

# THE MATHEMATICS IN THE POLYTECHNIC ACADEMY OF PORTO

(Portugal, 1837-1911)

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## ABSTRACT

The Polytechnic Academy of Porto (PAP, 1837-1911) was created in 1837, and replaced the Royal Academy of Navy and Trade Affairs of the City of Porto (RANTACP, 1803-1837). Its creation brought a new paradigm to higher education in Porto, because several engineering courses were then implemented – before that, the focus was on the formation of traders and navy sailors – and it was the first school in Portugal dedicated to engineering outside the military context (it should also be highlighted that Mathematics occupied a central role in its curricula). This work will be divided in three parts: The first part is a brief presentation of the RANTACP. In the second part, the Mathematics taught in the PAP will be presented, with special emphasis on three relevant moments of its history: its creation in 1837, the profound Reformation of 1885 which allowed its scientific apogee and its transition to the University of Porto in 1911. The third part will be a short presentation of the important Portuguese mathematician Gomes Teixeira (1851-1933) that arrived at PAP, as a professor, in 1884.

## 1 Introduction

The Polytechnic Academy of Porto (PAP, Academia Politécnica do Porto, 1837-1911) was created in 1837, and replaced the Royal Academy of Navy and Trade Affairs of the City of Porto (RANTACP, Academia Real de Marinha e Comércio da Cidade do Porto, 1803-1837). The creation of these two institutions was the beginning of superior teaching in the city of Porto. Both academies had an important curriculum in the field of mathematics and was the first time that the «higher» mathematics was taught outside the cities of Coimbra (where the single University (1290-) of the country at the time was located; note that the Faculty of Mathematics of this university was created in 1772) and Lisbon (with several academies within the military context, of which the most important was dedicated to the navy: the Royal Academy of Navy, Academia Real de Marinha (1779-1837)).

Both academies in Porto faced many difficulties during their implementation but, at the turn to the 20<sup>th</sup> century, the PAP was in its scientific apogee and in some aspects could be analogous to the University of Coimbra and to the Polytechnic School of Lisbon (which replaced the Royal Academy of Navy in 1837), the two most important schools in Portugal at that time. In fact, after the implementation of the Republic in Portugal in 1910, three similar faculties of sciences in the cities of Lisbon, Coimbra and Porto were created in 1911.

The most important scientist of PAP was, by far, the mathematician Gomes Teixeira. Note that Teixeira was the most important Portuguese mathematician of his time and the only Portuguese with some reputation among the international community. His arrival as a professor to PAP, as we will see, was one of the most decisive moments of the institution.

## **2 The Royal Academy of Navy and Trade Affairs of the City of Porto (1803-1837)**

The official predecessor of PAP was the Royal Academy of Navy and Trade Affairs of the City of Porto, created in 1803. This institution was established to graduate and prepare navy pilots and traders. The need of the city of Porto to form good professionals in these two areas arises from the fact that, at the time, the trade (mainly in the area of wines and liquorish beverages) with Brazil and northern Europe was very intense and vital for the economy of the city and to the rest of the northern region of Portugal. The creation of RANTACP was based on two classes that had already existed at that time in the city: the Nautical Class (created in 1762) and the Drawing Class (1779). These two classes, as well as the RANTACP, were under the full responsibility of the General Company of Agriculture of the Vineyards of the Upper Douro (*Companhia Geral da Agricultura das Vinhas do Alto Douro*), except for the selection of professors, that only the King could do. Note that this private company had been created by the Marquis of Pombal in 1756, and had the monopoly of the wine trade in the Douro region (which included the famous Port wine), being controlled by influential personalities of the city. Note that it was the city itself that paid for these classes, by several taxes on wine and trade affairs, which was, at the time, a novelty in the Portuguese context. For the first time, a superior teaching institution was created without the financial support of the King or the state. We should also note that, in many situations like collecting taxes or constructing public roads, the Upper Douro Company substituted the state and managed many important aspects of the daily city life.

In addition to the two existing classes, the RANTACP added classes of Mathematics, Trade Affairs, English Language and French Language (Law of February 9, 1803). According to the Law Decree of July 29 of that same year, it was also decided to create a course of Rational Philosophy. What stands out of RANTACP statutes is the relevance of mathematics in the curriculum of this institution; this was evidenced by the existence of three mathematical years which were very similar to what was practiced in the Royal Academy of Navy from Lisbon:

- First year: Arithmetic, Geometry, Plane Trigonometry and their practical uses, and elementary principals of Algebra until the second degree equations;
- Second year: the continuation of Algebra and its applications to Geometry, Differential and Integral Calculus, followed by the fundamental principles of Statics, Dynamics, Hydrostatics, Hydraulics, and Optics;
- The third year: Spherical Trigonometry, and the Art of Navigation (theoretical and practical), followed by naval manoeuvre notions, and knowledge and practical uses of the astronomical and navy instruments.

Note that the second mathematical year, the most advanced one in terms of contents, was not mandatory for the pilots. The last year was very practical and should be complemented with reports about the navy voyages that the pilot students should perform to the northern Europe seaports.

The political and social context that accompanied the existence of this institution was very problematical<sup>1</sup>, making its implementation very difficult and it never achieved the scientific level of its «similar» in Lisbon. In fact, the mathematical production of the professors that composed the RANTACP was not very extensive but it was very important to begin to break the mathematical «exclusivity» from Coimbra and Lisbon. With the RANTACP the (higher) education of mathematics in Porto began.

### **3 The Polytechnic Academy of Porto (1837-1911)**

#### **3.1 The creation of Polytechnic Academy of Porto**

The PAP was created in January 13, 1837, by Passos Manuel (politician from Porto, who was at the time Minister of the Kingdom), replacing the ancient RANTACP. This new academy was created with substantially different objectives, focusing their studies on the several engineering courses then implemented:

155.º Article

The Royal Academy of Navy and Trade Affairs of the City of Porto that now should be designated by – Polytechnic Academy of Porto –; with the special aim of teaching Industrial Sciences, and should graduate:

1. Civil Engineers of all classes, such as Mines Engineers, Constructors Engineers, Bridges and railroads Engineers;
2. Navy officers;
3. Sailors;
4. Trade business men;
5. Farmers;
6. Factory managers;
7. Artists.<sup>2</sup>

In fact, at that time, the socio-economic context in Porto had changed dramatically since Brazil had become independent in 1822 and the city began to attend a process of some industrialization. Note that, despite the changes introduced in 1837, the graduation of navy pilots and traders continued formally to be part of the studies. However, aspects related to navigation would lose relevance throughout the life of PAP, having completely disappeared, as we will see later, in the reformation of 1885. The trade affairs survived in the PAP curricula until the end of its life, but were always losing importance in comparison to engineering and other sciences such as mathematics, chemistry or natural history.

At the time of creation of PAP, eleven disciplines (divided in four sections) were introduced, namely:

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<sup>1</sup> It should be highlighted the Napoleonic invasions (1807-1811) which occupied the city; the Portuguese Liberal Revolution of 1820 and the civil war of 1832-34 which was particularly violent to the city of Porto and which opposed the liberal troops of D. Pedro to the absolutist troops of D. Miguel (the siege of the city lasted more than a year).

<sup>2</sup> *Collecção...*, 1837; pp. 52-53; original is in Portuguese.

- Mathematical section: 1. Arithmetic, Elementary Geometry, Plane Trigonometry, Algebra until the second degree equations; 2. Continuation of algebra, and its application to geometry, Differential and Integral Calculus, Principles of mechanics; 3. Descriptive geometry, and its applications; 5. Spherical Trigonometry, Principles of Astronomy and Geodesy, Theoretical and practical Navigation; 6. Artillery and Naval Tactics.
- Philosophical section: 7. Natural history of the three kingdoms of nature applied to Arts and Crafts; 8. Physics and industrial mechanics; 9. Chemistry and mines; 10. Botanic, Agriculture and rural economics, Veterinary.
- Drawing section: 4. Drawing.
- Trade affairs section: 11. Trade Affairs and industrial economics.

This structure changed slightly over the time, with PAP reaching to thirteen disciplines in 1885 [Pinto, 2013, pp. 116-128]: elimination of Artillery and Naval Tactics (6<sup>th</sup>) in 1844; creation of the discipline of Political economy and principles of commercial and administrative law (12<sup>th</sup>) in 1857; creation of the discipline of Applied mechanics to civil constructions (13<sup>th</sup>) in 1868 and restoration of the 6<sup>th</sup> discipline in 1883 (now dedicated to Mineralogy, geology, metallurgy and mining). Note that some graduations of PAP were eliminated in 1868, leaving only the three engineering graduations (1.), the graduation of Pilots (3.) and the graduation of Traders (4.).

It should be noted that the creation of these academies in Porto was an attempt to replicate the similar schools that existed in Lisbon at the time. The Porto academies were strongly influenced by what was practiced in Lisbon and not (at least in a direct way) by the famous polytechnic academies that existed in France and in other European countries.

### 3.2 The Reformation of 1885

The 1885 Reformation of PAP was largely due to Wenceslau de Lima (1858-1919), who propose it in the parliament in his condition of deputy. Note that Wenceslau de Lima was a substitute professor of the PAP, nominated in 1882. Note also that the 1885 reformation began, somehow, in 1883 with the restoration of the 6<sup>th</sup> chair, which was proposed also by Wenceslau de Lima in the parliament; this discipline was assign to Wenceslau de Lima himself (*i.e.*, he was promoted to full professor). After this first step, on July 21, 1885, a more comprehensive and extensive plan for the reformulation of studies of PAP was approved by parliamentary initiative of Wenceslau de Lima. This reformation<sup>3</sup> included the redistribution of the topics of 3<sup>rd</sup> discipline by two disciplines; the same was done to the 6<sup>th</sup> and 9<sup>th</sup>

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<sup>3</sup> “Artigo 1.º A geometria descritiva e suas applicações, mechanica geral e cinemática actualmente professadas por um só lente na 3.ª cadeira da academia polytechnica do Porto serão lidas d’ora avante em duas cadeiras; por igual fôrma se procederá ácerca da mineralogia, geologia, metallurgia e lavra de minas (6.ª cadeira); e da chimica inorgânica e orgânica (9.ª cadeira); as disciplinas da 13.ª cadeira (mechanica applicada e construcções civis) serão distribuídas por três cadeiras.

§1.º O concelho academico procederá immediatamente á revisão dos programmas dos cursos legaes da academia polytechnica, ordenando e distribuindo as suas materias pelas dezoito cadeiras que ficam constituindo o seu quadro, ...” [Collecção..., 1886; p. 272]

disciplines; the 13<sup>th</sup> discipline was divided into three new disciplines. With these alterations, the number of PAP disciplines increased substantially, as five new disciplines were added to the thirteen previously existing. Note that the mathematical section of the PAP was one of the greatest beneficiaries of this reformulation of 1885, having enlarged from five to eight disciplines – the 3<sup>rd</sup> was divided into two, the 13<sup>th</sup> (the only discipline of PAP full dedicated to engineering itself) would be decomposed into three (12<sup>th</sup>, 13<sup>th</sup> and 14<sup>th</sup>). It should also be highlighted the fact that, for the first time in the academies of Porto, the PAP professors were responsible for deciding the programmes of the different disciplines, as well the structure of the graduations of the institution (previously, it was almost a copy from what was practiced in Lisbon).

Gomes Teixeira joined the PAP, as a professor, the year before, in 1884, having been assigned to the 2<sup>nd</sup> discipline (Differential and integral Calculus; calculation of differences and variations). In the first school year after the reformation, Gomes Teixeira also accumulated, temporarily, with the 4<sup>th</sup> discipline: Descriptive geometry. The name of Gomes Teixeira was already in the list of professors of PAP that had been sent in a representative letter to the parliament to seek approval of this very important reformation. On the other hand, it should be also noted that Gomes Teixeira had participated in the review of the discipline's programmes.

The disciplines approved by this reformation were the following:

- 1<sup>st</sup>: Analytic Geometry; Higher Algebra; Spherical trigonometry.
- 2<sup>nd</sup>: Differential and Integral Calculus; Calculation of differences and variations.
- 3<sup>rd</sup>: Rational mechanics; Kinematics.
- 4<sup>th</sup>: Descriptive Geometry.
- 5<sup>th</sup>: Astronomy and Geodesy.
- 6<sup>th</sup>: Physics.
- 7<sup>th</sup>: Inorganic Chemistry.
- 8<sup>th</sup>: Organic and Analytical Chemistry.
- 9<sup>th</sup>: Mineralogy, Paleontology and Geology.
- 10<sup>th</sup>: Botany.
- 11<sup>th</sup>: Zoology.
- 12<sup>th</sup>: Strength of materials and stability of buildings.
- 13<sup>th</sup>: Hydraulics and machines.
- 14<sup>th</sup>: Buildings and roads and railroads.
- 15<sup>th</sup>: Montanistic and docimasy.
- 16<sup>th</sup>: Economy policy. Statistic. Principles of public, administrative and commercial law. Legislation.
- 17<sup>th</sup>: Trade affairs.
- 18<sup>th</sup>: Drawing.

In this reformation the following graduations were still approved: 1. Civil Engineers: Public works, mines and industrial; 2. Trade affairs (the graduation of Pilots was eliminated).

Note that PAP, as previously, continued to do the preparatory studies to those who want to follow to the Army, to the military Navy (officers) or to the medical schools.

As can be easily seen, the engineering graduations also gained more importance in the statutes of PAP. Highlight also that each PAP engineering graduation had six years of duration while the graduation of trade affairs only had three. Note, however, that trade affairs did not last long in PAP and its correspondent discipline (17<sup>th</sup>) was replaced, in 1897, by the discipline of “Industrial Technology”, which further accentuated the feature of “engineering school” of PAP.

This reformation left out the graduation of “Pilots” that had been formalized in 1837. In fact, the reformation of 1885 eliminated all the remaining vestiges of the old navy academy. On the other hand, there was in the city the Industrial Institute of Porto (founded in 1864 to replace the former Industrial School, which had been established in 1852), an institution that was more focused and prepared than PAP to teach a more technical and practical education, as it was the case of, for example, the graduation of “Factory managers”.

The importance of this reformation was, without a doubt, vital for the PAP, because it allowed its expansion and consolidation as an “engineering school”, and to establish itself, definitely, as a higher educational and scientific institution (note that there had been some proposals to merge PAP with de Industrial Institute of Porto, with the last one in 1882). As stated by Magalhães Basto, perhaps with some exaggeration:

The Polytechnic Academy was safe at the end of almost fifty years of struggle! It was now at the level of their counterparts in Portugal! (...) In short, it can actually well be said that a new life began on that date.<sup>4</sup>

The reformation of 1885 was, in fact, and almost at all levels decisive for the PAP and allowed it to reach its scientific apogee. The coincidence between this reformation – remember that it has brought an increasing number of disciplines, the significant expansion of subjects taught, as well as an improvement of the material conditions – and the arrival of new and important professors of which stood out, inevitably, the name of Gomes Teixeira, allowed it an important increase in their academic and scientific activities.

### **3.3 The transition to the University of Porto**

With the reformation of 1885, the PAP formalized an approximation to the theoretical feature that existed in Coimbra and in Lisbon. Note that the Polytechnic School of Lisbon (school that replaced the Royal Academy of Navy in 1837), since its creation, was comparable to the University of Coimbra in terms of prestige and scientific level. For instance, in mathematics, there were many professors that were graduated in Coimbra but moved to the Polytechnic of Lisbon and were very active in the Royal Academy of Sciences of Lisbon (created in 1779).

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<sup>4</sup> “Salvara-se, quasi ao cabo de cinquenta anos de lucta, a Academia Politécnica! Ela estava agora a par das suas congêneres em Portugal! (...) Em suma, pode na verdade bem dizer-se que vida nova começou naquela data!” [Basto, 1937; pp. 414 e 418].

The PAP just reached this kind of scientific level at the end of the century with the arrival of Gomes Teixeira and the reformation of 1885.

This enormous improvement of PAP allowed the creation, in 1911, of the Faculty of Sciences of Porto, institution that formally replaced the PAP. Note that this was done by the new Portuguese republican regime (implemented in October of 1910), that had treated similarly the three cities (Coimbra, Lisbon and Porto) in the reformulation of the Portuguese higher education, creating three faculties of sciences very similar to each other. The University of Porto was then implemented with two faculties: Sciences and Medicine (replacing the ancient Royal Medical-Surgical School of Porto created in 1836). The structure of the Faculty of Sciences was divided into three sections: 1<sup>st</sup>, Mathematical sciences (1<sup>st</sup> group: Calculus and geometry; 2<sup>nd</sup> group: Mechanics and astronomy); 2<sup>nd</sup>, Physical and Chemical sciences (1<sup>st</sup> group: Physics; 2<sup>nd</sup> group: Chemistry); 3<sup>rd</sup>, Historical and Natural sciences (1<sup>st</sup> group: Geological Sciences; 2<sup>nd</sup> group: Biological Sciences). The Faculty of Sciences of Porto had also attached a School of Civil Engineering that was transformed in an autonomous Technical Faculty in 1915 (in 1926 changed its name to Faculty of Engineering).

Note that this change in 1911 it was not as significantly as it had been the reformation in 1885. In fact, the majority of professors of the PAP remained in their disciplines (the majority of them remained with the same subjects as before) and it was only need to implement minor adjustments in the new context. In fact, in a way, the decisive step towards the creation of a university in the city of Porto was done in 1885.

#### **4 The Portuguese mathematician Gomes Teixeira (1851-1933)**

This part will be a short presentation of the important Portuguese mathematician Gomes Teixeira (1851-1933, Figure 1) that arrived at PAP, as a professor, in 1884 – just one year before of the implementation of the Reformation of 1885, in which he participated (also highlight that he was nominated Director of PAP in 1886).



Figure 1. Portrait of Gomes Teixeira published in (*Anais...*, 1933, p. 4)

Note that, Gomes Teixeira was a respected mathematician in his time; for instance, he was included in the Patronage Committee of the first volume (1899) of the *L'Enseignement Mathématique* – it should also be noted that “among the authors [of this journal] there were [...] famous mathematicians (E. Borel, C. Bourlet, L. E. J. Brouwer, E. Czuber, G. Darboux, F. Enriques, M. Frechet, Z. G. de Galdeano, J. Hadamard, D. Hilbert, F. Klein, H. Lebesgue, B. Levi, C. Méray, P. Painlevé, H. Poincaré, F. Gomes Teixeira, H. Weyl, etc.)” [Coray et al, p. 33]. His international reputation was also manifested on the two honorary doctorates that he received from the Universities of Madrid in 1922 and Toulouse in 1923. He had also exchanged letters with some of the most important mathematicians of his time such as Levi Civita, Peano, Mittag Leffler and Hermite.

Gomes Teixeira made all his academic studies at the Faculty of Mathematics at the University of Coimbra (from 1869 to 1875, year in which he obtained his PhD degree). Gomes Teixeira enters the Faculty of Mathematics in 1876, first as substitute professor, having arrived in 1880 to full professor. However, he stayed shortly at the University, having been transferred in 1884 to the PAP (a short time after his transfer, he holds the position of Director of PAP; this kind of promotion could not have happened in Coimbra where the criterion was only the time of service). It should be noted that in those years Gomes Teixeira was deputy in the parliament having spent long periods in Lisbon (1879 and 1882-1884). Thus, it can be considered that Gomes Teixeira arrives to the PAP coming from the Parliament (the last session he attended was on May 17, 1884) rather than from the Faculty of Mathematics, despite its official disassociation with University of Coimbra just happened on that year.

In 1884, Gomes Teixeira asked and obtained his transfer to the PAP. In the words of Rodolfo Guimarães [Guimarães, 1918; p. 126], this happened due to family reasons. Almost all the existing literature on Gomes Teixeira makes exclusive reference to the family reasons as a justification for his transfer to PAP, although, in general, they are presented with no detail – the only exception is found in [Alves, 2004; p. 51] which states that, according to the testimony of his grandchildren, Gomes Teixeira “came to Porto to marry” (in fact, he married with a lady from a very important family from the city). It should also be noted that these reasons were presented in Gomes Teixeira lifetime and he could, if he wished, refute them. Since there is no knowledge of such an initiative by Gomes Teixeira, we can assume that, in fact, “family reasons” were one of the factors that led him to move to Porto, or alternatively, that Gomes Teixeira was comfortable with the public display of this reason (not creating any sort of embarrassment to Gomes Teixeira nor to the University and the Faculty of Mathematics; note that he showed, throughout his life, public recognition and appreciation for these two institutions).

Since decisions of this magnitude are taken almost always taking into account various factors, we must consider, potentially, other reasons that have contributed to this decision. In [Pinto, 2013; pp. 289-354] are presented two other possible factors: the existence of conflicts between the professors of the Faculty of Mathematics and the deep reformation that PAP suffered in 1885, by the political action of Wenceslau de Lima, colleague (from the political party and PAP) and friend of Gomes Teixeira.



Although there are several examples of conflicts into the Faculty of Mathematics, we are only presenting the most important that involved Gomes Teixeira. This episode happened in 1879 and was triggered by a proposed law in parliament with the intent to change the subjects of the 4<sup>th</sup> discipline (beyond the descriptive geometry, this discipline should also teach “Superior Geometry”). This law had been proposed in parliament by Rocha Peixoto and Gomes Teixeira (both members of the parliament and they were also the two youngest professors of the Faculty of Mathematics...). They presented this law without giving any advance warning to the others professors of the Faculty of Mathematics and, even worse, without asking for previous agreement of the professor of that discipline. As expected, the Faculty of Mathematics, by unanimity (the two proponents of this law were in Lisbon and did not participate in this decision), decided to complain by letter (with very harsh words) to the parliament against the proposal and this law was not approved (highlight the gravity of the situation: the Faculty strongly refused a law proposed by two of its members...). Note that this episode was a public disapproval of his conduct and should have been very unpleasant for Gomes Teixeira (note that Gomes Teixeira never said anything about this question). Three years later, in 1882, Gomes Teixeira tried again in the parliament, now alone, to introduce the Superior Geometry at the Faculty of Mathematics but again the law was not approved (although this time, we did not find any reaction from the Faculty of Mathematics).

A pertinent question is to know if these events have actually contributed in some way to Gomes Teixeira’s decision to leave to the PAP. After what it was presented here, it seems clear that the Gomes Teixeira relationship with some of his colleagues would not be the best. The lack of courtesy to let them know of the proposed law and all subsequent reaction of the Faculty let foresee some problems within the Faculty. What was the intention of Gomes Teixeira to interfere in this manner in the affairs of a discipline that was not his and that had a well-defined owner? Would it be a test to his strength and his influence in changing the *status quo*? Or was it just a naive behaviour, due to youth, considering that his attitude would not be strongly rejected by the Faculty and, in particular, by the owner of the discipline?

Anyway, this episode is quite suggestive that, despite the scientific value of Gomes Teixeira as a mathematician (at the time, already far superior than his elderly colleagues), he would not have the permission, at least at this early stage of his career, to reform the Faculty without the consent and collaboration of his senior peers. Gomes Teixeira did not have to confront such problems in PAP: the new programs introduced in 1885 were produced by the PAP itself – Gomes Teixeira participated on that; the second discipline program was even «made for him», since it was based on his text of Infinitesimal Analysis (*Fragmentos de um curso de analyse infinitesimal*). In the following years, Gomes Teixeira wrote several didactic books, always in the field of Integral and Differential Calculus, his main scientific interest. These texts were used on his discipline, but also in the first discipline of PAP (Analytic Geometry, Higher Algebra and Spherical Trigonometry). On the first years he was also the professor of Descriptive Geometry (4<sup>th</sup> discipline). On the other hand, note that the majority of the mathematical professors of PAP were relatively young and must had been more receptive to Teixeira’s ideas (symptomatic is the fact that it had been possible to appoint as Director of the PAP a young newcomer, as it was the case of Gomes Teixeira in 1886).

Another reason that could be pointed out in the transfer of Gomes Teixeira to Porto is his close relationship with Wenceslau de Lima. Wenceslau de Lima was elected to the parliament for the first time in 1883, having shared several parliamentary activities with Gomes Teixeira (for example, they proposed some laws together and belonged both to the Public Education Committee which was related to higher education). From this contact, as well as by Gomes Teixeira's letters to Wenceslau de Lima which contain several exchanges of favours, it is possible to infer that Gomes Teixeira had a close relation<sup>5</sup> with him and he was aware of the intention of Wenceslau de Lima to improve the PAP, which were materialized in 1885, shortly after the transition of Gomes Teixeira to Porto. This reformation, as already noted, significantly improved the PAP, and this institution recognized the role of Wenceslau de Lima in its political implementation. The gratitude was such that Wenceslau de Lima had the privilege of seeing his portrait (Figure 2) published on the first page of the yearbook of PAP (1885-86, the first after the implementation of reformation) – usually on the first page of yearbooks only portraits of deceased professors appeared (most were already retired at the time of his death and appear portrayed in old age).



Figure 2. Portrait of Wenceslau de Lima published in (*Annuario...*, 1885, p. 3)

The publication of a portrait of someone so young (under thirty years) in the yearbook, honoring a personality in life, is truly indicative of the importance that the PAP gave to the reformation sponsored by Wenceslau de Lima (Gomes Teixeira wrote in the following yearbook that this honor was well deserved by Wenceslau de Lima).

Although there is no categorical and definitive answer about the motivations of Gomes Teixeira for moving to PAP (note that there are no indications by Gomes Teixeira himself on this subject), it is likely that these three factors may have contributed in some way to the change: family reasons, the existence of some conflicts in the Faculty of Mathematics and the “guarantees” that he had, given his relationship with Wenceslau de Lima, about the development and improvement of PAP.

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<sup>5</sup> There is also a reference in a text of Gomes Teixeira that he had done a trip to the Alps with Wenceslau de Lima in 1876 (note that both were very young at the time).

## 5 Conclusion

The Faculty of Sciences of the University of Porto (existing until today) succeeded two important institutions, the RANTACP and the PAP, which have always been linked to the city of Porto and to its real economic needs – the first institution formed traders and sailors when the commercial trades with Brazil were vital to the city; the second, an engineering school (since its foundation, a civilian one), was created to respond to the country's industrialization boost.

The two academies played a major role in the educational formation of the city's youth and made excellent contributions to raising the cultural and scientific level of the city, and, in general, the northern region. Although devoid of the status of universities, for its pedagogical action as by its scientific value, both can be considered true university institutes<sup>6</sup>

Note that the PAP, as expected, has contact points with both its predecessor and its successor – at the beginning, PAP still has some traces linked to the navy and to trade affairs that, over the time, disappeared. At the end of its existence, PAP became an important school of engineering and sciences, characteristics that were maintained during its transformation into the University of Porto.

It should be highlighted that RANTACP was a unique case of local initiative in Portugal and an embryo of a decentralized higher education that only later would be fully accomplished, creating the foundations that allowed the later establishment of a true engineering school in the city of Porto.

The PAP has reached its scientific peak in the 1880s. The arrival of the mathematician Gomes Teixeira in 1884 allowed this institution to have, for the first time, a recognized top scientist, which gave it a scientific and institutional legitimacy that never before had been achieved. Another decisive event, almost simultaneous with the arrival of Gomes Teixeira to Porto, was the Reformation of 1885 where the PAP formalized, in many aspects, an approximation to a more theoretical school, similar to those that existed in Coimbra and in Lisbon. It should be highlighted again the name of Wenceslau de Lima by his action on the implementation of this reformation of PAP:

A man of Porto [Passos Manuel] created the Polytechnic Academy; another man of Porto had given it, forty eight years later, the pedagogical elements that were most needed so that, with dignity, the Academy could fully accomplish its purposes.<sup>7</sup>

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<sup>6</sup> “As duas Academias desempenharam um papel de relevo na formação educativa da juventude portuense e contribuíram de forma notável para a elevação do nível cultural e científico da cidade, e, de uma maneira geral, da região nortenha. Ainda que desprovidas dos estatutos de universidades, tanto pela sua acção pedagógica, como pelo seu valor científico, podem ser consideradas verdadeiros institutos universitários.” [Azevedo, 1982; p. 148]

<sup>7</sup> “Um homem do Porto [Passos Manuel] criara a Academia Politécnica; outro Portuense lhe dera, quarenta e oito anos volvidos, os elementos pedagógicos que mais falta lhe faziam para que, dignamente, a Academia pudesse realizar os seus fins!” [Basto, 1937; p. 419].

These two events have enabled a significant increase, both in quantity and in quality, in the mathematical production of PAP. Consult [Pinto, 2013] for a comprehensive and detailed study of the PAP and, in particular, on the mathematics that were produced and taught at this institution.

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