filosofia, Ciências e Letras de Minas Gerais e a primeira Licenciatura em Matemática do estado*, [in:] *Histórias de formação de professores que ensinaram matemática no Brasil*, ed. by A.C. Ferreira et al., 2nd ed., EDUFBA, Salvador 2018, p. 120.

One characteristic that stands out in the organisation of the USP and UDF is the priority given to hiring foreign professors to form the faculty. In the conception of their founders, the university could only be considered different from existing faculties if it brought experience from places considered developed and civilised. To promote this search for foreign scientists, Fernando de Azevedo and Theodoro Ramos (1895–1937) did not accept the chairs of Sociology and Mathematical Analysis, respectively¹². Instead, the organisers of the USP sent a ‘headhunter’ – Ramos himself – to Europe to search for qualified scientists as professors! He went to France, Italy, and Germany. And he succeeded in finding such professors and bringing them quickly to Brazil. For mathematics, it was Italy from where mathematicians were transferred¹³. For the UDF, at first, Lélío Gama (1892–1981) was called, who together with Ramos was one of the few mathematicians who had acquired some fame. Due to decrees of the federal government demanding that professors serve in only one institution, Gama restricted himself to directing the National Observatory and left the UDF¹⁴.

The USP was created with a novel structure: besides the traditional faculties and schools, like the faculties of law, medicine, and the polytechnic school, there were two new elements:

- the *Faculdade de Filosofia, Ciências e Letras* (FFCL), assuming the functions of the Philosophical Faculty in Prussia, and
- the *Instituto de Educação*, for realising the pedagogical-didactic part of teacher training.

I alert the reader here to legends about this FFCL and its teaching functions, which are constitutive for the general conviction in Brazil of the last decades: firstly, to show the degree of mistaken ascriptions, and secondly to discuss – after their rectification – the reasons for the rise and perseverance of these legends, in a paper by the well-known historian of mathematics education, Maria Laura Magalhães Gomes, referring to various publications all affirming these ascriptions:

What I want to emphasise [...] about the first years of the mathematics course is the fact that they highlight the nature of the training provided by the Faculty of Philosophy in these first years, clearly distant from the perspective of preparing teachers for secondary school. Several authors (DIAS; LANDO; FREIRE, 2012; SILVA, 2002)

¹² F.F. de Araújo, *A contribuição de Lélío Gama no processo de construção de uma nova identidade para a ciência no Brasil*, PhD thesis (unpublished), Universidade Federal do Rio de Janeiro (UFRJ), Rio de Janeiro 2019, p. 72.

¹³ L.V. Souza da Lima, *A Missão Italiana da Faculdade de Filosofia, Ciências e Letras da Universidade de São Paulo: ciência, educação e fascismo (1934–1942)*, Master’s thesis (unpublished), School of Arts, Sciences and Humanities (EACH), University of São Paulo (USP), São Paulo 2015, p. 47 ff.

¹⁴ F.F. de Araújo, *A contribuição de Lélío Gama no processo de construção de uma nova identidade para a ciência no Brasil*, p. 88 f.

observe that the main function of the course was the preparation of mathematicians, leaving the goal of professional training of teachers in the background, subordinated to the training of scientists. To graduate as a secondary school teacher, the student, after obtaining a bachelor's degree in the first three years, should take a year of Didactics.¹⁵

As a matter of fact, the new faculty had neither the task of training mathematicians, nor did it provide a bachelor's degree: the only degree provided in the founding decree of January 1934 was the *licenciado* degree, which habilitated for the teaching profession at secondary schools (called *magistério*):

§ 1° – The licence for secondary teaching will be granted by the University only to the candidate who, having graduated in any of the sections in which he/she specialised at the Faculty of Philosophy, Sciences and Letters, has completed the pedagogical training course at the Institute of Education.¹⁶

Moreover, there was a revealing conception of providing the pedagogical-didactic qualifications. This part of the formation had to be studied at the *Instituto de Educação*, now an institution of higher degree at the USP, developed from an *escola normal* for primary teacher training! There, practical stages were also part of the formation:

§ 2° – The candidate for secondary teaching, having chosen the section of knowledge in which he/she intends to specialise at the Faculty of Philosophy, Sciences and Letters, may simultaneously take the pedagogical training course at the Institute of Education in the 3rd year.¹⁷

The principal task of this Institute was the training of teachers, even for all school levels:

The Education Institute [...] will participate in the University exclusively through its Teachers' College, although the Complementary Course, the Secondary School, the Primary School and the Kindergarten will be administratively and technically subordinate to it as attached institutes, intended for experimentation, demonstration and practice of teaching and for the professional internship of the students of the Teachers' College.¹⁸

The foundation of the USP in 1934 was followed in 1935 by the foundation of the UDF: *Universidade do Distrito Federal* – Rio de Janeiro was then

¹⁵ M.L.M. Gomes, *Os 80 anos do primeiro curso de Matemática brasileiro: sentidos possíveis de uma comemoração acerca da formação de professores no Brasil*, "Bolema" 2016, vol. 30, no. 55, p. 429.

¹⁶ São Paulo (Estado), Decreto n. 6.283, 25.01.1934 (Interventor Federal), 'Crea a Universidade de São Paulo', Título II, Capítulo I, art. 5, § 1, leginf.usp.br/historicas/decreto-n-o-6-283-de-25-de-janeiro-de-1934/ [accessed 18.12.2025].

¹⁷ *Ibidem*, § 2.

¹⁸ *Ibidem*, Art. 5.

a federal district, as the capital of Brazil, like Washington for the United States. Its founding decree stipulated – besides emphasising the promotion and stimulation of culture and encouragement of research in science, humanities, and arts – the exclusive task: ‘to provide the formation for the *magistério*, in all its degrees’¹⁹.

Its structure was quite analogous to that of the USP – two separate faculties for the sciences and for philosophy and humanities, called ‘schools’, and none for medicine, as it was already instituted at the *Universidade do Rio de Janeiro*. Again, a key role for the Institute of Education in realising the pedagogical-didactic component of teacher training was named as the first of six components of the UDF:

The Institute of Education, whose task is to provide training for teachers and, as a documentation and research center, to contribute to the formation of a national pedagogical culture, is directly incorporated into the University through its current School of Teachers [...].²⁰

Yet more explicitly, all the study courses offered at the UDF were listed in an Instruction, accompanying the decree, defining each one as a ‘curso de formação do professorado secundário’, organised for teacher training for secondary schools, and listing the ‘*Curso para professor de Matemática*’ as the first among ten such study courses²¹.

Different from the USP, studies of the subject matter were not only coupled with the pedagogical component, but also with a type of ‘studium generale’, requiring the study of foreign languages, design, philosophy, etc., in the first and the second years of the course. The pedagogical-didactic component had, here also, to be studied in the third and last year of studies. It showed a remarkably broad conception of this component, besides the not yet established discipline of mathematics education. Six parts had to be studied: Introduction to teaching; philosophy of education; psychology of the adolescent; educational measures; organisation and curricula of secondary school teaching; and teaching practice²².

¹⁹ M. de L.A. Fávero, *Faculdade Nacional de Filosofia*, vol. 1, Editora UFRJ, Rio de Janeiro 1989, Anexo 2: Decreto n. 5513, 04.04.1935, Art. 2, p. 59.

²⁰ *Ibidem*, Art. 4, p. 61.

²¹ PROEDES (Centro de Documentação da Faculdade de Educação, Universidade Federal do Rio de Janeiro – UFRJ), Rio de Janeiro, Arquivo da Universidade do Distrito Federal, *Instruções n. 3. Regulam os Cursos de Formação do Professorado Secundário nas Escolas de Ciências, Economia e Direito e Filosofia e Letras*, 07.1935, p. 31.

²² *Ibidem*, p. 32.

Documenting the primacy of teacher training at the USP and UDF

Documents from the first years of the USP confirm that the practice of the courses was the task of teacher training. For instance, in the first *Anuário* of the FFCL – its annual report – for 1934, the primacy of teacher training according to scientific standards was highlighted:

That is why the creation and operation of the Faculty of Philosophy, Sciences and Letters at the University of São Paulo in 1934 was immediately established with the aim of giving teaching a scientific character and making it possible to prepare for the profession of secondary school teachers.²³

And in the third *Anuário*, for 1936, the Faculty's director, in his speech at the 'solemn session for deferring diplomas' to the first group of graduates, emphasised this again:

And, if the Faculty of Philosophy, Sciences and Letters could decide between its two purposes – that of training teachers for our secondary education and that of encouraging scientific production – it would naturally be the first that would initially be its preference.²⁴

The list of these first graduates confirms that all of them were *licenciados*; Fig. 1 reproduces the list of the first mathematics graduates.

Os primeiros licenciados pela Faculdade de Filosofia, Ciências e Letras da Universidade de São Paulo são os seguintes:

Sub-seção de Ciências Matemáticas:

- 11 — Cândido Lima da Silva Dias
- 12 — Carmelo Damato
- 13 — Fernando Furquim de Almeida
- 14 — Júlio Rabin
- 15 — Mário Schöenberg

Fig. 1. The first students graduated as mathematics teachers at the USP in 1936.

Source: *Anuário da Faculdade de Filosofia, Ciências e Letras da Universidade de São Paulo 1937*, USP, Seção de Publicações, São Paulo 1938, p. 190.

²³ *Anuário da Faculdade de Filosofia, Ciências e Letras da Universidade de São Paulo 1934–35*, USP, Seção de Publicações, São Paulo 1935, p. 215.

²⁴ *Anuário da Faculdade de Filosofia, Ciências e Letras da Universidade de São Paulo 1937*, USP, Seção de Publicações, São Paulo 1938, p. 186.

Likewise, the first students who graduated in mathematics at the UDF in 1938 also all obtained the *licenciado* as secondary school teachers in a solemn ceremony. There were 11 students²⁵.

Having thus shown that the general conviction, dominant today in Brazil, that the first two Philosophy Faculties in Brazil were founded for forming mathematicians is completely anachronistic – as is already evident when one considers that then existed no career patterns for mathematicians – one could ask now whether there was an intended formation of scientists at the USP and at the UDF.

In fact, there was: a formation of scientists was conceived of in the founding decree – but not as an alternative to teacher training, and instead as a continuation of study after the *licenciado* degree. At the FFCL, for example, a second degree had been defined: the *doutorado*. Students who had obtained the teaching licence could obtain the doctoral degree by studying and researching for two additional years.²⁶ And there were students who continued. For instance, the first who obtained this doctoral degree was Cândido Lima de Silva Dias, in 1942, one of the first five students who had qualified as a mathematics teacher in 1936. He then became a professor of mathematics at the USP.

The changing relation between the *bacharel* and the *licenciado* in Brazil

So, what is the problem of present Brazilian historiography with the relation between *bacharel* and *licenciado*? Let us first have a look at the history of university degrees, which clearly originates from the Middle Ages. Traditionally, the degrees of the medieval universities had been:

- *baccalaureus* (finishing the studies in the Artes Faculty),
- *licentia docendi*,
- sometimes, as an equivalent: *magister*,
- *doctor*.

Thus, the *baccalaureus* had been the lowest possible degree, for those who had finished a first formation but not begun a professional career.

Which were the first degrees for mathematics in Brazil? This used to be ascribed to the Military Academy in Rio de Janeiro. Actually, its degree structure was for the engineers and became defined only in 1842/1846 as a study course of 7 years. It was stipulated that those who had been approved in the subjects of the 7th year of their course could obtain the title *bacharel*, and those who were

²⁵ L.J.B. de Vincenzi, *A fundação da Universidade do Distrito Federal e seu significado para a educação no Brasil*, “Fórum Educacional” 1986, vol. 10, no. 3, p. 24.

²⁶ São Paulo (Estado), Decreto n. 6.283, 25.01.1934 (Interventor Federal), Título II, Capítulo I, Art. 12.

moreover fully approved in all the subjects in all the 7 years could obtain the *doutor em ciências matemáticas* (as an engineer...) ²⁷.

Thus: the bachelor's degree was conferred as in Medieval Times: confirming completion of a first formation but without a professional career.

In Brazil, the change in the valuation of the *licenciado* degree expresses the same anachronism as the ominous Bologna process: in 1999, the rectors of European universities decided to impose on the countries of the European Community the badly understood academic structure of a few leading US universities. In particular, they introduced a new intermediate degree of the bachelor's. It was maintained that such a first, intermediate degree would reduce the number of early dropouts preoccupying them.

A certain legitimation for the wrong affirmations about the bachelor's degree

This legitimation arose from drastic political changes in Brazil, brought about by Getúlio Vargas (1882–1954), that affected the education system. Vargas became president in 1930, initially by a coup. He initiated a strong policy of centralisation, in particular of education, by establishing federal competence for it, while previously the provinces – respectively federal states – had organised education autonomously. In the same vein, he established federal legislation for universities. In a decree of 1931, it was demanded that the University of Rio de Janeiro have a Faculty of Philosophy and Science. For this university – renamed the Universidade do Brasil to express that it should be the national model for universities – it was defined again in 1937 that it must have such a Faculty. A new decree of 1938 defined even the structure of this Faculty, renamed now, following the pattern of the USP: Faculdade Nacional de Filosofia, Ciências e Letras (FNFil). This federal university had existed since 1920, but – and despite all these decrees – it still lacked such a Faculty. All the while there was such a Faculty in the other university in the same city of Rio de Janeiro, the UDF.

The solution for this situation was provided in a double coup by President Vargas. The first one occurred in 1937: Vargas eliminated the republican system, declared Brazil to be the *Estado Novo*, and established himself as its dictator. The second one occurred in 1939: he dissolved the UDF and integrated it into the Universidade do Brasil, finally providing it with the long missing Faculty, obtain-

²⁷ The Imperial decree of 29.09.1846 establishing the criteria for the *bacharel* and *doutorado* degrees is published as Anexo H in the PhD thesis: H.J.F. Moreira, *Escola Central: a academia do Largo de São Francisco de Paula que consolidou o ensino da engenharia civil no Brasil*, PhD thesis (unpublished), Universidade Federal do Rio de Janeiro (UFRJ), Rio de Janeiro 2014, p. 260–263.

ing the name FNF*i*. The headhunting for the mathematics professors occurred this time via the Italian embassy in Brazil²⁸.

While the liberal conception of the UDF changed to the conservative policy of Vargas, teacher education remained, however, a key task for the central government. Vargas' Minister of Education Gustavo Capanema (1900–1985) explained to Vargas in his proposal for dissolving the UDF:

The draft of the decree-law, organising the National Faculty of Philosophy [...], undoubtedly represents one of the safest and most decisive steps attempted in our country, towards the task of giving national education and culture solidity and elevation.

First of all, secondary education will receive considerable benefits. There is much talk about the decline of our secondary education. [...] This form of education has never been of the first order in our country. [...] In this area, the right, useful and vital renewal can only start from an essential basis, namely, the preparation of a large body of teachers, knowledgeable in the subjects of the curriculum and masters in the profession of teaching.²⁹

Capanema did not comment upon the introduction of the bachelor's diploma in the 1939 decree, suggesting that it did not imply a structural change. He had well emphasised the two components of teacher training. But the decree-law of 1939, defining the structure and functioning of the FNF*i*, introduced two diplomas: the bachelor's and the teaching licence, as a sequential order. The first degree should be the bachelor's; after finishing the study of the subject matter:

Art. 48. Students who complete the ordinary courses [...] will be conferred the following bachelor's degrees, respectively: [...]

2) Bacharel em matemática.

The teaching licence should now be conferred to those who had completed the entire course:

Art. 49. The bachelor's degree holder, graduated under the terms of the previous article, who regularly completed the didactics course referred to in art. 20 of this law, will be conferred the *licenciado* degree in the group of subjects that form his/her bachelor's degree course.³⁰

In this study structure of the FNF*i*, a doctoral degree was defined, too, but now as a continuation of the subject matter studies, that is, after having obtained the bachelor's degree:

²⁸ V. Mendes, *Os Primórdios do Desenvolvimento da Análise no Brasil e o Surgimento de Uma Comunidade Matemática*, Editora SBM, Rio de Janeiro [2025], forthcoming, p. 111.

²⁹ G. Capanema, *Exposição dos motivos apresentada ao Presidente da República*, 27.03.1939, [in:] M. de L.A. Fávero, *Faculdade Nacional de Filosofia*, Anexo 7, p. 93–94.

³⁰ Brasil (União), Decreto-Lei n. 1.190, 04.04.1939, 'Da organização à Faculdade Nacional de Filosofia', Arts. 48–49, https://www.planalto.gov.br/ccivil_03/decreto-lei/1937-1946/del1190.htm [accessed 18.12.2025].

Art. 48, § 1. The doctoral degree will be awarded to a bachelor's who defends an original thesis of notable value, after at least two years of studies, under the guidance of a professor of the discipline on which his/her work is based.³¹

This decree even defined the curriculum for the various courses to be taught at the FNFi. The curriculum for the mathematics course is revealing, showing the impressively developed pedagogical-didactic component in a period when mathematics education as a discipline did not yet exist (Table 1):

Table 1. The curriculum for the mathematics course at the FNFi.

<p>The mathematics course will last three years and will comprise the following series of subjects:</p> <p>First series</p> <ol style="list-style-type: none"> 1. Mathematical analysis 2. Analytical and projective geometry 3. General and experimental physics <p>Second series</p> <ol style="list-style-type: none"> 1. Mathematical analysis 2. Descriptive geometry and complements of geometry 3. Rational mechanics 4. General and experimental physics 	<p>The didactics course will last one year and will consist of the following subjects:</p> <ol style="list-style-type: none"> 1. General didactics 2. Special didactics 3. Educational psychology 4. School administration 5. Biological foundations of education 6. Sociological foundations of education
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Source: Brasil (União), Decreto-Lei n. 1.190, 04.04.1939, 'Dá organização à Faculdade Nacional de Filosofia', Capítulo III, Seção II, and Seção XII (Art. 20), https://www.planalto.gov.br/ccivil_03/decreto-lei/1937-1946/del1190.htm [accessed 18.12.2025].

In Brazil, one typically characterises the structure of this curriculum as the '3 + 1' formula. The literature about mathematics teacher training often denounces it as a non-adapted form³², without being aware of the conditions and conceptions available in the first decades of these regulations. Likewise, international comparisons for verifying the situation and structure of mathematics teacher training in other countries have not been made.

It is important to remark that the formula '3 + 1' never appeared in any official document, nor did the 1939 decree establish a sequence of the first three subject years followed by the didactics year. This year was to be studied in parallel manner, as at the USP and the UDF. The change to four years of studies, a true sequence of '3 + 1' years, occurred only in 1941 by an additional federal decree:

³¹ Ibidem.

³² See the critical reflection: P.C. Moreira, *3 + 1 e suas (In)Variantes (Reflexões sobre as possibilidades de uma nova estrutura curricular na Licenciatura em Matemática)*, "Bolema" 2012, vol. 26, no. 44, p. 1137–1150.

From the 1942 school year onwards, students in the faculties of philosophy, science and humanities will not be able to take a didactics course simultaneously with any bachelor's degree course.³³

Why was the bachelor's degree introduced in 1939?

As a matter of fact, this question has never been investigated hitherto – most probably because one assumes that this degree had been integrated since the creation of the new universities. There exists in Rio de Janeiro a voluminous archive containing the entire activity of Capanema as Minister of Education. It contains a large file concerning the preparation of the decree-law for the FNFi. Its documents show that the introduction of the bachelor's degree was highly controversial within the Ministry. There are 22 different versions for elaborating the final version. One of the points formulated differently in most of the versions is precisely the use of *licenciado* or *bacharel*. There are versions with only *licenciado*, there are versions with *licenciado* but torn out and replaced by *bacharel* and others closer to the final version with *bacharel* and *licenciado*. Fig. 2 shows an example of a version where the originally written *licenciado* was torn out and replaced.

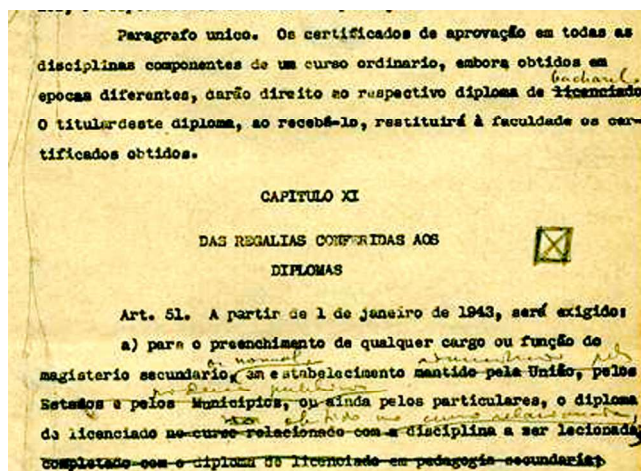


Fig. 2. An example of substituting *licenciado* with *bacharel*. Compare with the quoted final version of Art. 48.

Source: Centro de Pesquisa e Documentação de História Contemporânea do Brasil, Fundação Getulio Vargas, Rio de Janeiro, Arquivo Gustavo Capanema (arquivo pessoal), GC g 1936.01.18, FNFi, f. 323.

The usurpation of the UDF by the Federal Government and its use for creating the FNFi in Rio de Janeiro had an enormous positive impact throughout Brazil.

³³ Decreto-Lei n. 3454, 24.07.1941, [in:] *Legislação Federal do Ensino Superior (LFES) – 1825–1952*, ed. by Reitoria da Universidade de São Paulo (RUSP), São Paulo 1953, p. 261.

Such Philosophy Faculties for teacher training were established at an ever-growing number of capitals of the federal states. The formula '3 + 1' characterised the practice of study for several decades.

The archives about the exams and degrees conferred show that almost all students chose the *licenciado* degree, to become teachers, and very few remained satisfied with the degree certifying their subject-matter studies. The report on the graduation results of 1952 at the USP-FFCL can serve as an example:

**No ano letivo de 1952, concluíram o Curso na Faculdade, 2
bacharéis e 134 licenciados.**

Fig. 3. The 1952 graduation results in the FFCL of the USP.

Source: *Anuário da Faculdade de Filosofia, Ciências e Letras da Universidade de São Paulo 1952*, USP, Seção de Publicações, São Paulo 1954, p. 47.

As happened globally, becoming a mathematics teacher ceased to constitute the only career option for studying mathematics after WWII, and more specifically from the 1960s. Now, career options opened, and they became socially more valued than the teaching profession.

Brazilian historiography has re-projected this value system anachronistically into the origins, unaware of the true origins at USP and UDF and of the bachelor's degree as an intermediate one, far from intending a career for mathematicians. In the same vein, the '3 + 1' formula has been denounced as expressing a domination of mathematics education by mathematics.

While '3 + 1' was never established by decree, it is difficult to say when it became abolished. Yet, clearly, the curricula for teacher training in Brazil provided an articulation between mathematics and the professional components for teaching for decades.

Instituting university teacher training by 1900: the cases of Italy and Portugal

One should verify whether there were significant new structures for teacher training introduced in other states by 1900.

A first case is Italy. After its unification, it took some time to establish teacher education for secondary schools. It occurred eventually in 1875, with the founding of the *Scuole di Magistero*, attached to universities. Their history has been carefully studied by Livia Giacardi (2013). Of the 21 universities, only eight created these *Scuole*, and only three opened courses in mathematics. Their conception was to combine studies of subject matter and preparation for teaching. The functioning of these *Scuole* was not stable, due to frequent ministerial decrees. In the first regulations, it was stipulated that students preparing to teach should

be instigated to ‘the attitude of research and of original exposition’ of their discipline³⁴, perhaps inspired by the Prussian model. In 1888, a decree fixed the task as practical preparation for secondary teaching.

An additional problem was the dearth of mathematics teachers: due to highly selective social structures, those who eventually accessed university studies ‘rarely chose to study in faculties that led to low-earning careers as letters, philosophy and mathematics’³⁵.

In 1920, the Scuole were suppressed; in 1921, there was a certain substitution by a so-called ‘combined degree’ in physical and mathematical sciences, established with the aim of qualifying young people to teach scientific subjects in secondary schools. In 1922, a course in complementary mathematics (*matematiche complementari*), accompanied by didactic and methodological exercises was introduced. There, formation focused upon elementary mathematics, largely following Felix Klein’s conception of *Elementary Mathematics from a Higher Standpoint*. A national report, in 1933, showed the lack of institutions for professional teacher training³⁶.

Portugal presents pertinent institutional developments. There, a system of public secondary schools had been established only in 1836. Despite the structure of the Faculty of Mathematics of 1772, mathematics teachers for these new schools were chosen by *concurros* – public examination competitions – without any regulation for the formation of such teachers. This situation began to change profoundly by the end of the 19th c. Eventually, in 1901, such formation was established as a higher education study course of four years. The first three years were for studying the subject matter, at an institution of higher education. And the fourth year was for pedagogical formation, to be realised in the capital, Lisbon, at a special *Curso Superior de Letras* dedicated to psychology, logic, pedagogy, history of pedagogy and methodology of secondary teaching. Thus, this meant a first case of a ‘3 + 1’ course for teacher training³⁷.

³⁴ L. Giacardi, *I matematici e la formazione degli insegnanti in Italia nel primo Novecento*, [in:] *La formazione degli insegnanti di matematica. L’esperienza italiana a confronto con alcune esperienze europee*, ed. by L. Catastini, F. Ghione, E. Rogora, Università Bocconi, Milan 2013 (PRISTEM/Storia. Note di Matematica, Storia, Cultura, no. 36–37), p. 62.

³⁵ F. Furinghetti, L. Giacardi, *Secondary school mathematics teachers and their training in pre- and post-unity Italy (1810–1920)*, “ZDM – The International Journal on Mathematics Education” 2012, vol. 44, no. 4, p. 541.

³⁶ L. Giacardi, R. Scoth, *Secondary School Mathematics Teaching from the Early Nineteenth Century to the Mid-Twentieth Century in Italy*, [in:] *Handbook on the History of Mathematics Education*, eds. A. Karp, G. Schubring, Springer, New York 2014, p. 222.

³⁷ A. Santiago, J.M. Matos, *Os professores de matemática dos liceus: acesso à profissão e formação (1836–1930)*, [in:] *A matemática e o seu ensino na formação de professores. Uma abordagem histórica*, ed. by J.M. Matos, Associação de Professores de Matemática (APM) e UIED, Lisboa 2018, p. 214–215, 221–222.

The revolution of 1910, achieving the fall of the monarchy and the rise of the Republic, effected an innovative establishment of teacher education, due to the now high valuation of education. The government founded, in 1911, two *Escolas Normais Superiores* – inspired by the French name of the ENSs but with a different conception. These ENSs were attached to the Faculty of Letras e de Ciências at the now two Portuguese universities. Now, a complete organisation and curriculum for teacher education was established. The first part was the subject matter studies, to be studied for three years at a university or polytechnic. Passing an exam, teacher candidates would obtain the degree *bacharel* and could present it to enter the entrance exam for the ENSs. The studies comprised two more years; the first was devoted to general pedagogy and psychology, methodology of teaching mathematics and the sciences, and school organisation and curricula; whereas the second year provided intensive practical preparations for teaching, from observations of classroom practice to teaching rehearsals accompanied by mentors. This meant a formula not realised in any other country: ‘3 + 2’³⁸. This elaborated structure of teacher education, in particular for mathematics, was eliminated in 1930 with the putsch establishing the dictatorial period in Portugal³⁹. It is reasonable to assume that these Portuguese structures for teacher education were known in Brazil and in the Ministry of Education.

Conclusion

It constitutes the most ironic metamorphosis that the bachelor’s degree, the lowest academic degree since the Middle Ages, documenting only to have finished a certain part of one’s studies – and imposed again as the new first academic degree when the degree system of European states became Americanised⁴⁰ by the Bologna process – was transformed into the more highly valued degree in Brazil. A metamorphosis having occurred so completely that the origin of the rise of genuine mathematics teaching and research in Brazil is unknown to its communities of mathematics and mathematics education.

The case of Brazil with the change of meaning of the two degrees for mathematics students, *bacharel* and *licenciado* – and the inversion of the social value of the professional values attributed to them – calls for an international comparative investigation about the development of the relation between the formation for future mathematics teachers at secondary schools and that for practicing

³⁸ According to José M. Matos (Lisbon), there were no intended and realistic career options for graduates having achieved only the *bacharel* degree, until the 1970s (personal communication).

³⁹ A. Santiago, J.M. Matos, *Os professores de matemática dos liceus: acesso à profissão e formação (1836–1930)*, p. 216 ff. Even after the dissolution of the ENS, the two years of pedagogical-didactic formation were maintained. I am thanking José M. Matos for this information.

⁴⁰ It is worth recalling that the bachelor’s degree, being so characteristic of US-American university structures, had originally been ‘imported’ from English universities.

mathematics. Were they instituted as parallel, as separated, or as intertwined for a certain period?

A few indications about this development in Germany should serve to indicate another such constellation. The other German states introduced an exam for future mathematics teachers, following Prussia as a model, but with less weight on the scientific character of the subject matter studies. It is characteristic that the profession of mathematics teacher continued to be practically the only career prospect for those studying mathematics in Germany throughout the entire 19th c. and until the mid-20th c. A first differentiation of the teacher licence was introduced in 1898, upon an initiative by Felix Klein: the teaching licence for applied mathematics. Regrettably, there is as yet no research on how far this second licence had been studied for and been conferred. One does not know the number of these licences in relation to the traditional one in pure mathematics, and whether such graduates actually did become teachers and in which type of schools⁴¹.

A definitive new degree emerged within the Technische Hochschulen – the parallel higher learning institutions for engineering studies. There was a general department, providing studies in mathematics and the sciences. A degree for students of this general department was, apparently, first established in the 1920s at the technical college in Danzig (after WWI no longer part of Germany): the *Diplom-Mathematiker*. This degree, conferred by the university or the technical college itself, thus no longer by the state as in the case of access to public education, was introduced generally in Germany in 1942 by the central Nazi-government. After WWII, the *Diplom-Mathematiker* became the dominant career option for those studying mathematics in Germany⁴².

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⁴¹ G. Schubring, *Pure and Applied Mathematics in Divergent Institutional Settings in Germany: the Role and Impact of Felix Klein*, [in:] *The History of Modern Mathematics*, vol. 2: *Institutions and Applications*, ed. by D. Rowe, J. McCleary, Academic Press, Boston 1989, p. 192.

⁴² *Ibidem*, p. 191–192.

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