THE TRANSMISSION OF MATHEMATICS INTO GREEK EDUCATION, 1800-1840: FROM INDIVIDUAL INITIATIVES TO INSTITUTIONALIZATION

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ABSTRACT

In the early 19th century, a number of Greek communities developed a remarkable education in mathematics. The subject matter for this instruction was drawn mainly from French textbooks, although some teachers displayed a preference for Prussian mathematical sources.
These efforts, however, were thwarted by the religious conservatism of the Greek establishment of the time, which did not favor the emergence of a Greek mathematical discourse. As a consequence, the reception of mathematical knowledge was a fragmented, random process lacking cohesion, collectivity and transitivity.
The situation radically changed during the second and third decades of the 19th century. The Ionian Academy in Corfu, and the Military School in Nafplio, founded in 1824 and 1828 respectively, created the first institutional frame for a Greek education in which post-revolutionary French mathematics was established as the basis of Greek mathematical discourse. The French background of Greek mathematical education was further reinforced after 1837, subsequent to the institutionalization of secondary education, and to the founding of the University of Athens in 1836-1837. At the same time, along with this French infusion into Greek mathematical discourse, some noteworthy translations of Prussian textbooks were promoted as well.
The first half of the 19th century also witnessed the transmission of the respective epistemological trends of that era, i.e. of the analytical model, of the positivism dominating French mathematics, and of the combinatorial "paradigm" of Prussian mathematics, to the historical setting of Greek mathematical education.

INTRODUCTION: THE EVOLUTION AND BACKGROUND OF NEO-HELLENIC EDUCATION AT THE TURN OF THE 18TH CENTURY

At the beginning of the 19th century, the traditional Orthodox education[1] of the Greek communities in the Ottoman state took on the major challenge of developing innovative schools, which promoted and sustained certain social groups. Two very characteristic examples for that were the establishments of the Academy in Kydonies (Ayvalik, in Turkish) about the year 1800, and of the

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[1] The education provided by the Orthodox Church.

Philological Gymnasium in Smyrna (Izmir in Turkish) in 1808.[2] It is worth noting that these innovative trends were not exclusively confined to the two aforementioned cities of the Eastern Aegean. Several well-established Greek educational centers updated their curriculum, or occasionally presented some relevant revisions of the latter. Four schools to restructure their curriculum during this period were those of Ampelakia[3], at the end of the 18th century, the Gymnasium in Chios, and the School in Milies, Pilio[4] during the second decade of the 19th century, and one of the two educational institutes of Ioannina, in 1805. At the same time, progressive attempts were also made at the Patriarchic School in Constantinople[5] (Istanbul in Turkish) and at the Academies of Bucharest and Jassy[6].

The common goal of these schools was to enhance their curriculae with scientific subjects, with advanced mathematics, and with current philosophical theories. To achieve this goal required an effort at superseding, to a certain degree, the established system of education, which focused on religion. This effort at revision was neither accepted nor even tolerated by certain traditional circles of Neo-Hellenic education intent on impeding, and in some cases even thwarting, its implementation. In this inauspicious environment, it was difficult to attempt; let alone effect any spontaneous, utopian changes regarding orientation, subject matter, and teaching staff involved in Neo-Hellenic education. In short, initiatives and activities in this direction called, as conditions of their realization, both for novel intellectual and social ideals, demands and expectations to emerge, and for strong economic and political forces in their support. In the late 18th century, infrastructures and perspectives conducive to such conditions indeed developed within a number of Greek communities, which happened to flourish because of their booming industry and commercial shipping.

It is noteworthy that the new educational trends emerged primarily within two geographical areas: Thessaly (i.e. mainland Greece) and the Eastern Aegean[7]. In Thessaly, the center of this spectacular rise was Ampelakia, a mountain village opposite Mount Olympus; while the Eastern Aegean centers

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[2] Chatzopoulos, K., *The Greek Schools during the Period of the Turkish Occupation (1453-1821)* (in Greek), (Thessaloniki, 1991), pp.227-245**;** Clogg, R**.**, Two accounts of the Academy of Ayvalik (Kydonies) in 1818-1819, *Revue de Etudes sub-est européennes,* X, 1972, pp. 640-648.

[3] Vakalopoulos, A.K., *The History of New Hellenism* (in Greek), Vol. 4, (Thessaloniki, 1973), pp.545-547.

[4] Chatzopoulos, K., *The Greek Schools during the Period of the Turkish Occupation (1453-1821)* (in Greek), (Thessaloniki, 1991), pp.245-261.

[5] *Ibid*, p p.75-82.

[6] Camariano-Cioran, A., *Les Academies Principes de Bucharest et de Jassy et leurs Professeurs*, Institute for Balkan Studies, (Thessaloniki, 1974), pp.53-84, 100-121.

[7] Asdrachas, S. *et al*, *The Greek Economic History, 15th-19th century* (in Greek), (Athens, 2003), pp.395-402; Katsiardi-Hering, O., *Artisans and Cotton-Yarn Dying Methods. From Thessaly to Central Europe (18th to the beginning of the 19th century)* (in Greek), (Athens, 2003); Leontaridis, G., *Greek Merchant Shipping (1453-1850)* (in Greek), (Athens, 1981), p.54; Sfyroeras, B.B., *An Economic and Demographic Survey of the Greek Area during the Period of the Turkish Occupation (1669-1821)* (in Greek), (Athens, 1979); Kremmydas, B., *Greek Shipping, 1776-1835* (in Greek), (Athens, 1983); Moskof, K., *The National and Social Conscience in Greece* (in Greek), (Athens, 1978), pp. 53-70.

were Chios, Smyrna and Kydonies. This was not quite accidental, as the economies of the Greek communities in these regions soared. In Thessaly, during the second half of the 18th century, the cotton spinneries, in particular those dyeing their yarn red, flourished, exporting their produce to Austria and into Central Europe. At the turn from the 18th to the 19th century, the grain and cotton trade with France prospered in the Eastern Aegean, driven by local Greek shipping ventures.

This relative prosperity promoted and sustained the novel interests and efforts at modernizing education shown by certain Greek communities in Thessaly and in the Eastern Aegean at the close of the 18th and the beginning of the 19th century. The goal of these efforts was to raise educational standards, and to enhance the cognitive capabilities of the younger generation in order to qualify them for meeting the requirements of new vocations, and for adapting to the culture of the countries they traded with.

The exchange of Greek traders and entrepreneurs with a number of European countries during this period opened up two major lines of communication infusing the Neo-Hellenic educational system with ideals and contents of school education transmitted from abroad. The first of these linked Thessaly to Central Europe (Austria, Hungary, and Germany), while the second connected the Eastern Aegean to Leghorn (the Italian Livorno), and to France. These lines of communication caused the most eminent teachers, and authors or translators of schoolbooks to emerge as professionals seeking employment at the innovative Greek schools of the time. Of course, the educational traditions prevalent in their foreign countries of study exerted a certain influence on the contributions these representatives were to make to Neo-Hellenic education.

THE NOVEL CHARACTERISTICS OF NEO-HELLENIC MATHEMATICAL LEARNING IN THE EARLY 19TH CENTURY

Under these conditions, education in mathematics was introduced and expanded in modernized Greek schools. This marked the rise of Neo-Hellenic mathematical education from its formerly marginal, confined and precarious status in the 18th century to a self-assured and well-established component of the school curriculum during the first decades of the 19th century. Within this new educational reality, the syllabus of studies came to include arithmetic, geometry, and algebra, in some cases even extending to trigonometry, conic sections, and infinitesimal calculus.

The first attempts at modernizing the learning of mathematis can be traced to the end of the 18th century in Ampelakia. This is no accident. The economic growth of the region at that time offered both opportunities and demand for upgrading its school system to empower it to provide an education compatible with, and equivalent to, the schooling of their European counterparts in trade. It would seem that both the financial situation and the social preferences matured around 1790, causing young, progressive teachers to be appointed for implementing the bold project of modernization (e.g. the cleric Grigorios

Konstantas) by bolstering the teaching programme with new subjects. Within this context, the Cephalonian doctor Spyridon Asanis (1749-1833), who was then serving both as medical doctor and teacher in Ampelakia, translated Nicolas-Luis de Lacaille's (1712-1762) *Arithmetic and Algebra*, the *Conic Sections* by the same author, and Guido Grandi's (1671-1742) *Conic Sections.* The monk Ionas Sparmiotis (c.1750-1824/1825), together with Constantinos Koumas (1777-1836), undertook the Greek editing of these translations. The translation of Lacaille's *Arithmetic and Algebra* was published in Venice in 1797, and the two translations of the *Conic Sections* were printed in Vienna in 1803.

These volumes had not been chosen by happenstance, as they were of Western European origin and had already gained a foothold in Greece from 1776-77, Iosipos Moisiodax (1730-1800) had indeed drawn on Lacaille's book for his teaching of mathematics at the Greek Academy of Jassy in Moldavia. He had studied in Padova, continuing these studies in Vienna, just like Asanis. The fact that these two scholars had a similar educational background, and equally preferred Lacaille's book, is certainly due to the status Lacaille's work enjoyed in the scientific culture of Italy and Austria during the second half of the 18th century. It is noteworthy that Lacaille's books were hugely popular in Italy, and had spread to Austria as well.[8] Apparently, they had been introduced by Jesuits[9], possibly having been accepted and incorporated into the educational system and cultural heritage of the Jesuits living in the regions mentioned above.

This Ampelakia translation had a sustained impact on the entire region. Particular interest seems to have been raised by the translation of the volume on algebra. As a result, Neo-Hellenic mathematical literature on Algebra was expanded, in the early 19th century, by three young local scholars[10] who had been sent abroad to study in Central and Western Europe. All of these played a major role in Neo-Hellenic education, translating books on arithmetic and on algebra from German works published between 1800 and 1818, or writing books influenced by them. We should add to this list the translation of part of Euler's *Algebra* by the monk Ionas Sparmiotis (who collaborated with other Ampelakia authors on the Greek versions of Lacaille's *Algebra* and Grandi's

[8] Kastanis, N., *Aspects of the Neo-Hellenic Mathematical Culture* (in Greek), (Thessaloniki, 1998), p.111; Rider, R. E., *A Bibliography of Early Modern Algebra, 1500-1800*, (University of California, 1982), p.163.

[9] For instance, Lacaille's volume *Lectiones elementares astronomiae, geometricae, et physicae* (first published in Paris, 1755) had been translated into Latin by the Jesuit Karl Scherffer (1716-1783) and published in Vienna in 1757. In the same year, Lacaille's *Lectiones elementares opticae*, edited by the eminent Jesuit Rudjer Boscovich (1711-1787), were published in Vienna, and reedited in Venice in 1773.

[10] Zisis Kavras (c.1765-1844) of Ampelakia, who studied medicine in Jena, and translated a German book on arithmetic and algebra, his translation having been anonymously published in Jena in 1800. The second young scholar was Dimitrios Govdelas (1780-1831) of Rapsani (a village near Ampelakia), who studied Science and Philosophy in Pest, and wrote a volume on algebra largely inspired by German sources and published in Halle in 1806, bearing the title *Elements of Algebra.* Later, he wrote a book on arithmetic published in Jassy in 1818 The third was Stefanos Dougas (c.1765-1829) of Tyrnavo (a village near Ampelakia), who studied Science and Philosophy in Halle, Jena and Göttingen, and who published a four-volume arithmetic and algebra inspired by German tradition in Vienna in 1816.

Conic Sections), his Euler translation remaining in unpublished manuscript form. These efforts constitute the most representative transmission of German (Prussian) mathematics to Neo-Hellenic culture, two decades prior to the Greek Revolution of 1821.

By way of this Prussian influence, the idea of a de-geometrized, symbolic calculus for Algebra was promoted within the Neo-Hellenic mathematical context.[11] This idea would seem to have stemmed from Euler's *Algebra*[12], and from certain comparable German textbooks, like that of Abraham Gotthelf Kästner (1719-1800), or that of Simon Klügel (1739-1812).[13] It is worth mentioning that the promotion of combinatorial analysis within the context of Neo-Hellenic culture was also a dimension of this particular German influence.[14]

This Neo-Hellenic adoption of Prussian mathematics instruction was not only promoted by the links of commerce between Thessaly and Germany, but was also favored by the views held by important Greek scholarly circles at the end of the 18th century. The observation that "in Weimar, lessons are taught with more order and method"[15] is a typical example for that. At the time, the Greek Orthodox Church showed a benevolent neutrality towards protestant education which, in contrast to that offered by Jesuits, and by Catholics in general, did not pose any threat, as it did not aim at turning Orthodox Christians into converts.

Unfortunately, these Thessalian scholars did not carry their educational activities home, probably because the Greek communities of Thessaly were facing economic decline at the time they had completed their studies and were ready to offer their services. This kept the local educational setting from being upgraded, as there were no prospects for integrating these promising scholars into a dynamic frame suited to their abilities, and for thus cultivating a mathematical tradition of German inspiration at their place of origin. The three Thessalian graduates from Universities in North and Central Europe shifted to more prosperous centres of Neo-Hellenic education. Stefanous Dougas taught at the Patriarchic School of Constantinople during the academic year 1809-1810, and at the Academy of Jassy from 1813 to 1816. Dimitrios Govdelas taught at the Academy of Jassy from 1808 to 1811 and from 1816 to 1821. This is the reason why they were able to contribute towards establishing a German-inspired educational environment in Jassy during the second decade of the 19th century. That the two had gravitated to Jassy was probably rather more a coincidence than the result of a any intentional strategy.

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[11] Kastanis, N., Algebra [in Neo-Hellenic Culture] (in Greek), in *Karas, I.(ed.), History and Philosophy in the Greek Area (17th-19th century)* (in Greek), (Athens, 2003), pp. 144-195.
[12] *Ibid.* pp. 167,194.
[13] *Ibid.* p.178.
[14] *Ibid.* p.197.
[15] Tomadakis, N., Churches and Institutions of the Greek Community in Livorno (in Greek), *Yearbook of Byzantine Studies Association*, 16, 1940, pp. 81-127.

The circle of educated Thessalians in Ampelakia involved in realizing and supervising the mathematics translations of the late 18th century also encouraged an eminent author who took a different path. Constantinos Koumas (1777-1836) became one of the pioneers of modernizing Greek education in the early 19th century. In contrast to his fellow townsmen, who used and taught according to German mathematical standards, Koumas adhered to the "Austrian scholastics"[16], that is to say to the traditional representatives of Catholic rationality. His choice went back to his own training at the University of Vienna from 1804 to 1808. Within this period, he published the eight volumes of his *Elementary Series of Mathematics and Physical Treatises Collected from Various Writers* (Vienna, 1807). His authoring drew mainly on the multi-volume *Cours Encyclopédique et Élémentaire de Mathématique et de Physique* (Vienna, 1800) by Jean-Claude Fontaine (1715-1807).[17] This compendium had been recommended to him by Remigius Döttler (1748-1812), Professor of mathematics at the University of Vienna, who belonged, as a monk, to the Catholic order of the Piaristen.[18]

The first four volumes of Koumas' *Series* present a broad spectrum of contemporary mathematics ranging from arithmetic and geometry to infinitesimal calculus. From the cognitive and methodological characteristics of the various units of this work, it is obvious that they reflect respective French mathematical textbooks of the period around 1770[19] like that of Abbé Sauri (1741-1785).[20] It is worth mentioning that Koumas' presentation of geometry deviated from the model of Euclid's *Elements*. More specifically, his unit on rational geometry, developed in the second volume of the *Series*, reflected the tendency prevalent in the 17th and 18th centuries towards reformulating the geometric discourse of Western Europe by modernizing it and by liberating it from *Euclidism*, i.e. from Euclidean scholasticism. In contrast to the *Elements*, Koumas' subdivided his own contents into longimetry, planimetry and stereometry. This systematization of geometrical knowledge relied on d' Alembert (1717-1783)[21] and besides on some authors of mathematical textbooks like Luis Bertrand (1731-1812).[22]

This distancing from Euclid might in a certain sense be seen as a rejection of national heritage, as it signified that a Greek intellectual had decided to ignore, and thus to reject, the one legacy of Greek antiquity which had the

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[16] Kastanis, N., *Aspects of the Neo-Hellenic Mathematical Culture* (in Greek), (Thessaloniki, 1998), p.189.

[17] Stassinopoulou, M.A., *Weltgeschte im Denken eines griechischen Aufklärers-Konstantinos Michail Koumas als Historiograph*, Studien zur Geschichte Südosteuropas, Band 9, Peter Lang, 1992, p.32 n.122.

[18] *Ibid.* p.31 n.115.

[19] Kastanis, N. *An Introduction of Mathematics in the Neo-Hellenic Culture. The Cases of Algebra and Calculus* (in Greek), Ph.D. University of Thessaloniki, (Thessaloniki, 2001), p. 119, 174.

[20] That book was probably: *Cours complet de mathématique, I-V*, (Paris, 1974) by Abbé J.Sauri.

[21] Cantor, M., *Vorlesungen über Geschichte der Mathematik*, Vierter Band, (Teubner, 1908, Johnson Reprint, 1965), p. 327.

[22] *Ibid.* pp. 332-336; Schubring, G., *Analysis of the Historical Textbooks in mathematics*, Lecture Notes, (Departamento de Mathemática, Pontificia Universida de Católica do Rio De Janeiro, 1999), p. 34.

greatest diachronic and universal value. Actually, Greek national pride was but in a fledgling state during the first years of the 19th century[23], and only began to grow among the Greeks, who languished under Turkish foreign rule, under the influence of the ideas disseminated, and social changes brought about, by the French Revolution. This development was strongly opposed by the Orthodox Church, this hostility being, however, only one of the aspects relevant for the status of Neo-Hellenic mathematical culture at the time. Another particular aspect, which interestingly has been valid to our days, is that Euclid's propositions (and logic, in general) are at odds with the Theology of the Orthodox Church. As one of the most eminent representatives of Orthodox Theology typically declared: "L' essence divine […] n'a pas de relation avec le créé et ne peut par conséquent être prouvée au moyen d' arguments syllogistiques, ni au moyen de demonstrations géométriques".[24] In other words, the Orthodox Church still shuns every approach to theology relying on axioms and proof, abhorring any related state of mind, and thus Euclid's beliefs as well. What kept the clerics on their toes with regard to Euclid, however, was that the latter had been fully incorporated into rivalling educational systems established by Catholics. It is remarkable that the Greek translation[25] of the French Jesuit André Tacquet's (1612-1660) *Elementa Euclidea Geometriae* was published[26] during this period in 1805.

This transmission of mathematics into Greek culture doubtlessly had a French basis dating from the *Ancien Régime*, which seems to have concurred with Austrian rationality of the period. It was not merely a transmission of mathematical facts, but one dominated by the prevalent Austrian view. It is true that this echo of Austrian values had a directly formative influence on Greek scholars and students living abroad. For example, the modernized syllabus applied by the progressive scholar Athanasios Psalidas (1764-1829) after 1796 in Ioannina emcompassed the mathematical handbooks by the Austrian Jesuit Georg Ignaz Freiherr von Metzburg (1735-1798).[27] This transmission of mathematical knowledge was rooted in the learning environment offered in Vienna, where Psalidas had studied from 1787 to 1795. In 1794, he had published a Greek translation of Metzburg's

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[23] Roudometof, V., From *Rum Millet* to Greek Nation: Enlightenment, Secularization, and National Identity in Ottoman Balkan Society, 1453-1821, *Journal of Modern Greek Studies*, 16, 1998, pp. 11-48

[24] Tatakis, B., *La Philosophie Byzantine,* as Fascicule Supplémentaire N° II of Bréhier, Émile: *Histoire de la Philosophie*, (Presses Universitaires de France, 1949), p. 274.

[25]The *Elements of Geometry* by Tacquet (Vienna, 1805), translated by the eminent Greek man of letters Evgenios Voulgaris.

[26] It is well known that all Byzantine manuscripts of ancient Greek origin were pillaged, destroyed, or sold after the fall of Constantinople (an abomination beginning with the crusades from 1204-1261). Thus, the scientific works of the Greek civilization of antiquity, like Euclid's *Elements*, were missing both in the libraries of Neo-Hellenic communities and in those of the Orthodox monasteries, and it was extremely difficult for Greek scholars to access them. A typical statement by an eminent Greek man of letters, around 1780, was: "I do not have my *ancient heritage* " [Katartzis, D., *The findings* (in Greek), (Athens, 1970), p. 55].

[27] The first volume of *Institutiones mathematicae,* tomus I-V, (Vienna, 1775-1790) which contained Arithmetic and Algebra. Other volumes of this work were probably also used, including Geometry, Mechanics, Optics, etc.

Arithmetic.[28] Ten years later, another of Ioannina's men of letters[29] published a Greek translation of Metzburg's *Arithmetic and Algebra*[30] in Padova.

Apart from the modernized mathematical syllabus of the reform school of Ioannina, the "Austrian scholastics" apparently had an impact on the Academy of Bucharest[31] in the same period as well, and their teachings were disseminated as far as Smyrna. The reason for that was that the Greek community of Smyrna invited Koumas to head the local reform school in 1808 for what was to become the most creative period of his didactical activity from 1809 to 1813, and from 1815 to 1817. Koumas taught scientific and philosophical disciplines including mathematics and advanced mathematics on the basis of his own publications. On his urging, two of his disciples, the Thessalian brothers Konstantinos Economou (1780-1857) and Stefanos Economou (1786-1831) were appointed to teach at the Smyrna school. Stefanos, who had studied medicine in Vienna, taught science and relayed Koumas in teaching mathematics during the latter's periods of resignation. There is no doubt that this team of Thessalian teachers had a decisive role in modernizing education in Smyrna and in making the reform school bearing the name of Philological Gymnasium a widely popular establishment.

The progressive Gymnasium of Smyrna, however, became a target for all reactionary circles and was closed down by force in 1819.[32] The Evangelical School of the same city, which had a long history, was orientated towards a traditional, religiously centred model of education. However, this School also saw two progressive interludes, probably due to rivalry with the Philological Gymnasium, when progressive headmasters were appointed. In 1811, Theofilos Cairis (1784-1853) became headmaster, followed by Veniamin of Lesvos (1762-1824) in 1820. These excellent teachers were two of the most eminent representatives of the group of reform mathematics teachers from the Eastern Aegean. Dorotheos Proios (c. 1765-1821) and Ioannis Tselepis (?-1822) from Chios also belonged to this group.

A feature they shared was their origin from the same region, and the fact that they had studied in Pisa and in Paris.[33] Dorotheos Proios, for example, went to study in Pisa around 1787. He taught mathematics at the Greek school of Chios from 1793 to 1796. After that, he studied in Paris at the Ecole Polytechnique from 1800 to 1803. Upon his return, he became headmaster of the Patriarchic School, teaching mathematics and sciences from 1804 to 1807. In the early 1790s, the Kydonian community sent Veniamin of Lesvos to Pisa on a scholarship, who then continued his scientific training in Paris. He

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[28] The textbook *Arithmetic for use in Greek Schools, translated into "our vernacular"* (into Greek) *from Latin* (Vienna, 1794) (Karas,1992, p. 153).

[29] Michael Christaris (1773-1851), who studied medicine in Padova in the early 19th century.

[30] The textbook *Elements of Arithmetic and Algebra, compiled[…]by Metzburg[…]* , see Karas, I., *Sciences during the Period of the Turkish Occupation. Manuscripts and Printed Matters*. *Vol. A' mathematics* (in Greek), (Athens, 1992), pp. 151-152.

[31] Camariano-Cioran, A., *Les Academies Principepes de Bucharest et de Jassy et leurs Professeurs*, Institute for Balkan Studies, (Thessaloniki, 1974), p. 233, 457.

[32] Heliou, P., *The Social Struggles and the Enlightenment. The Case of Smyrna* (in Greek), (Athens, 1981); Heliou, P., *Blind, Lord, thy People* (in Greek), (Athens, 1988).

[33] With the exception of Tselepis, who did not study in Paris.

returned to Kydonies and taught mathematics, sciences and modern philosophy at the Academy from 1798 to 1812. The following year, he taught at the Greek school of Mytilene, then from 1814 to 1820 at the Academy of Bucharest, and at the Evangelical School of Smyrna during the academic year 1820-1821. In 1792, Ioannis Tselepis received a scholarship from the Greek community of Leghorn (Livorno) for studying sciences at the University of Pisa. He returned to Greece in 1796, and taught mathematics at the Greek school of Chios until 1822. From 1812 to 1815 he also served as headmaster. Cairis went to study in Pisa in 1803 with the financial support of the Kydonian community. He continued his studies in Paris in 1807 and returned in 1810 to teach in Kydonies. He was then appointed director of the Evangelical School of Smyrna in 1811, and of the Academy in Kydonies from 1812 to 1821.

The choices of university made by these Greek teachers, who all taught mathematics during the first two decades of the 19th century, were determined by two socio-economic factors:

1. their sponsors, i.e. those funding their studies, and
2. the close commercial relations between the Greek communities of the Eastern Aegean and that of Leghorn (Livorno) in Italy.

Because Leghorn did not have a university, and Pisa was nearby, Greek students were sent to the University of Pisa, while the luminosity of French culture after 1798 and the intellectual circle of Greeks in Paris acted as magnets for a number of Greek students like Proios, Veniamin of Lesvos and Cairis, who went to complete their studies in the French capital.

This latter group of teachers was largely influenced by the French educational system, which shaped their didactical approach. In particular, they were responsible for the introduction of French mathematics into the Greek curriculum. Tselepis actually translated and used L.-B. Francoeur's *Cours complet de mathématiques pures* (Paris, 1809) for his teaching in Chios.[34] Veniamin of Lesvos based his lessons on French literature, which also influenced his philosophical leanings[35] and mathematical teaching.[36] Cairis displayed a similar attitude[37] and it is also very likely that Proios introduced

[34] In the first period of his teaching, he used his Pisa tutor's Pietro Paoli (1759-1838) (Sotirakis, 1939, p. 37) books, probably the latter's two-volume *Elementi d' Algebra* (Pisa, 1794).

[35] Dragona-Monachou, M., The reception of Aristotle by Veniamin of Lesvos in his *Elements of Ethics*, in *Voudouris, K.(ed.): The Neo-Hellenic Philosophy* (in Greek), (Athens, 2000), pp. 79-94.

[36] Veniamin Lesvios, *Elements of Arithmetic*, (in Greek), (Vienna, 1818), p. 85, 115, 134, 138; Veniamin Lesvios, *Elements of Geometry*, (in Greek), (Vienna, 1820), p. 15. It should also be noted that the notation applied in Veniamin's Geometry bears resemblance to that found in Legendre's *Geometry*, see also Karas, I., *Sciences during the Period of the Turkish Occupation. Manuscripts and Printed Matters*. *Vol. A' mathematics* (in Greek), (Athens, 1992), pp. 57-59.

[37] Palamiotou-Thomaidou, K., The logical cognition in the Philosophy of Th. Cairis, in *Voudouris, K.(ed.): The Neo-Hellenic Philosophy* (in Greek), (Athens, 2000), pp. 221-233; Kastanis, N. *An Introduction of Mathematics in the Neo-Hellenic Culture. The Cases of Algebra and Calculus* (in Greek), Ph.D. University of Thessaloniki, (Thessaloniki, 2001), p. 140, 178, 195.

some elements of French mathematics[38] when teaching at the Patriarchic School.

It is true that the intellectual culture and approach of these teachers with regard to teaching mathematics, and to the formative character of their French studies were somewhat disparate. Veniamin of Lesvos, who played a pioneering role in education[39] in Kydonies, promoted and established the teaching of mathematics. He was "the first who taught and wrote mathematics, physics and philosophy using simple Greek in a systematic manner".[40] He also saw to the continuation of his modernizing project by having French-oriented mathematics taught by his disciple Theofilos Cairis, when the latter left the Academy of Kydonies. He was undoubtedly a dynamic person, whose interest in mathematical education and learning in general was not ephemeral, but anticipatory and sustained. On the other hand, Tselepis, teacher of mathematics in Chios, "taught elementary mathematics in ancient Greek and under a theological light".[41] This attitude did not only manifest his own idiosyncrasy, but also the views of those around him, who strongly reacted to the first period of his teaching, when he lived under the mighty shadow of the over-conservative director of the School, Athanasios Parios (1721-1813). The latter was one of the leaders of a powerful group of traditionally-minded Orthodox clerics, who vigorously fought the modernist Greek teachers, actually succeeding in having some of them ousted from office, after accusing them of atheism and having them persecuted by the Orthodox Church. This stout defender of Orthodox faith had a very typical aversion to mathematics, professing that it "was the source of Atheism", and predicting that all involvement with this science would bring about tragic results, the first and foremost being that of "breaking the fast".[42] Patriarch Grigorios V. was just as hostile towards the teaching of mathematics, and in one of his encyclical messages in 1819 he required Orthodox Christians to desist from studying arithmetic and algebra, i.e. "cubes and triangles, logarithms and symbolic calculus", because these brought on apathy, jeopardizing "our irreproachable faith".[43] Mathematics was subject to the broader skepticism and distrust exhibited towards the positive sciences which, being a product imported from the West, were considered to be a Trojan Horse of atheism, and a factor destabilizing the dominant order in ecclesiastical, as well as national, issues.[44]

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[38] Such historical analysis is absent in contemporary Greek publications.

[39] Kitromilides, P. M., The Idea of Science in the Modern Greek Enlightenment, in *Nicolacopoulos, P. (ed.): Greek Studies in the Philosophy and History of Science*, (Kluwer, 1990), pp. 187-200; Henderson, G. P., *The Revival of Greek Thought, 1620-1830*, New York, 1970), pp. 127-141.

[40] Sotirakis, N., *Veniamin Lesvios, Part A' Biography* (in Greek), (Mytilene, 1939).

[41] Valetas, G., A History of Kydonies' Academy. Part A': The enlightening Period of Veniamin Lesvios (1798-1812*)* (in Greek), *Near East Annals*, 4, 1948, pp. 145-208.

[42] Terdimou, M., The Confrontation of mathematics on Behalf of the Eastern Orthodox Church during the Ottoman Period, in *Ihsanoglou, E. et al.(eds.): Multicultural Science in the Ottoman Empire*, (Brepols Publ., 2003), pp. 53-62.

[43] Karas, I., *Natural Sciences in Greece during the 18th century* (in Greek), (Athens, 1977), p.99.

[44] Terdimou, M., The Confrontation of mathematics on Behalf of the Eastern Orthodox Church during the Ottoman Period, in *Ihsanoglou, E. et al.(eds.): Multicultural Science in the Ottoman Empire*, (Brepols Publ., 2003), p. 62.

This negative attitude largely impeded the establishment and development of Greek mathematical culture up to the War of Independence in 1821. It meant rejection of an educational system apt to undermine the dominance of learning focusing on religion, and reflected the French post-revolutionary rollback as well. The Greek establishment was unable, or unwilling to embrace such French ideology and policy, because the Ottoman Sublime Porte was strongly opposed to it. The Orthodox Church was inimical to the French ideas of reform, both because the clergy considered these to be ideologically incompatible and because the ecclesiasts had to bow to Ottoman preferences.[45] Fortunately, however, some Greek communities developed an economic potential which provided a toehold for reform, and thus for an educational influence of French culture as well. In this anti-conventional environment, some reform teachers were able to introduce French mathematical textbooks into Neo-Hellenic culture. Apart from Veniamin of Lesvos, Cairis and later Tselepis, other Greek educators used French mathematical textbooks during the first decades of the 19th century as well. Two eminent teachers of the previous generation originating from Pilio in Volos, Daniel Filippidis (c.1750-1832) and Grigorios Konstantas (c.1753-1844), taught mathematics using French books.[46] Some younger teachers of mathematics who based their teaching on the books of S.F. Lacroix (1765-1843) were Ioannis Carandinos (1784-1835) in Corfu after 1812,[47] and Constantinos Iatropoulos in Bucharest, from 1818 to 1820.[48]

It is hence clear that Neo-Hellenic mathematical education in the early 19th century was in a turmoil of intellectual instability, which did not permit a smooth buildup and homogenization of mathematical discourse, causing it to be fragmented and heterogeneous. This again led to an intrinsic ephemerally and extreme individualism in the orientation, content and epistemological characteristics of mathematical studies. The essence and structure of the proposed mathematical education originated, as a rule, from spontaneous efforts of the teachers assigned who tended to base their didactical models on their own university studies, and had often been influenced by the academics from abroad they were familiar with.

Before this backdrop, any commonly shared set of didactical positions was limited. This restriction was not only due to the temporary and individual nature of every teacher's work, but mainly both to the lack of infrastructure

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[45] Economidis, D.B., Athanasios Parios (in Greek), *Yearbook Cycladic Islands Studies Association*, 1, 1961, pp. 347-422.

[46] Philippidis studied in Vienna and Paris and taught mathematics at the Academy of Jassy, at around 1801. He used the textbooks of A.R. Mauduit (1731-1815). Konstantas studied in Halle, Padova and Vienna. He taught mathematics in Bucharest (1782-1787), in Ampelakia (1795-1803), and in Milies in Pilio (1812-1821). It is a known fact that he used French textbooks.

[47] Kastanis, N., *Aspects of the Neo-Hellenic Mathematical Culture* (in Greek), (Thessaloniki, 1998), p.183-184; Phili, Chr., La reconstaction des mathématiques en Grèce : l' apport de Ioannis Carandinos (1784-1834), in *Goldstein, C. et al.(eds.) : Mathematical Europe*, (Paris, 1996), pp. 303-319

[48] Camariano-Cioran, A., *Les Academies Principepes de Bucharest et de Jassy et leurs Professeurs*, Institute for Balkan Studies, (Thessaloniki, 1974), pp. 543-545.

conducive to any kind of collective learning, training, and professional reproduction, and to the absence of any institutional context of instruction. These deficiencies also impeded the development of certain forms of reflection and critical consciousness. However, some important metacognitive components of mathematics were actually transmitted to the Greek culture, such as the analytical method and the combinatorial approach. Etienne Bonnet, Abbe de Condillac's (1714-1780) *Logique*, for instance, was translated by Daniel Filippidis, and published in Greek in 1801, while an article by Cyrillos Liverios[49] was published in the journal "*Logios Hermes*" [Hermes the Learned] with the title of *Mathematical "Syntaxiology"* in 1821.

Condillac's *Logique* was taught by his translator into Greek in the Danubian principalities. Konstantas and Veniamin of Lesvos were also influenced by Condillac's philosophical, linguistic and methodological ideas, which they incorporated into their own courses in philosophy. They highlighted the significance Condillac attributed to the analytical method with regard to formulating and developing human knowledge. Their interest in this method focused on issues pertaining to gnoseology, pedagogy, and the theory of language.[50] They were obviously not concerned, however, with the method's role and value for the discipline of mathematics. Although this cognitive dissociation tended to be the rule, there was an interesting exception in a text on the didactics of mathematics, a Greek translation of an article about the *Logic of the Teaching of Mathematics*[51] (written by a teacher[52] of mathematics in Lausanne). The article itself examined the pedagogical value of the analytical and synthetic method within the philosophical contexts of Dugald Stewart, Condillac, Degérando, Lacroix, Bonnet, and others.

A second epistemological input concerning the combinatorial view of mathematics largely indicates the Prussian influence on Neo-Hellenic mathematical culture. The importance of the *combinatorische analysis* (sic) "in all sciences and arts"[53] is emphasized in the article on the *Combinationslehre* (sic)[54], which underlines its methodological power and also mentions a set of corresponding innovative ideas developed by a group of renowned German mathematicians[55] along with giving some mathematical examples. In closing, Koumas' mathematical work is criticized for its brevity with regard to the issue at hand. This, however, ignored the fact that the combinatorial method had been extensively presented in other Greek mathematical books of the period influenced by German textbooks.[56]

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[49] The article was by Cyrillos Liberios, who studied at the Universities of Leipzig, Jena, Würzburg, and Göttingen, from 1816 to 1820.

[50] Argyropoulou, R., Condillac in Greece (18th-19th cent.) (in Greek), *Newsletter of the Greek Society for the History of Sciences and Technology,* 19, 1999, pp. 44-53.

[51] *Logios Hermes*, 9, 1819, pp.763-771, 785-800.

[52] By Em. Develey

[53] *Logios Hermes*, 11, 1821, p.187.

[54] Manning, K.R., The Emergence of the Weirstrassian Approach to Complex Analysis, *Archive for History of Exact Sciences,* 14, 1974, pp. 297-383; Jahnke, H.N., Algebraic Analysis in Germany, 1780-1840: Some Mathematical and Philosophical Issues, *Historia Mathematica*, 20, 1993, pp. 265-284.

[55] For example: Hindenburg, D. Burckhardt, Klügel, Fischer, Rothe, Thibaut, and others.

[56] These were Kavas' *Algebra* translated from German, Dougas' *Algebra*, and the Greek translation of Metzburg' s *Algebra*.

It is thus evident that Neo-Hellenic culture was neither devoid of means nor one-sided during the first two decades of the 19th century. It took form from the transmission of German and French mathematics, either via translations of relevant works, or by combining the contents of didactical textbooks taken from related sources. A number of dominant elements of the German and French epistemology of mathematics can also be traced. The Neo-Hellenic mathematical culture of that period however did not succed in overcoming the individualistic and erratic preferences of its teachers and translators, because the social and intellectual environment this culture was particularly narrow-minded, and largely dependent on traditional values, thus blocking any collective initiative and scientific institution from emerging. Under these circumstances, Neo-Hellenic mathematical discourse remained fragmentized and without uniformity. Nevertheless, its contribution to Neo-Hellenic culture, in combination with the corresponding inflow of new scientific ideas, amounted to an "educational revolution".[57]

CHANGES IN THE GREEK MATHEMATICAL CULTURE AFTER 1821

The "educational revolution" of the Greek communities under Ottoman rule in the early 19th century was part of a major campaign for cultural and social change. It contributed to creating a climate of revolutionary expectation, which blazed a path for the outbreak of the War of Independence in the spring of 1821.[58] The developments in the decade that followed were earth-shattering, not only in the social and political field, but in that of education as well; Greek education was radically transformed, and mathematical education evolved accordingly. The first educational institutions were established, fostering a new dynamic in the Greek mathematical culture. Founding of the Ionian Academy in 1824, and establishing the Military School in 1828, resulted in two new centers of higher education, which introduced and gave rise to a new mathematical mentality within Greek reality.

The Ionian Academy was the first Neo-Hellenic University. It was founded in Corfu[59] thanks to the generous financial contributions and long-term efforts of Lord Guilford.[60] The lord organized its structure and the way it operated himself, primarily influenced by Scottish and German standards.[61] He appointed the staff and, in certain cases, also provided further training for some well-educated Greeks prior to offering them a tenure; among them

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[57] Kitromilides, P. M., The Idea of Science in the Modern Greek Enlightenment, in *Nicolacopoulos, P. (ed.): Greek Studies in the Philosophy and History of Science*, (Kluwer, 1990), pp. 187-200.

[58] Kitromilides, P. M., *Neo-Hellenic Enlightenment* (in Greek), (Athens, 1996), p. 466 [English origin: *Tradition, Enlightenment and Revolution: Ideological Change in Eighteenth and Nineteenth Century Greece*, Harvard University Ph.D., dissertation 1978].

[59] At the time, which is from 1815 to 1864, Corfu and the other islands of the Eptanese formed part of the British protectorate.

[60] The British lord was Frederic North, 5th Earl of Guilford (1766-1827), son of a prime minister of the United Kingdom.

[61] Aggelomati-Tsougaraki, H., *The Ionian Academy. The Chronicle of the Constitution of the first Greek University (1811-1824)* (in Greek), (Athens, 1997), p. 231.

Ioannis Carandinos[62] whom Guildford chose to teach mathematics and mechanics. Actually, Carandinos was also offered the position of Dean of the Academy, which he filled until 1832. Apart from the prestige of his elevated academic position, Carandinos' impact on the Greek mathematical education of the period was most significant for two reasons: firstly, he established post-revolutionary French mathematics in Greece by making it the hub of the curriculum and, secondly, he laid the foundations for the discipline's cognitive development.

Carandinos' syllabus at the Ionian Academy included algebra, geometry, trigonometry, descriptive geometry, infinitesimal calculus, and mechanics. It is likely that he also taught arithmetic in preparatory classes at the beginning. For purposes of his courses, he first translated parts of the Lacroix series[63], of Bourdon's *Algebra*, Biot's *Analytic Geometry*, Lagrange's *Analytic Functions,* and of Poisson's *Mechanics*.[64] Besides, he used Monge's *Descriptive Geometry*, and Lacroix's *Applications of Algebra to Geometry*.[65] Later, he translated and published: Bourdon's *Elements of Arithmetic* (Vienna, 1828), Legendre's *Elements of Geometry* (Corfu, 1829), John Leslie's *Geometrical Analysis*[66] (Corfu, 1829), and Legendre's *Treatise on Trigonometry* (Corfu, 1830).[67]

Carandinos' translations and their integration into the mathematical education offered to the students at the Ionian Academy constituted a compact and multidimensional infusion of contemporary French mathematical culture into Greek education. It was the most comprehensive and sophisticated transmission of mathematics ever to happen in modern Greek history. Carandinos' attachment to French mathematical culture also had another dimension: his involvement with research into French mathematics. Between 1825 and1829, he published five essays dealing with specialized mathematical research issues.[68] Basis and context of these papers were fully up to date, referring to contemporary French literature and perspective.

Evidently, French mathematics greatly influenced Carandinos throughout his teaching career, shaping the mathematical culture of his disciples. Thus, via through the mechanisms of educational reproduction, the graduates of the

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[62] He was initiated to French mathematics by Charles Dupin (1784-1873), when the latter organized and directed the Society of General Intellectual Culture in Corfu from 1808 to 1810, while the Ionian Islands were under Napoleon's rule. Carandinos adopted the French system while teaching mathematics at a public school in Corfu from 1812 to 1820. From 1820 to 1823, he studied at the Ecole Polytechnique with Lord Guilford's support.

[63] His Arithmetic, Algebra, Trigonometry, the Elementary Treatise of Differential and Integral Calculus, and the 1st volume and part of the 2nd volume of his 3-volume Treatise of Differential and Integral Calculus.

[64] Kastanis, N., *Aspects of the Neo-Hellenic Mathematical Culture* (in Greek), (Thessaloniki, 1998), pp. 185-186.

[65] Phili, Chr., La reconstaction des mathématiques en Grèce : l' apport de Ioannis Carandinos (1784-1834), in *Goldstein, C. et al.(eds.) : Mathematical Europe*, (Paris, 1996) p p. 303-319.

[66] From a French translation of this book published by Hachette.

[67] Kastanis, N., *Aspects of the Neo-Hellenic Mathematical Culture* (in Greek), (Thessaloniki, 1998), p. 186.

[68] Two of them were on combinatorics, one on algebraic equations, one on the foundation of differential calculus, and one on angles of polygons.

Ionian Academy who taught mathematics in Greek educational institutions, propagated, maintained and extended this particular current within the Greek mathematical culture. A large number of his students became teachers of mathematics[69], and two of them contributed to the mathematical education of the first years after Greece's liberation: Christos Vafas (1804-1880) and Dimitrios Despopoulos. Vafas taught at the first gymnasium of Nafplio and Athens, authored numerous mathematical textbooks, translating L. F. Lefebure de Fourcy's *Leçons d' algèbre* (1837) and A.M. Legendre's *Elements of Geometry* (1860) (edited by A. Blanchet). Despopoulos taught from 1828 to 1854 at the Central Military School, and in 1834 published in Greek a compilation made from A. Lagrange's *Traité de arithmétique commerce augmenté de problems sur toutes les opérations du calcul de commerce* (1830) and F. Lagrange's *Traité de géométrie èlémentaire suiri de problémes* (1830).

This reference to Carandinos' students seems to have led us to the Military School, possibly indicating some form of connection between the two. Was this just a superficial link, or something more profound? In other words, did Carandinos influence the mathematical culture of the school in question? Was his mathematical credo compatible with the school's mathematical education? To provide an answer, let us examine the organizational context and intellectual orientation of the Military School in reborn, liberated Greece.

The Central Military School opened in January 1829 under the direction of the French captain J.H. Pauzié (1792-1848), supported by French government funds.[70] The school's purpose was to train army officers and engineers. Its operation was based on the École Polytechnique[71], and consequently the subject of mathematics was a basic component of its theoretical education. The mathematics curriculum included: L. P. Bourdon's *Arithmetic and Algebra*, A.M. Legendre's *Geometry and Trigonometry*, and G. Monge's *Descriptive Geometry*.[72] Greek translations of these books, however, proved indispensable for realizing these courses, and Carandinos had a decisive role in meeting this didactical requirement. He translated and published Bourdon's *Arithmetic*[73] and Legendre's *Geometry* and *Trigonometry* just as the Military School began to operate, apparently at the suggestion and under the patronage of the Governor of Greece, Ioannis Capodistrias.[74]

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[69] Kastanis, N., *Aspects of the Neo-Hellenic Mathematical Culture* (in Greek), (Thessaloniki, 1998), p. 188; Phili, Chr., La reconstaction des mathématiques en Grèce : l' apport de Ioannis Carandinos (1784-1834), in *Goldstein, C. et al.(eds.) : Mathematical Europe*, (Paris, 1996) p p. 303-319.

[70] Kastanis, A., *The Military School of Cadets in the First Years of its Foundation, 1828-1834*, (in Greek), (Athens, 2000), p. 228.

[71] Kastanis, A., The teaching of mathematics in the Greek military academy during the first years of its foundation (1828-1834), *Historia Mathematica,* 30(3), 2003, pp. 123-139.

[72] *ibid.* p.136.

[73] He had also translated Bourdon's Algebra, and Monge's Descriptive Geometry, which for unknown reasons never saw publication.

[74] Kastanis, A., The mathematics' Books during the period 1828-1832 (in Greek), in *Aroni-Tsichli, K. (ed.): In Honor of Antonis Antonakopoulos*, (Athens, 1997), pp. 531-540.

It thus becomes obvious that Carandinos largely contributed to formulating the Military School's mathematical culture while having a more or less secondary role in this as compared to his primary role for the case of the Ionian Academy. While he merely facilitated transmitting French mathematics to the Military School, he was the architect of its infusion into Greek higher education in the 1820's, the reason why he deserves to be considered the first modern Greek mathematician in the sense of this term. He was the first to attain a high level of mathematical education for himself, to lecture exlusively on mathematics (in contrast to his predecessors), and to act as a productive researcher in the discipline as well.

The transmission of French mathematics to Greece by Carandinos, in the favorable environment of the Ionian Academy and at the Central Military School, became an invaluable legacy to succeeding generations. A revealing detail is that he had 520 copies of Legendre's *Geometry* in Greek translation a huge dimension for contemporary standards of Greek education, distributed to Greek schools by the Greek government between February 1828 and July 1832.[75] Besides this spectacular diffusion of Legrende's *Geometry*, it would seem that Bourdon's *Arithmetic* was used at Greek schools in the 1830's[76] as well.

In May 1832, the young Prince Otto Wittelsbach of Bavaria was proclaimed King of Greece. His arrival in Nafplio in January 1833 together with his entire Bavarian entourage of advisors and officers meant the onset of an era where the "liberated" Greeks were subjected to the authoritarian regime of Bavarian counselors and military men. They zealously undertook to get public matters in Greece organized, and education was one of their top priorities. It was soon visible what the Otto's Bavarian courtiers were intent on doing. In June 1833, the first committee for education, nominated by the Royal Court, delivered its report on the status and organization of public education to the royal administrators who were of Bavarian origin. The educational framework the committee recommended focused on classical studies. This position was held by two of the Royal Court's most eminent scholars, Georg Ludwig von Maurer (1790-1872) and Friedrich Thiersch (1784-1860).[77] This conception meant downgrading mathematics in principle, but also interestingly recommended for secondary education that Geometry be taught on the basis of Euclid, and of Diesterwerg's *Geometry*.[78] This recommendation probably came from the classical philologist Johann Franz (1804-1851), the only German committee member.[79]

The above shows the attitude of the Bavarian rulers of Greece who wanted to shape Greek education according to some megalomaniac version of classicism; a goal they implemented and institutionalized in secondary

[75] Kastanis, A., The teaching of mathematics in the Greek military academy during the first years of its foundation (1828-1834), *Historia Mathematica,* 30(3), 2003, pp. 123-139.
[76] Kastanis, N., *Aspects of the Neo-Hellenic Mathematical Culture* (in Greek), (Thessaloniki, 1998), p. 196.
[77] Kyprianos, P., *A Comparative History of Greek Education* (in Greek), (Athens, 2004), p. 97.
[78] Antoniou, D., *The Origin of Educational Planning in the Neo-Hellenic State: The Plan of the Commission of 1833* (in Greek), (Athens, 1992), p. 109.
[79] *Ibid.* p. 33.

education in 1836.[80] They also intended to boost the Greek culture by introducing German literature into it.

This educational policy and ideology also influenced the status of school mathematics. It is remarkable that teaching mathematics ranked third with 21 weekly lessons in the first curriculum for secondary education of 1836, after Ancient Greek extending to 70, and Latin to 22 lessons.[81] The mathematical syllabus at this level was barely defined by the state, briefly listing but some stereotypical mathematical topics like plane geometry, solid geometry or plane trigonometry.[82] As a result, the teachers of these topics enjoyed much freedom, but the lack of specialized mathematics teachers meant that these liberties quickly led to disorientation and embarrassment. The key to didactically systematize these topics, according to officialdom, was to have suitable textbooks for school published. This created a powerful incentive for printing mathematical textbooks adapted to the new educational situation, and authors with the required skills provided Greek literature with the necessary works.

The most prolific educators were Christos Vafas and Georgios Gerakis. Apart from his two translations already mentioned, Vavas wrote a complete series of mathematical textbooks on various topics for the lower and higher levels of secondary education, beginning in 1842. As one of Carandinos' faithful disciples at the Ionian Academy, he also adhered to his teacher's French orientation. His own books drew on French mathematical textbooks, and he continued infusing the Greek system of secondary education with the French mathematical culture, profiting from it, and making it his own. Gerakis initially was a teacher of mathematics in lower secondary education at an Athens school. In 1837, thanks to a scholarship granted by the Greek state, he went to Germany for studies, teaching mathematics for many years after his return at the Gymnasium of Patra.[83] Beginning in 1837, he authored and published various schoolbooks on arithmetic and geometry. He also translated the German textbooks *Elementary Geometry and Trigonometry*[84] (1842) by Friedrich Wilhelm Daniel Snell (1771-1827), *Arithmetic and Algebra*[85] (1855) by Carl Koppe (1803-1874), *Plane Geometry*[86] and *Solid Geometry* by the same author.[87] His translations and his methodological approach show his

[80] Education in liberated Greece was provided by 49 non-elementary schools in 1829, a number reduced to 39 by 1831.

[81] Toumasis, Ch., The Epos of Euclidean Geometry in Greek Secondary Education (1836-1985): Pressure for Change and Resistance, *Educational Studies in mathematics*, 21, 1990, pp. 491-508.

[82] Toumasis, Ch., *Trends and Characteristics of Secondary School mathematics in New Greece, in Relation to Socio-Economic Changes and the Developments of Mathematical Science (1836-1985)* (in Greek), Ph.D. University of Patra, (Patra, 1989), p. 131.

[83] Zorbala, K., A Greek Geometry Textbook of the 19th Century: Influences of Mathematical Science on Axiomatic in School, *Sudhoffs Archiv*, 86(2), 2002, pp. 198-219.

[84] The textbook: *Leichter Leitfaden der Elementargeometrie und Trigonometrie* (Giessen, 1799, [6]1819).

[85] The textbook: *Die Arithmetik, Algebra und allgemeine Grössenlehre für Schulunterricht* (Essen,1836).

[86] The textbook: *Die Planimetrie und Stereometrie für Schulunterricht* (Essen,1836).

[87] Koppe's Solid Geometry and Plane Geometry had been published in one volume in German, see previous note.

dedicated and persistent effort at transmitting German (Prussian) mathematics to the Greek educational culture. This was as it were an effort at propagating a model of school mathematics alternative to that of French textbooks whose prestige pervaded the entire spectrum of Greek mathematical education of the time.

Gerakis was the only author to introduce German (Prussian) mathematics into Greek schools. Conversely, French mathematics had a number of disciples and adherents translating or authoring mathematical textbooks[88] besides Vafas, showing that the Francophile trend was wide-spread during that period.

The turn towards French mathematics in Greece was further amplified after 1837 with the opening of the University of Athens. The first Professor of mathematics to be appointed to the Philosophical Faculty was Constantinos Negris (1804-1880), who had studied at the Lycée de France and from the Ecole Polytechnique.[89] It was a natural result of his intellectual background that he adhered to French standards in his university courses. He lectured from 1837 to 1845 on Legendre's *Geometry* and *Trigonometry* and, among other authors, on Hachette's *Descriptive Geometry*.[90] Besides directly using French textbooks, a more intricate aspect of the French scientific culture which inspired his teaching is evident from his conscious choice of August Comte's Positive Philosophy as basis of his own didactical approach.[91]

It is a fact that the transmission of French mathematics into university studies was decisive, since it was linked to the training of prospective mathematics teachers. On the basis of this transmission, the above-mentioned schools were in some way ceaselessly reproducing the spirit of French mathematics, and hence a mathematical mentality of larger scope whose sources were fed from its being combined with epistemological positions or propositions. This is precisely what happened at the time to the mathematical courses at the University of Athens, and in a similar way at the Ionian Academy.[92]

On the other hand, the transmission of German mathematics was both institutionally discouraged and epistemologically ineffective. It spread, however, the interesting epistemological "gene" of the operational conception of mathematics, because Carl Koppe, whose textbooks were translated into

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[88] Some of them came from the Ionian Academy, like Antonios Fatseas (1821-1872) and Gerasimos Zochios (1821-1881). Others came from the Military School, like V. Nikolaidis and Michael Sofianos (1811-1888).

[89] Phili, Chr., Some Aspects of Scientific Society in Athens at the End of the XIXth Century: mathematics and Mathematicians, *Archives Internationales d' Histoire des Sciences*, 50 (n, 145), 2000, pp. 302-320.

[90] Kastanis, N., *Aspects of the Neo-Hellenic Mathematical Culture* (in Greek), (Thessaloniki, 1998), p. 197.

[91] *Ibid.* p.197.

[92] It should be noted that Carandinos made a minor meta-theoretical contribution in the preface of his translation of Leslie's book, he quoted the analytical method.

Greek, adhered to Martin Ohm (1792-1872) [93], who was one of the pioneers of that conception.[94]

The predominant feature of these transmissions to Greek mathematical education in the decades after 1821 was that they expanded in straightforward and systematical manner which reflects that mathematics were being solidly and seriously established in structures of secondary and of higher education. Greek mathematical instruction thus took its first steps towards institutionalization. This entailed that mathematics teachers had to specialize, reproduce their profession by established training, and become more homogenous in their cognitions and functions. As a result, their work became less fragmented, and their mathematical discourse acquired cohesion.

The transmission of French mathematics to Greek culture took place within the special cultural and political bonds that developed between Greek scholars and politicians and France. These bonds, however, were not always innocent, but had frequently been subtly imposed by French cultural imperialism. The peculiar situation in which the Greek educational system was permitted a Francophile mathematical mentality to evolve, and to become dominant. In this general environment, the transmission of German mathematics was merely an exception to the rule.

ACKNOWLEDGMENT

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[93] The preface of *Die Arithmetik, Algebra und allgemeine Grössenlehre für Schulunterricht* says that he followed the ideas of Martin Ohm (1792-1872).

[94] Mehrtens, H., Mathematics in Germany circa 1800, in *Jahnke, H.N. / Otte, M. (eds.): Epistemological and Social Problems of Sciences in the Early 19th Century*, (D. Raidel, 1981), pp. 401-420.