# Chapter 8
# In Pursuit of Monge's Ideal: The Introduction of Descriptive Geometry in the Educational Institutions of Greece During the Nineteenth Century


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**Abstract** From 1824, during his teaching Ioannis Carandinos introduced descriptive geometry, as well as Monge's classical treatise in the Ionian Academy. A few years later in independent Greece, the newly founded Military School, inspired by the model of the *École polytechnique*, included in the curriculum the teaching of descriptive geometry from Monge's book. Konstantine Negris, a former student at the *École polytechnique*, tried to diffuse the spirit and methods of Monge during his period at the University of Athens. In the Polytechnic School of Athens, Monge's treatise was also adopted in the teaching of descriptive geometry as a useful tool for the instruction of craftsmen and engineers. Moreover, the translation of Louis-Benjamin Francœur's book on linear drawing, as well as that of Jean-Pierre Thénot's on perspective, gave a considerable impulse in spreading the basic notions of descriptive geometry into secondary schools during the last decades of the nineteenth century when the first treatises on descriptive geometry appeared written in Greek.

**Keywords** Descriptive geometry · Perspective · *École polytechnique* · Ioannis Carandinos · Ionian Academy · Military School · Konstantine Negris · George Bouris · University of Athens · Polytechnic School · Ioannis Papadakis · Louis-Benjamin Francœur · Jean-Pierre Thénot · Technical education

## 1 Introduction

It might be emphasized that even though Greece was occupied, it was not an intellectual desert. Before the proclamation of the War of Independence in 1821, and more specifically between 1770 and 1821, many mathematical textbooks were

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published in Greek in Europe (Karas 1992). The main aim of all these books was the education of Greek readers, an indispensable condition for their revolt against the Ottoman Empire.

However, it would be an omission here not to mention the edition of various journals and periodicals published in Vienna (Phili 2010), which had the objective of functioning as a channel that would popularize scientific and literal knowledge. Among them, *Hermes the Scholar* (Vienna 1811–1821) played a decisive role as a bridge diffusing Western ideas in the East (Karas 2003). In this journal, Greek intellectuals read for the first time the modern editions of books devoted to descriptive geometry. Thus, in the issue of 15 June 1817, the Greeks learned that in Brunswick a treatise of descriptive geometry was published, *Traité de Géométrie descriptive á l'usage des éléves de l'institut des voyes de communication, par M. Potrér avec grav.*[1] Vol. gr in 8° á Brunswick, Pluchart.[2]

The next year, in this same journal in the issue of 1 August 1818, p. 422, an anonymous Greek writer from the Greek diaspora informed his compatriots about and presented his comments on new mathematical publications. Thus, the Greeks learned that the following books had recently been published: *Traité de la Géométrie descriptive par M. Potrér, Géométrie descriptive par Monge (sénateur) avec les deux suppléments de la Géométrie descriptive par Hachette*.[3]

We consider that this information regarding Monge's new geometry probably constitutes the very first reference to descriptive geometry in the Greek diaspora, as well as for those who lived under Ottoman rule. We must take into consideration that the journal Hermes the Scholar was quite well diffused in more than 40 Greek and European cities through its numerous subscribers. Therefore, it became an important channel for transferring the ideas of the French Enlightenment in Greece.

## 2 The Flourishing Epoch of the Ionian Academy Under Carandinos' Dominance

Thanks to the numerous and persistent efforts of Frederick North,[4] the 5th Earl of Guilford as well as his influence on the British Government, the Ionian Academy

[1]Despite the orthographical error, it concerns the book by Charles Marie Potier, *Géométrie descriptive* Paris 1817 (96 pages in 8°).

[2]*Hermes the Scholar*, News regarding French books. Vienna, 15 June 1817, p. 284.

[3]From this notification results that it concerns Hachette's *Supplément á la Géométrie descriptive de Gaspard Monge*, Paris 1811 (published according to the 3rd edition of Monge's Descriptive Geometry), as well as, *Second supplément de la Géométrie descriptive … suivi de l'Analyse géométrique* de M. John Leslie, Paris, 1818. *Hermes the Scholar*, 1 August 1818, p. 422.

[4]Frederick North Guilford (1766–1827), the younger son of Prime Minister Frederick North, 2nd Earl of Guilford, showed early evidence of his capacities by promoting and developing the status of education during his mandate (1798–1805), as the governor of Ceylon. Later, he traveled across Europe in order to enrich his knowledge in the leading universities. His relationship with the former

**Fig. 8.1** A gravure representing the inaugural ceremony of the Ionian Academy (Gazzetta Ufficiale degli Stati Uniti delle Isole Ionie n. 335, 17/29, May 1824)

(Fox 2012), i.e. the first university, was established by the Legislative Assembly (*Gazzetta Ufficiale degli Stati Uniti delle Isole Ionie* 284, 26 May–7 June 1823) in Corfu in 1823 with Greek as its official language (Idem 339, 17 May–29 May 1824). However the Ionian Academy opened in 1824 (see Fig. 8.1).

Professor Ioannis Carandinos the Ephorus (Ἔφορος) or Rector was entirely responsible for mathematical education, as well as administrative matters.[5]

Ioannis Carandinos (1784–1834), a penniless child from the island of Cephalonia studied at the first public school created in Corfu under the regime of the Septinsular Republic (Phili 2006). Later during the second French occupation of the Ionian Islands, he had the opportunity to study mathematics privately (analysis and mechanics) under Charles Dupin's guidance. After Dupin's departure from Corfu (Bradley 2012, pp. 73–75), Carandinos returned as the teacher at this public school and was in the position "to teach the young pupils concerning the Lacroix's and Laplace's systems and other contemporary French [Scientists]".[6] The meeting of Carandinos with Lord Guilford was decisive in his career. The early education

Minister of Foreign Affairs, Lord Bathrust, facilitated his task organizing the Ionian Academy. In 1819, he was named Chancellor (Ἄρχων) of that institution.

[5]Guilford proposed Carandinos for this position: "I will take the liberty of proposing, for that office, our well deserving senior professor John Carandinos". 17th May 1824. Plans submitted to the government, for the establishment and regulation of the Ionian Academy, Corfou Reading Society. Guilford's Archives. file V5.

[6]See Proselantis' letter to the Review, *Hermes the Scholar*, 1812, p. 190.

of Carandinos facilitated Guilford's options. Through Guilford's scholarship, his young *protégé* attended lectures at the *École polytechnique* in 1821 as free auditor (auditeur libre) (Phili 1996, p. 307).

After the inaugural ceremony, Carandinos started his lectures. Fortunately, we found his weekly program in his book, which can be found now in the Gennadius Library in Athens. Thus, Carandinos declared in his autographed notes that:

> I give three lectures per week… complement of Algebra [of] Lacroix as well as to the primary class from 1 November 1825 in the first class, which comprises of 11 students, I did 10 hours per week, and I presented the following authors… text [of] Monge descriptive geometry and the above mentioned introduction (Carandinos 1826).

After Carandinos' departure in 1832 due to health reasons, a new epoch started for the Ionian Academy that was never again able to reach the previous high level of mathematical education except during the presence of Ottaviano Fabrizio Mossotti (1836–1840). It might be stressed that the preference for applied mathematics of the new High Commissioner Lord Howard Douglas (1776–1861) and Mossotti's preference for the same topic were the main reasons for the reform of 1837, which created the Faculty of Civil Engineers. Mossotti, who was associated with its establishment, proposed that the candidates for this new faculty followed preparative lectures on analytic and descriptive geometry, on optical instruments as well as on elements of surveying (Phili 2012a). Nevertheless, as the students were not adequately qualified and as the Professor of Mathematics Ioannis Kontouris resigned in order to attend the lectures at the *École polytechnique* as an auditeur libre, the faculty of civil engineers never opened.

During the academic year 1837–1838, lectures in the Faculty of Philosophy on pure mathematics were attended by several students, although in this same year the Othonian University was officially established. Professor Kontouris taught stereometry,[7] elements of algebra and trigonometry. For these courses, Kontouris mainly utilized Adrien-Marie Legendre's book translated by Carandinos.

After Mossotti's departure in 1840, the curriculum of the Faculty of Philosophy was modified, and descriptive geometry was no longer included in the curriculum.

## 3 The Military School of Evelpides

When Ioannis Kapodistrias arrived in Greece on 6 January 1828, he found a country without determined borders, devastated by the War of Independence, as well as by internal conflicts. In this atmosphere of disorder and misery, Kapodistrias undertook the first measures in order to establish a well-organized state worthy of ensuring a successful outcome of this disastrous war and the recovery of the Greek people.

After the War of Independence, primary schools developed a quite well-balanced curriculum between classical studies and sciences. But in the Central School

[7] We cannot be certain if the lectures on stereometry comprised elements of descriptive geometry.

(Κεντρικὸν Σχολεῖον), established by Kapodistrias in Aegina in 1829, pupils had the opportunity to have the most modern manuals of that time: Carandinos' translations on arithmetic and algebra. Specifically about 600 books of Caradinos' translations of Legendre's Elements of Geometry were distributed in 1830–1832, an impressive number for that period.

However, the re-organization of the army remained one of the main aims of the governor. So, on 1 July 1828, he established the Company of Evelpides[8] in Nafplion, the first capital of Greece from 1829 to 1834. However, due to the poor condition of the building, the Military School was housed in an orphanage in Aegina from 1834 to 1837.

We owe a special mention to the subsequent translation of Francœur's book, *Dessin Linéaire et arpentage* ...[9] (Linear Drawing and land surveying...) (Francoeur 1819, 1827). During the first years of his mandate, Ioannis Kapodistrias ordered Konstantinos Kokkinakis (1781–1831), the co-editor of the journal Hermes the Scholar, to translate Louis-Benjamin Francœur's book. Finally, this book was published (Fragkirou 1831) posthumously in 1831, as its translator had died and the final revision was undertaken by Ioannis Kokkonis (1795–1864), a member of the educational commission, a general inspector of the schools in the Peloponnese peninsular and an ardent partisan of the mutual teaching method due to his studies in Paris (1824–1829) with Louis-Charles Sarazin. We must stress that Kapodistrias invited two distinguished architects to teach linear drawing in the School of Aegina: Stamatis Kleanthis (1802–1862) and Eduard Schaubert (1804–1860).

This book largely contributed to the diffusion of linear drawing, as well as some elementary methods of projection, leveling and rules of perspective (see especially the "Descriptive Geometry in Nineteenth Century Spain: From Monge to Cirodde" chapter on the rules of dioptics, i. e. Greek translation of the word perspective) and became an indispensable tool for artisans, carpenters, etc. Thus, we could consider that this manual became the preliminary tool for the teaching of descriptive geometry in several secondary schools. However, we must take into consideration that according to the educational planning of the Regency (3/15 July 1833) (Greece adopted the Gregorian calendar only in 1923), the theory of shadows (σκιαγραφία) was included in the curriculum of secondary schools, as well as "Euclidean geometry and the geometry of Diesterweg (1828)" [sic] Project of the committee regarding the public education. Nafplion 3/15 July 1833 in (Antoniou 1992, p. 109). It might be stressed that after Kapodistrias' assassination, the teaching of design was established by the royal decree of 6 February 1834, art. 1 (*Journal of the State* no 11, 3 March 1834), while the teaching of painting became obligatory

[8]In Greek, this adjective (here it is used as noun) means hopeful, promising, and this name was given to the very young students of the Ionian Academy. We consider that this nomination, which is used until now, was given also to these young students, who represented the hope for the Greek nation.

[9]The complete title is: *Dessin Linéaire et arpentage pour toutes les écoles primaires quel que soit le mode d'instruction qu'on y sait*, 1e éd. 1819, 2e éd. 1827, Paris. Francœur dedicated this book to the Duc of Gazes.

by the royal decree of 31 December 1836 art. 7 (*Journal of the State* no 87, 31 December 1836). Unfortunately, we have not been able to find any official list regarding their syllabi.

On 2 December 1828, Kapodistrias accepted Jean-Pierre-Augustin Pauzié's proposal for the founding of a military school (Kastanis 2003, p. 125), inspired by the model of the *École polytechnique* in order to supply the country with qualified officers, who would provide for the administration of the state and contribute to its growth. Thus, the Military School was officially established on 28 December 1828. Kapodistrias entrusted the direction of the school, the first in Greece, to Pauzié (a former student at the *École polytechnique* in 1812).

In the General State Archives, we found an important manuscript (General State Archives. Secretary of Military Affairs doc. 54 January 1829, f. 102) (see Fig. 8.2) in French, probably dictated by Pauzié, in which he revealed, among other things, the regulation of the curriculum.

From this important French manuscript, which in fact constitutes a relevant document for an historian of mathematics, we will focus on the 64th article of the regulation regarding studies. This article ordered that the Military School should deliver the following indispensable tools to each student, such as a drawing board, a box of pencils, two rulers, an inkpot, an elastic gum, a French-Greek dictionary,

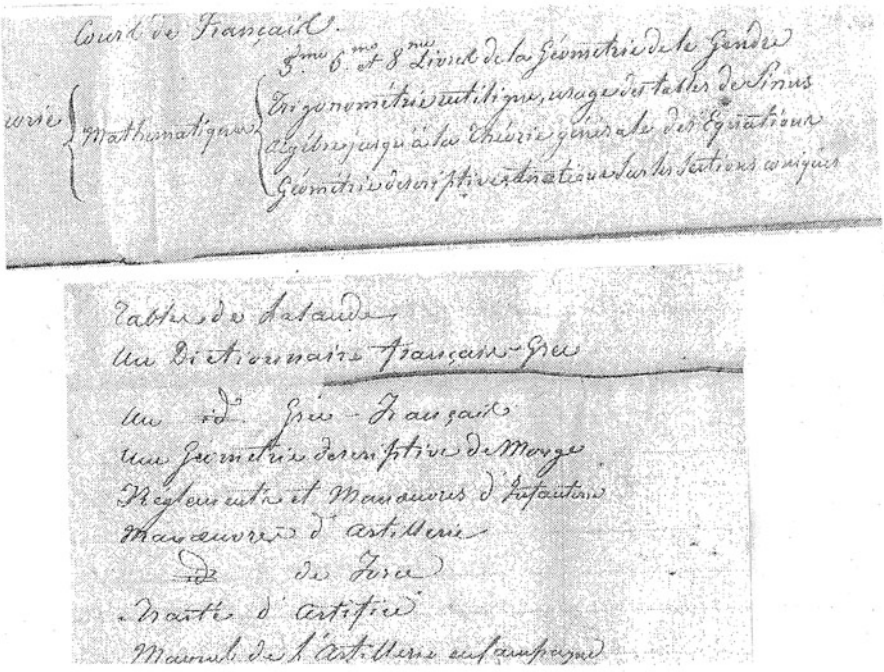

**Fig. 8.2** The 64th article regarding the regulation of the curriculum (General State Archives. Secretary of Military Affairs doc 54 January 1829. f. 102)

books on algebra and arithmetics by Pierre-Louis-Marie Bourdon, Legendre's geometry and "une géométrie descriptive de Monge" (sic), i.e. one descriptive geometry by Monge. According to this list, we consider that as Carandinos' translation was never edited, Kapodistrias was able to provide several copies of Monge's treatise via his supporters abroad to make up for the lack of that manual in Greek.

After King Otto's crowning and his decrees establishing primary and secondary education, a new era began in education. The secondary schools that were named Hellenic Schools were similar to the German *Lateinschulen*. The pupils learnt mainly ancient Greek and Latin and less mathematics, physics, zoology, etc. The mathematics curriculum comprised of, firstly, arithmetic, based mainly on Bourdon's book, elements of arithmetic and, secondly, geometry, based on Legendre's, Elements of Geometry. Christos Vafas, a former student in the Ionian Academy, translated in 1837 Louis Lefébure de Fourcy's book, *Éléments d'Algèbre*, which he taught in the first Gymnasium in Athens. However, under Otto's reign, we can see a "shift" from the French mathematical ideal, which was inaugurated in Greece with Carandinos' translations, to the German one. In 1842, George Gerakis, Professor of the Gymnasium, translated "Elementary Geometry and Trigonometry" by Friedrich Snell (Snell 1799, 1819) and a few years later presented Karl Koppe's *Arithmetic und Algebra* (Koppe 1836a) as well as "Plane Geometry (1836b) and Stereometry" (Koppe 1836b) in Greek (Kopp 1855, 1857, 1858).

In 1834, the Regency re-organized the Military School, whose first 4 years were mainly dedicated to a preparatory curriculum. Henceforth, the studies lasted 8 years in order to become the highest institution in the country's educational system. The Bavarians modified the curriculum and, apart from German, introduced differential and integral calculus, spherical trigonometry, geodesy, mechanics and fluid mechanics and hydraulics, etc. Of course, descriptive geometry maintained an important role within the curriculum. Especially in the fifth year when students attended lectures regarding elements of differential, integral calculus and descriptive geometry, while in the sixth year the mathematical curriculum included the continuation of lectures on differential and integral calculus and descriptive geometry and a calculus of variations, the last being an extremely innovative course for that epoch in Greece.

There was a significant lack of didactic books in 1840. Thus, on 6/18 June 1840 the new commander of the Military School Colonel Spyridon Spyromilios (1800–1880), who replaced the Prussian Colonel Eduard von Rheineck (1796–1854), emphasized the lack of handbooks. In his report (General State Archives. Othonian period Ministry of Defense f. 372, no 323) to the Ministry of Defense, he remarked that this lack meant professors were obliged to translate or to compile European treatises as students otherwise tried with difficulty to note or to partially copy the lectures. This situation constitutes one of the main factors that prevented their progress. Thus, the commander proposed that the Military School should offer lithograph handbooks in Greek to its students. However, despite our research, we could not find any mathematical manuals from that period.

From the list of professors (General State Archives. Ministry of Defense. Othonian period M/B f. 372) in the academic year 1841, we can ascertain that Major Dimitrios Stavridis (1803–1866) was appointed to teach architecture, descriptive geometry, leveling and surveying of buildings and machines for 20 h per week, while Dimitrios Despotopoulos, a former student of Carandinos, taught mathematics for 18 h per week.

The report of the Council of Studies on 17 March 1842 revealed the course material. Regarding descriptive geometry, the course material of the 5th grade comprised of intercepts and applications of projectivity to the theory of shadows and scenography[10] (sic) for $1\frac{1}{2}$ h per week and the surveying of buildings and machines, which also included the presentation of woodcutting and the construction of the five capitals of columns for 2 h per week.

In the 4th grade, after the course of projective geometry, the lessons in descriptive geometry included leveling were taught $3\frac{1}{2}$ h per week. It might be stressed that the coefficient of 8 (General State Archives. Ministry of Defense. Othonian period M/B f. 421) for this course was quite high.

A letter (General State Archives. Ministry of Defense M/B f. 421) (written in French) on 11/23 June 1843 by Adolph Hast, a bookseller in Athens, to the Royal Ministry of War regarding the books, which would be distributed by the King as prizes to the diligent students, revealed that Monge's treatises were abandoned, although Monge's *Géométrie descriptive*—after its 6th edition in Paris 1838—was later edited for a 7th edition in Paris and in Brussels in 1854 (Taton 1951, p. 383). The bookseller's list, among others (General State Archives Ministry of Defense. M/B f. 421), contains the recently edited book by the Professor of the Polytechnic School, Charles-François-Antoine Leroy (Leroy 1837).[11] This permits us to conclude that the teaching of descriptive geometry was modified slightly and that Monge's classic treatise was relinquished (on Leroy's textbook, see Barbin, Chap. 2, this volume).

It might be stressed that King Otto showed evidence of his sincere interest in the Military School, as during his reign he attended exams and several times visited the school in Piraeus in order to attend lectures and regularly received reports regarding the progress of students. Therefore, Otto decided that the studies should last 7 years and the preparatory year was abolished in 1842. Descriptive geometry was taught in the fourth year for 16 h per week, and the students, along with the well known chapters regarding the surfaces' intersections, evolute and evolutionary, were initiated to study the applications of projectivity: theory of shadows and perspective. It is quite impressive that almost at the same time these chapters were also included

[10] It is interesting that the erudite Greeks named the science of perspective as scene painting based on Geminus' classification of the mathematical sciences (σκηνογραφικὴ in Greek).

[11] Charles-François-Antoine Leroy published his treatise on descriptive geometry in Bruxelles in 1837 (Leroy 1837). See *Traité de Géométrie Descriptive avec une collection d'épures, composée de 60 planches.*

in the curriculum of the Polytechnic School, but, unfortunately, for the purpose of this chapter we ignore the course material.

However on 16 September 1858, Lieutenant Dimitrios Antonopoulos (1821–1885), a former student of the *École polytechnique* and the professor of descriptive geometry and the theory of shadows and scenography (General State Archives. Ministry of Defence M/B f. 407), was replaced by officer Vassilios Romas. On 2 September 1859, Dimitrios Tournakis, a lieutenant of artillery was appointed to teach descriptive geometry.

Spyromilios' mandate was also characterized by an important innovation as in 1840 he introduced written exams. He considered that the oral ones could not offer an accurate idea of students' background as the examiner could intervene in order to facilitate the level of the questions. Thus, thanks to this modification, several copies are preserved in the General State Archives. The copies regarding descriptive geometry reveal the topics of the exams, as well as the name of the examiner.

On 14 October 1854, Professor V. Romas asked his students to determine the figure of the shadow and the perspective of a triangular pyramid (General State Archives. Ministry of Defense f. 427) (see Fig. 8.3). On 6 November 1857, Professor D. Antonopoulos demanded the intercept of a girder by a vertical plane, the shadow of the girder as well as its perspective (Idem, f. 424). On 13 September 1858, the same professor asked his students to describe a sphere in a triangular pyramid (Idem f. 429). On the 16 September 1859, the problem for the students was the intersection of a rectilinear cone by a cylinder (Idem).

After Otto's expulsion in 1863, the Military School was reformed. Thus, the new King, George I, a former student of a Danish naval school, introduced in 1864 the entry exams and decided that the studies should last 4 years for students who desired to study infantry and cavalry weapons and 6 years for those who opted for technical weapons: artillery and engineering. The first 3 years were preparatory and common for all the Evelpides, and, of course, descriptive geometry had a prominent role in the first 2 years. During the third year, the students learned about the intersections of surfaces, while during the fourth year those who were to become officers of the artillery and engineering corps were introduced to the applications of descriptive geometry: shadows, perspective, wood cutting.

Nevertheless, during this period, Greece was attempting to adopt modern technology, and military staff were one of the main supporters of its administration, and so a new reform of the Military School was announced on 31 October 1866 in order to speed up studies, which were reduced. From then on, studies lasted 5 years, three of which were preparatory as before. Descriptive geometry, having ten as a coefficient, remained an important part of the curriculum. However, this reform lasted only 1 year. In July 1867, the authorities closed the Military School and its re-opening in January 1868 was marked by the re-adoption of the 1864 program.

According to the new reform of 1870, lessons in the Military School lasted 7 years. During the first 5 years, students attended several courses, including mathematics. Descriptive geometry remained an important part of the curriculum as it retained the highest coefficient of ten; it was taught in the third year in its basic form. In the fourth year, its applications, gnomonics and wooden frameworks were

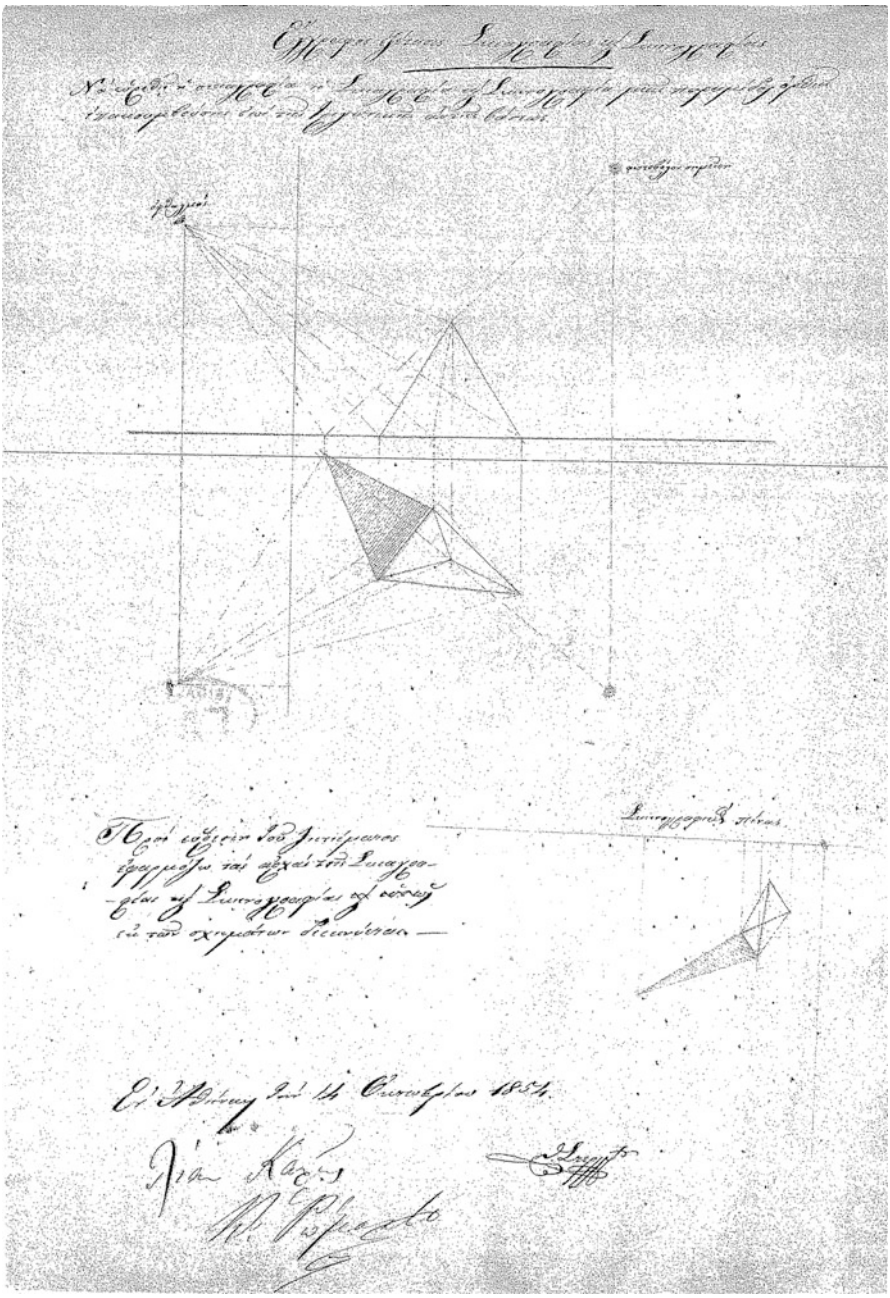

**Fig. 8.3** A copy of a student's work from the Military School of a figure's determination of a shadow and the perspective of a triangular pyramid (14 October 1854) (General State Archives. Ministry of Defence f. 427)

introduced, while the fifth year was more focused on applications like the theory of shadow, perspective and enumerated plans (Poulos 1988, p. 137).[12]

From 1880 to 1886, the Professor of Descriptive Geometry was a major in the engineering corps, Miltiadis Kanellopoulos, who wrote one of the first treatises on descriptive geometry. Indeed his treatise,[13] "Lectures on descriptive geometry", based on his lessons given during the academic year 1882–1883 in the Military School appeared in 1883 (Kanellopoulou 1883). In this same year, Timoleon Moschopoulos' book, "Elementary Descriptive geometry" (Moschopoulos 1883), based on his lessons given in the school to non-commissioned officers, also appeared (Poulos 1988, p. 133). During the same period, Theodore Libritis, a captain of the engineering corps and Professor of Descriptive Geometry at the Military School, presented his books on the topic (Libritis 1881, 1886, 1888).

We must take into consideration that the demanding curriculum of the Military School became an extremely rigorous filter for young students. Thus, between 1831 and 1860, only 138 students managed to graduate (Stasinopoulos 1933). The majority of them completed their studies in the *Grandes Écoles of France* (General State Archives. Ministry of Defence. Othonian period f. 444).

Konstantine Chatzis notes (Chatzis 2018) that from 1830 to 1860 these well-educated officers started to translate a multitude of terms in their manuals and in their articles in military reviews into Greek. However, most mathematical terms had already been translated into Greek during the eighteenth century. Therefore, Ioannis Carandinos introduced the teaching of descriptive geometry by literally translating the adjective "descriptive" into Greek as "περιγραφική" (Phili 2012b).[14] Moreover, Dimitrios Stavridis, a graduate of the Polytechnic School of Vienna, contributed to the translation of some terms in these disciplines in his lectures in the Military School on descriptive geometry (Efimeris tou Stratou 1860), leveling and surveying of buildings (*Journal of Army*, Veteran no 21, 30 September 1860, p. 336). Nevertheless, the introduction of scientific terms in Greek during the nineteenth century demands special and meticulous research.

## 4 The University of Athens

By the royal decrees of 14/26 April 1837 and of 22 April/4 May 1837, King Otto established the first University, the Othonian University, a unique high institution in the Balkans and the Near East.

[12] In 1887 in Piraeus (where the Military School was located since 1837), an anonymous translation of Charles-François-Antoine Leroy treatise entitled "On Enumerated Plans" was published (Stratiotiko Scholeio ton Evelpidon 1887). In his book, Greek Mathematical Bibliography, Andreas Poulos considers that this translation followed the 4th edition of the book (Leroy 1855).

[13] His book on the theory of shadows was published in 1884.

[14] See, for example, Carandinos' notification on 22 Mai 1827 or his letter to Fourier on September 1828.

The teaching of mathematics was ensured by Konstantine Negris (1804–1880), a former student of the *École polytechnique* in Paris. In his autographed note on 21 of July 1836 (General State Archives. Othonian period f. 32) addressed to the Secretary of Education, he proposed, among other things, to teach descriptive (διαγραφική from the verb διαγράφω = to trace) geometry, dioptics (perspective) and the theory of shadows. However, Negris' ambitious curriculum was only partially realized.

Thus, for the first academic year 1837–1838, the curriculum consisted of the last five "Books" of Legendre's Elements of geometry, Legendre's rectilinear trigonometry, the general properties of numbers, algebra and Hachette's descriptive geometry[15] (Phili 2001, p. 84). These lectures were given from 4 to 5 p.m. every Monday, Wednesday and Friday.

It might be stressed that in the very first years, special care was taken to teach students the principles of practical geometry such as land surveying, leveling and of course, the use of geometrical instruments. These last instructions were indispensable not only for those following a career in civil engineering, but also for those who following a military career. The students conceived that mathematics in its applied form was the basis of astronomy, mechanics, architecture, fortification and navigation, etc. (Phili 2001, p. 85).

In 1840, according to the program, Konstantine Negris lectured on differential and integral calculus and continued lectures on descriptive geometry, focusing on the intersections of second degree surfaces and three-dimensional analytic geometry. He also taught rectilinear trigonometry and algebra considering known the Newton's binomial. During his teaching, the former student in the *École polytechnique* tried to educate his very few[16] students on the basics of mathematics.

By the royal decree of 19 May/31 May 1842 regarding exams, students of the mathematical department in order to obtain their graduation were obliged to be examined in the following subjects: "high pure mathematics and applied mathematics, i.e. the analysis of finite quantities, differential and integral calculus, research regarding various curves, descriptive and practical geometry, mechanics and astronomy" (Phili 2001, p. 86). So, this royal decree confirmed that descriptive geometry through Negris' teaching remained in the curriculum.

However, we must stress that after Negris' dismissal in 1845, due to the election of the university deputy, lectures in descriptive geometry were taught again in the Othonian University only for a while (1886–1887) with Cyparissos Stephanos (1857–1917).

Nevertheless, in the "Instruction to the Students…" (Odigiai pros tous fititas ekastis scholis peri allilouchias ton diaforon epistimon 1838,1853, p. 27) edited by

[15]It is not clear which book was followed in these lessons. According to this source, we could suppose that it refers to J.N.P. Hachette (Hachette 1811).

[16]The fees probably made the universitarian studies imperative. However, the majority of students opted for the faculties of law and medicine. It might be stressed that during Negris' short mandate, no more than six students attended his lectures. However, we must note that only five students graduated from the mathematical department from 1837 until 1866.

the university in 1853, we can read that students had to attend six semesters of the following lessons:

*1th semester:* rectilinear trigonometry, algebra and algebraic application to two-dimensional geometry
*2nd semester:* continuation of algebra's application to two-dimensional geometry, statics and the beginning of descriptive geometry
*3rd semester:* spherical trigonometry, algebraic application to three-dimensional geometry and continuation of descriptive geometry
*4th semester:* end of descriptive geometry and differential calculus
*5th semester:* integral calculus and mechanics
*6th semester:* integral calculus and mechanics.

But this curriculum, along with that of 1838, once more contradicts the official program of 1853 as it is recorded that Professor George Bouris (1802–1860), a graduate from Vienna University and Negris' substitute, was to teach[17] a simplified syllabus based mainly on geometry and stereometry, every Tuesday, Thursday and Saturday from 5 p.m. to 6 p.m. Unfortunately, there is no mention of whether these lectures comprised elements regarding descriptive geometry.

Therefore, after the departure of Professor Negris, Professor Cyparissos Stephanos during the academic year 1886–1887 taught descriptive geometry every Tuesday and Saturday from 11 a.m. to 12 a.m. However, we can consider that the spirit and the method of Monge were abandoned at the university, and that his method was mainly used and developed in the Military School and in the Polytechnic School, instead.

## 5 The Polytechnic School of Athens

The construction of the Royal Palace in Athens according to the plan of the Bavarian architect Friedrich von Gärtner (1792–1847) revealed a lack of qualified Greek builders (craftsmen, stonemasons, bricklayers, etc.). Moreover, the needs for new techniques in order to build the new capital exceeded the actual technical abilities of Greek artisans. Thus, at the end of 1836, a noble Bavarian officer Friedrich von Zentner (1777–1847), as he revealed in his book "The Kingdom of Greece…", conceived the idea of creating a technical school based on the model of the Royal School of Building (*Königliche Baugewerkeschule*) in Munich (established in 1826) as well as the technical school in Lyon, *La Martinière*, (Zentner 1844, pp. 11–13).

The first lectures were elementary mathematics, architecture and drawing. The Professor of Drawing (liberal and linear) was Christian Hansen,[18] a distinguished

[17] Since 1850 Ioannis Papadakis ensured the teaching of astronomy and analysis.

[18] In 1839, his brother Theofile Hansen (1813–1891), whose buildings constitute even today the architectural ornaments of Athens, was appointed to give lessons in drawing, too.

Danish architect. The lessons in plastic constructions were given by the French architect Charles Laurent and his assistant, a Bavarian sculptor called Karl Heller. A 2nd lieutenant of the engineering corps, Theodore Komninos (1807–1883), taught mathematics, i.e. practical arithmetic and elementary geometry, until 1854 when Komninos was appointed to give lessons in mathematics, mechanics, geometry and architecture (Biris 1952, pp. 486–487).

As the demand for educated craftsmen, surveyors and technicians increased, the school was transformed into a daily one in 1840, and consequently its curriculum was enlarged. Thus, this newly established daily school functioned side by side with the Sunday school. Nonetheless, mathematics remained an important part of the curriculum in both schools.

The next year, Zentner proposed that the French architect Charles Laurent teach mathematics and descriptive geometry side by side with Komninos. The mechanics lectures were covered by other professors at the university. Indeed, George Bouris was invited to teach physics and elements of mechanics.

After the revolution on 3 September 1843, all the foreign professors like Friedrich Zentner, Charles Laurent, Christian Hansen and Theofile Hansen were expelled, and, henceforth, only native Greeks were appointed to the administration. The School of Arts[19] was re-organized and divided into three distinct schools: the Sundays School, the Every Day School and the Higher School, exclusively dedicated to the instruction of Fine Arts (*Official Gazette* no 38, 9 November 1843. Decree regarding the organization of the School of Arts).

The curriculum of the Sundays School comprised elementary algebra, principles of practical geometry, arithmetic but also courses on drawing, construction of objects, courses which from the didactic point of view should follow the Greek translation of Francœur's book, Linear drawing, while their teaching was covered by Michael Georgiades, an architect, who taught the construction of objects 11 h per week, as well as 11 h per week of drawing.

The curriculum of the Every Day School contained among other elements, construction of objects, elements of algebra and geometry, applications to the arts, elements which undoubtedly permit us to suppose that the applications included at least some elements of perspective. M. Georgiades was appointed to teach the construction of objects and drawing 3 h per week, respectively.

In 1844, Lyssandros Kavtanzoglou (1811–1885), a distinguished architect, who had graduated from the Fine Arts Academy of Rome, was appointed to succeed Zentner, as director of the Polytechnic School, in which he remained until Otto's dethronement. However, according to Konstantine Biris' book, in the first year of his mandate the students could not attend the lessons of descriptive geometry, as well as those of building and architecture (Biris 1952, p. 70).

[19]This institution is known under several names: Polytechnic School, School of Constructing Arts and Professions, School of Craftsmen, Royal School of Arts, School of Industrial Arts. We usually utilize the name of Polytechnic School here.

However, Kavtanzoglou, taking into consideration the complicated situation regarding the studies in the Polytechnic School and in his report of 5th May 1851 addressed to the Ministry of Internal Affairs tried to elucidate it. In this interesting document (General State Archives, Secretariat of the Ministry of Internal Affairs (Otto's reign) f. 2185), which we found in the General State Archives, among others, he exposed a deficiency regarding mathematical education, as well as the lack of scenography (i.e. perspective) lessons which, as a main application of descriptive geometry, was an indispensable course, which should have been taught practically like its other applications. Therefore, a priori, Kavtanzoglou opted for practical teaching, probably based on design. In this same framework, we could include his remarks regarding the affinity of this Greek institution to the similar French Schools: *École des Beaux Arts*, (School of Fine Arts), *École des Arts et Métiers*, (School of Arts and Crafts), *École préparatoire du dessin*, (Preparatory School of Design) and his proposition for free access.

In 1853, according to the former tradition, Ioannis Papadakis (1820 or 1825–1876), professor of the University of Athens was invited to teach descriptive geometry and perspective. Although he had previously studied in Munich, he attended the courses of the "physicomathematical department"[20] of Athens University and graduated from it. As a distinguished student (Proceedings of the Philosophical Department, session of 28 December 1840 (M.S.), in Greek) and thanks to the favourable opinion of Konstantine Negris he obtained a stipend from the Greek government to study in Munich and since 1842 in Paris at the *École polytechnique* and at the *École des Mines* (1844) (Assimakopoulou et al. 2009, p. 40).

Papadakis was quite adequate in ensuring the teaching of descriptive geometry and its applications to the Polytechnic School, as he was trained in the French *Grandes Écoles*. Therefore, he started to teach descriptive geometry in the Polytechnic School twice a week, firstly from 1853 until 1856. "The lessons of perspective, as application of descriptive geometry were firstly introduced by I. Papadakis and were taught with zeal and success. These courses were mostly indispensable for the progress of any art" (Journal *Helios* of the 12th October 1855. [in Greek]). We must take into consideration that these lessons regarding perspective were mainly considered as a substitute for elementary architecture. The above statement makes clear that the teaching of descriptive geometry actually began between 1853 and 1855.

However, an ordinary event changed this apparently calm situation. In 1856, the lesson of stenography was introduced in order to re-compensate the lack of manuals. Joseph Mindler (1808–1868), a Bavarian officer at the Royal court and stenographer of the Parliament was appointed as professor of stenography. As his salary was superior to that of Papadakis, the professor of descriptive geometry resigned as a mark of protest.

[20]The university of Athens was established according to the German model of ordus philosophicus. The physicomathematical department gained its autonomy only in 1904.

As a temporary solution, the Director of the School of Arts, Lyssandros Kavtanzoglou proposed that the Ministry of Internal Affairs authorize Sotirios Pilotos (Salvatore Pilotto) (Assimakopoulou et al. 2009, p. 40), who was born in Corfu and studied at the *École Centrale des Arts et Manufactures* (sic) in Paris graduating in 1855 as an "ingénieur métallurgiste" (sic), to give lessons in mechanics and, especially, in descriptive geometry and its applications, as well as in geodesy, gratis. In the ministerial report was also stressed Pilotos anterior experience as "until then he had successfully given lessons to 14 regular auditors" (General State Archives. King George's reign unclassified). Thus, the ministerial report ended by entreating the King to appoint Sotirios Pilotos (or Pilottos) as full professor. This demand was fulfilled, and Pilotos was appointed as professor of descriptive geometry and its applications, as well as geodesy in the 1860s.

Meanwhile in 1856 in Hermoupolis (Syros) (an important town of the Cyclades), the French treatise of Jean-Pierre Thénot (Thénot 1834) was translated[21] into Greek by the Secretary of the Prefecture of the Cyclades, Panos Pleskas. The translation was probably requested by A. Kriezis, who, along with the publisher M. Petridis, covered the costs of the edition (see Fig. 8.4). Andreas Kriezis (1813–1878), who

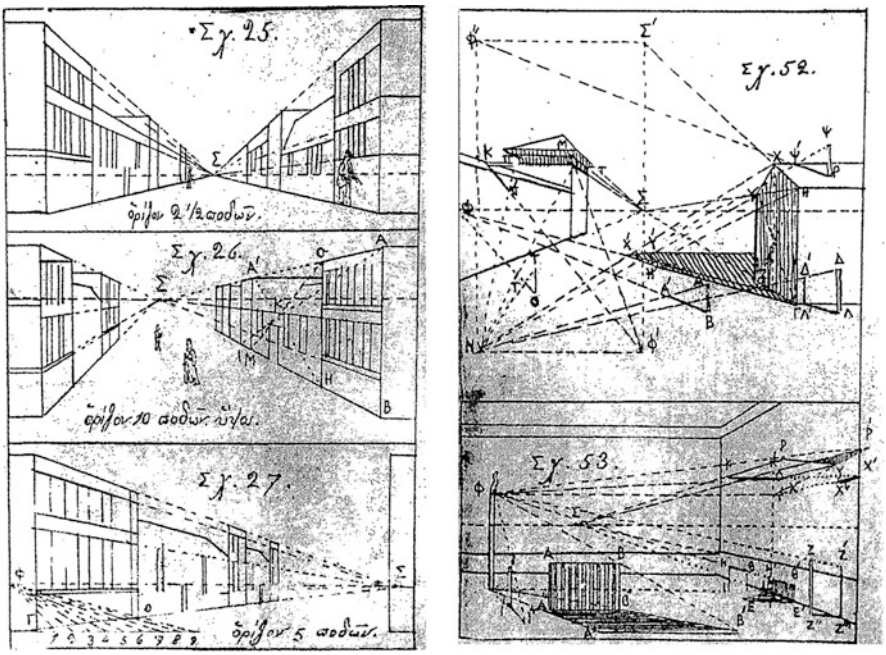


**Fig. 8.4** Exercises (Tenetou 1856, p. 28), Hermoupolis (Syros) 1856

[21]The word perspective was translated in Greek as dioptics and the same word was used in Francœur's book, too.

after his studies in painting in Paris, was appointed to teach linear design and painting in the gymnasium in Syros (the Greek Liverpool of the nineteenth century). We must stress that Kriezis' designed the 66 figures (Mykoniatis 1995, p. 347) of the treatise. It is possible that this book covered the needs for the teaching of perspective in the Polytechnic School.

Nevertheless, at the end of the same year, on 15 December 1860, the new minister of Internal Affairs repeated the request concerning the teaching of descriptive geometry. In his report to the King, he stressed the existing gap after Ioannis Papadakis' resignation, as his courses were indispensable for the training of surveyors. Ending his report, the Minister of Internal Affairs proposed that Ioannis Papadakis be appointed in order to teach rectilinear trigonometry, descriptive geometry and its applications, as well as elements of statics. This proposal was accepted in 1863 and Papadakis was appointed again by a royal decree and continued to teach until his death in 1876.

In October 1862, after Otto's dethronement, a new era began for the School and the decree on 26 August 1863 marked the re-organization of its aims. Thus, henceforth the institution would ensure: "Craftsmen's theoretical and practical education, as well as to the owners of the manufacturing, in the most necessary arts, i.e. building construction, smothery, joinery sculpture, painting, ceramics, tanning and soap-making" (*Gazette of the State* no 33. Decree regarding the new organization and direction of the School of Arts).

Dimitrios Skalistiris (1815–1883) who from 1859 was engaged by a royal decree to teach physicomechanics (sic.), became the new director of the Polytechnic School (1864–1873). His first task was to improve studies, in line with the standard in France. Thus, in his letter on 12 October 1864 addressed to the Ministry of the Internal Affairs, he noted the existence of three technical schools in France, the *Écoles des Arts and Métiers* (more precisely he noted that one of them is situated in Aix, near Marseille), and considered that all three constituted an appropriate model to follow. Moreover, in his letter, he emphasized that France "owed a lot to these schools regarding the diffusion and the perfection of the arts" (Biris 1952, p. 181).

He openly stated that after the revolution of 1843, the Polytechnic School had not reached the targets that were cultivated in the French institutions. Thus, Skalistiris revealed that his very first intention was to re-organize the Greek Polytechnic School based on the French model.

The new director D. Skalistiris was a captain of the engineering corps and a graduate from the Military School, who attended lectures at the *École polytechnique* and later the *École des Ponts et Chaussées* (Assimakopoulou et al. 2009, p. 40). Returning to Greece, he was appointed professor of bridge construction in the Military School in 1846, as well as professor of physicomechanics in the Polytechnic School, as we have already mentioned.

At the end of 1876, Papadakis died and, thus, in January 1877, Dimitrios Tournakis (1820–1902) a lieutenant of artillery started to teach descriptive geometry in the Polytechnic School. It might be stressed that Tournakis had significant experience as since 1859 he had taught descriptive geometry in the Military School. However, Tournakis' career in the Polytechnic School was brief. In February 1878,

he was removed and replaced by an officer of the engineering corps Nikolaos Solomos, a professor of the Military School, whose teaching career also lasted just a year (he was removed in December 1878). N. Solomos (1840–?) side by side with his educational duties devoted his life to writing manuals for Greek artisans and workers (Chatzis 2003, pp. 83–86).

Solomos' successor in the Polytechnic School was Andreas Zinopoulos (1842–1890), a graduate of the *École Centrale des Arts et Manufactures* in Paris (Assimakopoulou et al. 2009, p. 40) and a civil engineer, who started to teach descriptive geometry from 1878 until 1882 and was then appointed to the direction of public works.

In the General State Archives, a certificate of 1882 regarding the training of a civil engineer translated into French presents the curriculum of that time, and shows the high level of teaching, which permitted the young graduate to continue his studies in Ghent, Belgium.

Solomos' resignation matched the plan of the new director,[22] Gerasimos Mavrogiannis (1828–1905), a former consul in Marseille and Trieste and an erudite man specializing in history, who opted for the demilitarization of the school (Biris 1952, p. 287). Of course the military staff were against his decision, which reversed its long-standing tradition. After Mavrogiannis' dismissal, the new director of the Polytechnic School was Anastasios Theofilas (1827–1901) (Assimakopoulou et al. 2009, p. 348) a graduate from the Military School, who later completed his studies at the *École de Saint-Cyr* (Assimakopoulou et al. 2009, p. 41). Theofilas started the reform of 1887, which transformed the Polytechnic School into a university institution, although the military spirit and austere discipline were maintained.

In October 1882, the Council of Instruction at the Polytechnic School ordered several books, scientific journals as well as some drawings regarding descriptive geometry, in order to enrich its library "because the non-experienced students had an absolute need to understand this course" (Biris 1952, p. 287). In the General State Archives, we found several receipts from an international bookshop in Athens during Theofilas' direction (1878–1901). Among the books, the Polytechnic School bought four copies of Ernest Lebon's book on descriptive geometry,[23] while in the same year, Theofilas approved the expenses for 300 copies, a most impressive number for 1886, a lithographic leaflet of 168 pages on descriptive geometry. (General State Archives. Ministry of Internal Affairs. King George's reign, unclassified, f. 32, no 89).

Immediately after A. Zinopoulos' dismissal in November 1882, Apostolos Apostolou (1840–1918), an officer of the engineering corps, taught descriptive geometry until 1905. It might be stressed that Apostolou presented one of the first treatises on descriptive geometry (Apostolou 1883). Thus, his lectures during the academic

[22] His mandate was very short, from 1876 to 1879.

[23] Maybe it concerns the book of Ernest Lebon (Lebon 1881).

year 1883–1884 were edited in 1883 in Athens, thanks to Thomaidis' will.[24] This treatise was re-edited in 1890 and adding a second part (Apostolou 1890) devoted to the theory of shadows (Poulos 1988, p. 140).

In 1887, French became an obligatory course. So, in December of this year, Joseph Cellar was appointed to teach a French course. In this same year, a new decree modified the status of the school, whose name now became the "School of Industrial Arts", which comprised of mainly two faculties: the faculty (School in Greek) of civil engineers and that of mechanical engineers. Henceforth, the institution would provide for the scientific education of engineers, who were then ready to face the challenges of the great technical projects in the country (railways, road constructions, as well as the construction of the Isthmus of Corinthos).

In January 1888, for the first time, an open selection was announced for the appointment of an assistant in topography. Nikolaos Karakatsanidis (1852–1920), a graduate of the Polytechnic School, was appointed the position and subsequently became professor of descriptive geometry in 1905 and taught this course until his death in 1920. In 1917, he published his own treatise of descriptive geometry, "Lectures on descriptive geometry" (Karakatsanidis 1917), which constitutes a complete manual as it covers the complete curriculum.

However, we must state that September 1890 constitutes a turning point in the history of the Polytechnic School as its subordination was modified; henceforth, it was under the direction of the public works of the Ministry of Interior Affairs.

At the end of the nineteenth century, descriptive geometry was recognized as an indispensable tool for the studies of civil and mechanical engineering. Thus, the proclamation of 12 July 1891 regarding the admission of forthcoming students is quite impressive, as among other disciplines, the elements of descriptive geometry (Biris 1952, p. 322) were also included.

The French dominance in descriptive geometry in respect of the professorship and literature lasted until 1897. After the marriage of the crown prince to the Kaiser's sister, subsequent staff sought their training in Germany (Munich, Berlin, Dresden, Karlsruhe, etc.) (Biris 1952, p. 365). They introduced the German model of engineering into Greece, which largely contributed to promoting the industrialization of the country as well as its technical progress.

## 6 Conclusion

The introduction, the adoption and the teaching of descriptive geometry into higher technical education in Greece during the nineteenth century had French origins. Every manifestation in descriptive geometry revealed its French affinity.

[24] Dimitrios Thomaidis (?–1878) originated from Metsovo (Epirus) became a wealthy merchant in Constantinople. Established since 1873 in Athens, he decided to use his legacy, valid until today, to support the studies (edition of books, scholarships) at Polytechnic School.

The diffusion of this branch of geometry in Greek educational institutions was impressionable thanks to some former students of the French *Grandes Écoles*, who, after returning to Greece, spread the discipline by teaching and for holding important posts in the administration. For example, regarding the administration of the Polytechnic School, we must take into consideration that among the six directors from 1837 until 1901, four were officers of the engineering corps: Friedrich von Zentner (1837–1843), Dimitrios Skalistiris (1864–1873), Dimitrios Antonopoulos (1873–1876), (Nikolaidis 2000) and Anastassios Theofilas (1879–1901) (Chatzis 2003, pp. 81–83).

During the nineteenth century, technical education was monopolized by the Military School and the Polytechnic School, which was founded a few years later. Until 1880, the profession of engineer was exclusively bestowed to the officers of the engineering corps who had graduated from the Military School. A great number of the didactic books of the Military and Polytechnic Schools were written by officers of the engineering corps.

The teaching of the Mongean method of projections became a quite important tool not only in developing geometric knowledge, but also in familiarizing the Greek students with graphic procedures, which were useful for engineers and builders. Via this training, the graduates of the Military School and the Polytechnic School were able to participate in the modernization of the Greek state due to their contribution to urban planning, buildings, roads and railway construction, etc.

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