Greek Secondary School Science Collections in Istanbul

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Introduction

The Greek community of Istanbul and more generally of the Ottoman experienced a strong blossoming in the second half of the 19th century, which lasted until 1920. The effort that began in the 1830s to modernize the empire played an important role in this, as well as the broader political and economic conditions at the time. In this context, some rights were given to Christians and opportunities for economic and cultural development were created. The Greek community of Istanbul, which was close to the centre of power, was active in many fields, especially education. Through the Patriarchate but also through a series of societies (mainly the Greek Philological Society of Constantinople) primary schools and gymnasiums were established wherever in the Empire Greek populations existed.

Many of these schools were equipped with equipment for physics and chemistry experiments, which is indicative of the importance given by the communities to the teaching of natural sciences.

Today, three secondary schools for the Christian orthodox citizens of Turkey continue to operate in Istanbul: the Great School of the Nation, Zappeion Lyceum and Zografeion Lyceum. They all host valuable and rich collections of scientific instruments. Another collection is hosted in the Theological School of Halki, a school that has been closed since 1971.

This essay will present a brief history of these institutions, their scientific instrument collections, along with some information about the evolution in the teaching of natural science.

It should be noted that according to the Principals of all three of the aforementioned schools, no documents related to the scientific instruments have ever been found in the school archives. Moreover, the archive of the Theological School of Halki is currently not accessible to researchers. Access to the archives would likely offer definitive answers to questions about how, when and where the instruments were purchased, how they were used in teaching practice, and how they were maintained and repaired. Fortunately, some of the gaps can be covered by the fairly regular annual operating reports of some of the schools and other available sources.

The Phanar Greek Orthodox College

The history of the Phanar Greek Orthodox College (PGOC) (Fener Rum Erkek Lisesi in Turkish and Πατριαρχική Μεγάλη του Γένους Σχολή in Greek) is unique among all the educational institutions of the wider Greek space. Its uninterrupted operation since the mid-14th century is remarkable. The PGOC was founded shortly after the fall of Constantinople, in 1454, by the Patriarch George Gennadios Scholarios and has operated continuously until today, with a short break in the year 1821. Since 1882, it has been housed in an impressive self-owned building (Fig. 1) that stands out in the Fener (Phanari) district. The cost of its construction was covered by donations, the most important of which was by Georgios Zarifis and by the Vatopedi Monastery on Mount Athos.

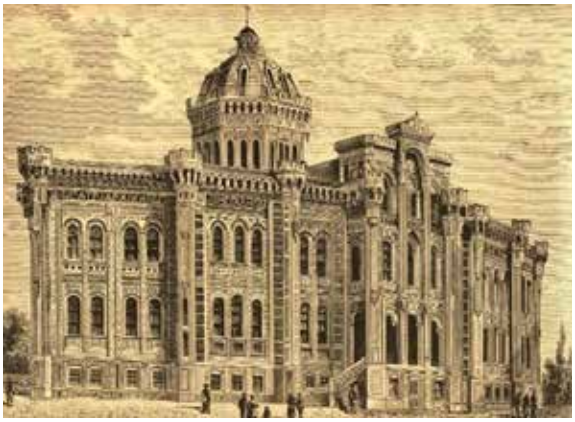

Fig. 1 *Phanar Greek Orthodox College from the report of the principal of the School around 1880 and it was drawn in Leipzig from a photo of the School.*

Fig. 2 *Apparatus for demonstrating that atmospheric pressure acts upon all the surfaces of an object. Phanar Greek Orthodox College.*

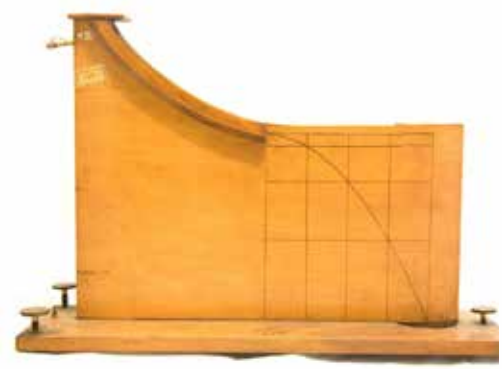

Fig. 3 *Horizontal projectile ramp. Phanar Greek Orthodox College.*

Fig. 4 *Colour Mixing wheel. Phanar Greek Orthodox College.*

Fig. 5 *Pasteboard Models for explaining the Ring Systems in uniaxial and biaxial Crystals, after Fresnel. Phanar Greek Orthodox College.*

Certainly, the PGOC owes its great reputation mainly to classical studies and not to the teaching of science. Until the mid-19th century, the School curriculum was clearly oriented to classical education with only few and short-lived exceptions.[1]

Science classes were either totally absent or intermittently taught, except during certain school years.[2] This fact should not be surprising, given that most graduates of the School until the first decade of the 19th century used to become clergymen. However, it seems that there existed a collection of instruments

Fig. 6. *Planetarium probably by Secretan & Lerebours. Phanar Greek Orthodox College.*

Fig. 7 *Detail of a Helmholtz Double Siren. Phanar Greek Orthodox College.*

Fig. 8 *Medical Induction Coil, made by Ruhmkorff. Phanar Greek Orthodox College.*

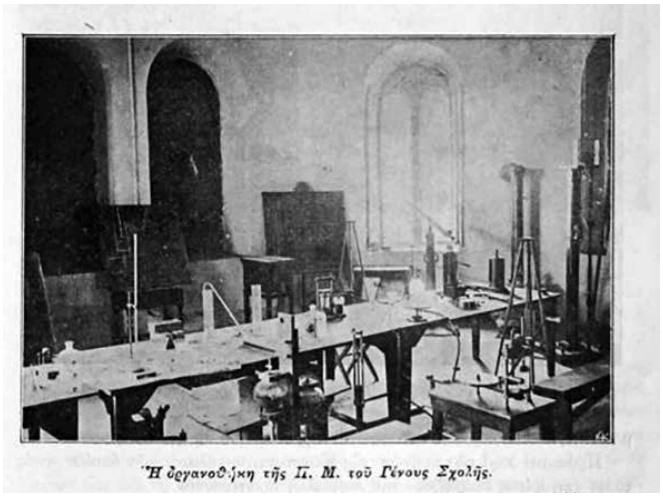

Fig. 9 *Scientific instruments in front of the small amphitheater. Phanar Greek Orthodox College. From an annual calendar of 1906.*

Fig.10 *A class with the physics teacher Aimilios Karousos at the small amphitheater. Phanar Greek Orthodox College. 1937.*

for performing physics experiments in the first half of the 19th century, even though in 1865 nearly all of them had been lost.[3]

The circumstances regarding the teaching of natural sciences gradually change after the mid-19th century. In the school year 1851-1852 a 'physics-chemistry class' is introduced.[4] Undoubtedly, the most important indicator of this trend is the gradual equipping of the instrument cabinet of the PGOC with instruments for teaching experimental physics (Figs 2- 5) and chemistry. The equipment was acquired in four phases, always with the help of donations of money or directly of scientific instruments. The first donation included 23 instruments and took place in the school year 1865-1866[5] by the imperial architect Hadji-Stefanis Gaitanakis, under the condition that the PGOC would each year accept one scholar from Madytos, the donor's place of origin. Among these instruments, was a 90 cm diameter planetarium (Fig. 6), with an impressive base built probably by the Company Secretan & Lerebours. Unfortunately today many of its parts are missing. Also among the instruments were two large caustic mirrors.

This first donation was followed by three larger-scale supplies of scientific instruments. Specifically, in the school year 1866-1867[6] with money raised from donations, about 90 scientific instruments were purchased, the most distinctive of which were an air pump made also by Secretan, a fountain in a vacuum, a fountain of Heron, an intermittent fountain and some instruments complementary to those donated by Gaitanakis in the field of static electricity.

In the school year 1878-1879[7] the School acquired at a bargain price from a private school which was closed, a collection of about 60 second-hand instruments. The most important of these was a Morse telegraph, an electrical machine Carré, constructed by A. Gaiffe, a sonometer, and a glass-drilling apparatus.

Finally, in the school year 1880-1881[8], on the occasion of the construction of the aforementioned building, a substantial amount of donations for the physics instrument cabinet was collected[9], followed by the purchase of 142 new instruments[10] of French manufacture. Many of them, such as a Helmholtz double siren (Fig. 7), a series of 10 Helmholtz resonators and a series of sonic tubes have great similarities with respective instruments by the renowned manufacturer Rudolph Koenig, but bear the unidentified inscription 'L.B.F.G. Paris'. Quite impressive instruments are also a device of Melloni, manufactured by 'Breton frères', an Atwood machine with a seconds pendulum (possibly of the same manufacturer), a solar microscope and a Coulomb torsion balance. At the same time, some individuals donated directly certain instruments to the PGOC. As a result, the PGOC had at the end of the century an enviable collection of more than 300 instruments (Fig. 8).

In the early 20th century, the PGOC will acquire another series of instruments, most of which were made by the famous German firm Max Kohl, while some were manufactured by the Austrian firm W. J. Rohrbeck's Nachfolger. This is the last heyday, not only for the physics instrument cabinet of the school, as well as for the School itself (Figs 9 and 10), as the wars and political turbulence that followed more or less disrupted its smooth operation and significantly reduced its financial resources. However, the enrichment of the physics cabinet from 1866 on was followed by an almost constant increase of the hours per week of teaching physics in all

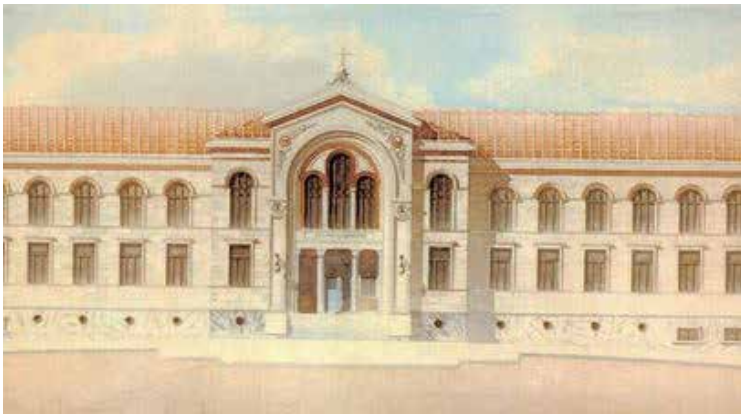

Fig. 11 *Painting of the Theological School of Halki.*

Fig. 12 *Photograph of the Theological School of Halki, early 20th century.*

classes (from 1 hour per week in 1864-1865 it was increased to 8 hours per week in 1888-1889 and to 7 hours per week in 1912-1913), and chemistry (from 2 hours in 1867-1868, to 10 hours in 1912-1913).[11]

Almost half a century passed, until the PGOC procured in the years 1948-1950 another large number of scientific instruments manufactured by the US Company CENCO, comprising about 30 instruments as well as a periodic table of the chemical elements known in 1947.

Halki Theological School

During the first half of the 19th century, the Ecumenical Patriarchate in Constantinople was responsible *inter alia* for the education of the Greek communities' children. Schools were often founded within churches, with the priests providing children with a basic education. There was also a need for competent preachers to counter what the Patriarchate perceived as movements involved in the worrying spread of Western anti-Orthodox views. The above conditions[12] created, or at least intensified, the Patriarchate's need for priests with a broad and profound education.[13] This could only be achieved by founding a theological school, whose absence had already made itself felt.

The decision was taken by Patriarch Germanos IV (1842-1845) who, having re-established and rebuilt the abandoned monastery of the Holy Trinity on the island of Halki, founded the Halki Theological School there (Figs 11 and 12)[14] in 1844. Halki was one of the four inhabited Princes' Isles[15], a group of islands some 10 miles from Istanbul. The Monastery of Agia Triada stands on the top of Elpida Hill, one of two hills on the island, and provided the School's monks, teachers and students with both a singular view and the requisite isolation.

The Theological School initially provided three years of study, though a fourth was soon added.[16] The listing of 'Elements of Physics'[17] in the School's first operating regulations[18] as a class taught in the second year of studies is of particular interest. The Patriarchate's decision to include the class in the curriculum reflects the importance the Orthodox Church ascribed both to its priests receiving a well-rounded education and to the natural sciences. The reply given by the Scholarch [Head of School], the Metropolitan of Stavropolis, Konstantinos Typaldos, to the Ephors of the Phanar Greek Orthodox College when they asked him in writing whether classes in physics and chemistry were preferable to physical theology and the history of philosophy, given that the former had replaced the latter in the College's curriculum for the 1851-1852 academic year[19], typifies this stance. He answered[20] that no such comparison was possible, given that all four lessons were both useful and necessary for a number of reasons. He discreetly suggested that a way be found to teach all four. The Head of the Theological School's views on the importance of the natural sciences is noteworthy and indicative of the views prevailing in the Patriarchate at this time.

Irrespective, however, of the stance taken to science by both the Patriarchate and the Scholarch, it should be noted that it was unlikely physics was taught during the School's first years in operation. Indeed, even if classes were held, they would have been taught by a pupil from a more senior class.[21]

In the School's internal regulations of 1853, the curriculum was extended to cover seven years of instruction. General courses were taught for the first five years and theological classes from the sixth year on. There is a reference to 'Elements of Experimental Physics' being taught in the 4th year[22] for one hour a week. This remained unchanged in the new regulations of 1857.[23]

Moreover, simply including physics as a class in the School's internal regulations was no guarantee in itself that the class would be taught. Typaldos notes that the class was finally introduced in the 1860-1861 academic year, on his own prompting[24], when it was taught by the mathematics teacher from Trapezond, Theodoros Kyriakidis.[25] It is unknown if the class continued to be taught in subsequent years, though various sources[26] indicate that there was no teacher to take experimental physics between 1860 and 1871.

Moreover, the School lacked the requisite laboratory facilities. According to Typaldos' reports and correspondence, the only scientific instrument in the School's possession prior to 1864[27] was a 'valuable and extremely accurate' barometer-thermometer.[28] In addition, in his report on the 1860-1861 academic year[29], the headmaster clearly states that Kyriakidis taught the experimental physics class, albeit without experiments due to the lack of scientific instruments. It does not therefore come as a surprise that experimental physics was replaced by mathematics in the 1867 regulations, and that it would also remain absent from the 1874 curriculum.[30]

However, there is a contradiction here in so far as the first member of staff listed as teaching Physics at the School was the mathematician Georgios Lianopoulos[31] in the 1872-1873 academic year. He had just arrived to teach Mathematics, when he spontaneously undertook to lead the course in physics, too.[32] In 1877, in addition to physics and mathematics, he also taught geology and cosmography[33], a subject which was not included in the regulations then current. We shall return to this problem below. Lianopoulos taught for almost forty consecutive years at the School. Indeed, in 1909, in recognition of his services, his old students collected the sum required to permit his son to continue his studies beyond the Gymnasium.[34]

The School flourished, which led in 1875 to the recognition by the Greek state of its leaving certificate as equivalent to that of its own Gymnasiums.[35] However, it also made the need to renovate and extend its existing premises more pressing still. However, although

the new building was completed in 1891[36], it was almost totally destroyed in the great earthquake of 1894.[37] The conclusion of a study conducted by a committee of engineers was that the building collapsed due to 'improper construction'.[38] Finally, after extensive repairs supervised by the architect Periklis Fotiadis[39], the building opened its doors to the student body once again in 1896.[40]

The next change to the curriculum would be made in the 1987-1898 academic year, when experimental physics reappears as a class taught in the 3rd and 4th years.[41] Clearly, the change could not have been made if the required laboratory facilities were not in place. We can thus surmise that the School had acquired an adequate collection of scientific instruments by 1897 at the latest, and probably somewhat earlier. Another change introduced at the same time was the extension of the curriculum from seven to eight years of instruction. However, this change would be short-lived as the required years of study would go back down to seven in the new regulations introduced for the 1903-1904 academic year.[42] Cosmography, experimental physics[43] and chemistry were introduced[44] at the same time. However, neither chemistry nor cosmography are referred to in the curriculum, while physics appears to have been taught for two hours a week in both the 3rd and 4th years.[45] It would appear that chemistry and cosmography -which, as you will remember, had been taught by Lianopoulos, starting in 1872- were taught during the four hours timetabled for physics. This would indicate a certain flexibility in relation to the implementation of the regulations, in regard to the teaching of the natural sciences, at least. One explanation for Lianopoulos teaching experimental physics could be that suitable scientific instruments had been acquired through purchases or donations, which made it possible -and, in a sense, obligatory- to teach the subject. Unfortunately, given the current inaccessibility of the School archive, we cannot explore this hypothesis further.

The headmaster's reports on the 1910-1911[46] and 1912-1913[47] school years refer to Lianopoulos teaching physics to the 2nd, 3rd and 4th grades. In the case of the 2nd-grade, 'physics' most probably refers to physical history, which was included in the curriculum from 1903.

The years that followed, through until 1919, were especially turbulent, with the School closing for periods of time, the building being commandeered for troops or refugees, and the School moving temporarily move to the Monastery of Saint George of Krimnos on Halki. The details of the above are beyond the scope of the present paper, but it can be understood that these events were accompanied by both damage to and losses from the scientific instrument collection in particular and the School's premises and facilities in general.

Fig. 13 *Volta electric lighter. Theological School of Halki.*

Fig. 14 *Babo generator. Theological School of Halki.*

For the 1919-1920 academic year, the School was turned into a Theological Academy with a five-year programme of study. Though the name of the institution remained the same, both its secondary education section and general courses of study were discontinued; experimental physics was among the courses which were dropped from the curriculum.[48] However, limited student intakes would necessitate a return to the previous state of affairs, with the School reinstating the 1903 internal regulations and curriculum for the 1923-1924 academic year along with its secondary and theological departments.

The teaching of physics, chemistry and mathematics was undertaken by Alexandros Iatropoulos[49] from 1925, while Stylianos Stasinopoulos[50] was hired to teach physics and cosmography the following academic year.[51] Stasinopoulos' arrival would seem to have released Iatropoulos from his obligations in regard of physics.[52]

The School's last internal regulations were issued in 1953; henceforth, students would be able to choose between a three-year secondary course and a four-year theological course. The secondary curriculum[53] included physics (two hours per week in each grade) and chemistry (two hours per week in grade One and one hour in grades Two and Three).

A number of projects aimed to improve the operation of the School were completed in the decade between 1950 and 1960. These included 'laying out the physics and chemistry laboratories'[54] and 'enriching' both. For the first time in decades, the School acquired new equipment for the teaching of physics.

With Iatropoulos and Stasinopoulos now in retirement, the teaching of physics and chemistry was undertaken[55] by Vasileios Kasapidis (1948-1950, chemistry) and Alexandros Kotsoglou (1951-?), physics and mathematics). The School closed in 1971 following the introduction of a law by the Turkish Government forbidding the operation of private institutions of higher education. It has never reopened.

The School's instrument collection is stored in the building's chemistry section, a room with four rising rows of desks, a bench for demonstrating experiments, an extractor fan and cupboards for the instruments. Around 45 instruments for physics and a number of vessels for use in chemistry experiments are stored there.

Of these, some ten instruments and devices were manufactured by CENCO[56], an American Company: of these, the High Frequency Apparatus, Tesla Type No 80700 and the oil-filled capacitor No 80705 stand out. The equipment acquired 1950-1960 comprised these two pieces of apparatus plus the Bausch & Lomb[57] spectroscope. The remaining instruments date from the last quarter of the 19th century and are of French manufacture; every signed piece bears the mark of A. Molteni, Paris. Of particular interest among this older apparatus are a Volta's electric lighter (Fig.13)[58], the only known example in a school in the Greek world, a Babo[59] device for producing hydrogen gas (Fig. 14), and an elegant example of an electric whirl combined with seven scintillating tubes. Although no catalogue of the equipment in the physics laboratory has yet been found, it is obvious that a number of the 19th-century instruments have been lost. This should come as no surprise, given the School's adventures down the

Fig. 15 *Zografeion School as it was when it was built. Almost 60 years later 2 more floors were added.*

Fig. 16 *Daniell Hygrometer. Zografeion School.*

Fig. 17 *Baroscope. Zografeion School.*

years. The presence of static electricity instruments (e.g. an electric egg, a Leyden jar) assumes the existence of an electric machine, while it is inconceivable that the collection did not include other related instruments and devices. Similarly, the presence of a fountain in a vacuum presupposes the existence of an air pump of some sort. Unfortunately, these instruments have been lost for good.

Zografio School for Boys

The clear aforementioned direction of the Phanar Greek Orthodox College towards classical studies had created in the last quarter of the 19th century, a gap in the education possibilities of Istanbul's Greek community. Merchants, doctors and engineers wanted to provide similar careers to their children and therefore the creation of a relevant school was essential. Since 1833, the 'School of Our Lady' was already operating in Peran, initially just as a primary school, to which the lower cycle of secondary education was later added.[60] In 1893 the School was extended to include a four-class gymnasium and was renamed to 'Zografion' Gymnasium, after a generous donation by Christakis Zografos[61], leading to the construction of an elegant and spacious building to house the school permanently (Fig. 15).

There was an open bid for the new building's design and Pericles Fotiadis, still an architecture student at the time, was selected. On the ground floor of the three-floor building[62] there were, among others, the chemistry lab and the physics cabinet.[63] As regards to the presence of natural sciences in the school curriculum, it is noted that in accordance with Regulation 1903[64] experimental physics was taught in the last two grades of primary school (2 hours per week) and in the three higher grades of high school (2, 2, and 3 hours respectively). Today the surviving collection of instruments includes more than 300 rescued instruments. (Fig. 16) As Zografeion Gymnasium was founded in the late 19th century, French-manufactured instruments were a smaller part of the total collection, contrary to the other Greek schools in this presentation.[65] We can highlight some instruments made by E. Ducretet, namely an electric egg, a Ruhmkorff coil, a prism, a baroscope (Fig. 17) and a very nice tellurium (Cosmographe de Girod[66]). There are several instruments made by German (Max Kohl e.g. a Morse telegraph and a Braun electrometer, Kohl & Volckmar, e.g. a barometer, an electric egg, an Atwood machine) and Austrian (e.g. a Hartle disc made by Noir & Forster, Wien and an air pump made by W. J. Rohrbeck, Nache, Wien[67]) manufacturing construction firms and a series of instruments by the English firm 'Griffin' such as a hydraulic press, and various accessories for a centrifugal machine (the latter has not been found).

Zappeion School for Girls

The Greek community of Istanbul had been very innovative in terms of girls' education.

Fig. 18 *Students from Zappeion School for girls and one of their teachers in the middle.*

The school for girls 'Pallas' was founded in 1874. In late 1874 the Association for Women's Education was founded and set as its main target the establishment of a Higher School both for girls and primary school teachers. This objective was able to be achieved only when to the initial donations of George Zarifis and Christakis Zografos the generous sponsorship of wealthy businessman and benefactor Constantine Zappa was added, whose name is permanently associated with the Zappeion School for Girls.

The School began its operation in September 1875 in a rented building. In 1879 the Zappeion was recognized by the Greek Kingdom as equivalent to Arsakeio School for Girls in Athens[68], which was the top school in Greece. This was an honor for the Zappeion and it also ensured that the graduates of the School could work as teachers in schools of the Greek state. To achieve this aim, a teachers' training school is operated by the Zappeion, with a two-year course for those

Fig. 19 *Electrical Puppet Theatre, an electrostatic instruments demonstrating attraction and repulsion by means of 'dancing' pith figure (Zappeion School).*

Fig. 20 *Zoetrope on an electric motor. Zappeion School.*

Fig. 21 *One of the two Telluriums at the Zappeion School.*

graduates wishing to work as teachers. This resulted in the need for a larger building.

In 1880 the reconstruction of a proprietary magnificent building began in a part of the school's land in Aghia Triada in Stavrodromi. The plans of the building were made by Ioannis Ioannidis. The imposing and luxurious four-storey building was 32 m high and was inaugurated in 1885.[69] The recorded descriptions of the new building show the lasting impression it created to those who visited it. As far as the infrastructure for science teaching is concerned the following has been written: 'On either side of this (pp the ceremony hall) there are two rooms containing the instrument cabinet, and all that is needed for the teaching of physics, chemistry, zoology , astronomy, mineralogy, and all other departments of practical human knowledge. These rooms with their collections and the rare and opulent paintings hanging in every corner constituted precious museums for whoever pried in them and wanted to learn effortlessly even through a simple conversation, as they left them with valuable skills and expertise'.[70]

Both the above description and the scientific instruments currently preserved at the Zappeion, are really impressive, especially if we consider they concerned[71] a School for Girls (Fig. 18). The choice of teaching experimental physics in a school for girls is innovative, at least for an educational institution of the Ottoman Empire in this era. Indicatively, according to the Regulation of 1879[72], physics was taught in gymnasium one hour per week in the 3rd and 4th grade (out of 5) and the chemistry one hour per week in the 5th. In 1906[73] the numbers of classes of primary and secondary schools are unified and the situation has developed as follows: physics is taught in the 8th grade (general properties of bodies and mechanics of solids, liquids and gases) and the in 9th grade (heat, electricity (Fig. 19), magnetism and acoustics) along with cosmography. The chemistry is no longer taught in the gymnasium, but it has been moved to the first year of the School for Teachers as the last chapters of physics (optics, meteorology and climatology).

The surviving instruments exceed 150 and come from two periods. The first period concerns French-made equipment purchased immediately or shortly after the reconstruction of the building, that is in the last two decades of the 19th century. Seventeen of these instruments are labeled: 'Ch. Duterme, Instruments De Physique, D'occasion, 11 Rue Blainville, Paris'. Duterme was a retailer, selling both new and second hand instruments around 1860-1890. Two out of the seventeen instruments are signed by their manufacturer: a small Ruhmkorff coil is signed by 'A. Gaiffe, Paris' and an incomplete Leslie thermometer is signed by 'Dumotiez, Paris'. Therefore, these instruments were purchased second hand and this is very probable for the rest as well. Among these the most significant instruments are a Carré electrical machine and an unusual zoetrope (Fig. 20), which can be rotated by an electric motor.

Other objects that adorn the collection, is an unsigned Ramsden electric machine, an air pump with double pistons signed by 'LOISEAU, Paris', a phonograph signed 'Je chante haut et clair', two tellurium (Fig. 21) and an armillary sphere. A very useful set of teaching aids is a collection of 238 glass slides in 3 wooden cases along with a magic lantern, all signed by 'Mazo, Paris'.

Moreover, there are about 10 instruments made by CENCO (e.g. a Kundt tube, a Hartle disc and an oscilloscope). There is no record about when they were purchased, but we believe this happened around 1955.

Epilogue

The existence of such rich collections in all Greek schools of Istanbul is a proof of how important the Western scientific culture for the Greek community was. It also very clearly reflects the economic, cultural and social development of the community in the period 1870-1910. The registration, maintenance and enhancement of these collections will be an important step in the study of the progress of the Greek community during this period and will illuminate some aspects of the commercial and economic connections between the Ottoman Empire and western states.

Acknowledgments

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Notes and References

1. Konsntantinos Kougas, 'Natural Sciences at the Great School of the Nation Curriculum' in the Proceedings of the Scientific Conference *The Patriarchal Great Nation School. History and Offer* (Athens, 2004), pp. 167-183.

2. For more information about teaching science courses before 1850 see Tassos Gritsopoulos, *Patriarchal Great School of the Nation*, Vol. II (Athens, 2004).

3. Efstathios Kleovoulos, Accountability for the School Year 1865-1866' in *Constantinople the Great School of the Nation* (Istanbul: Eastern Starl, 1866), p. 30.

4. Gritsopoulos, *op. cit*., note 2, p. 176.

5. Kleovoulos, *op. cit.*, note 3, p. 30.

6. Efstathios Kleovoulos, 'Accountability for the School Year 1866-1867' in *Constantinople the Great School of the Nation* (Istanbul: Eastern Star, 1867), pp. 40-42.

7. Grigorios Palamas, *Report of Mental and Physical Condition of the Patriarchal Great School of the Nation during the School Year 1878-1879* (1879), pp. 145-150.

8. Grigorios Palamas, *Report of Mental and Physical Condition of the Patriarchal Great School of the Nation during the School Year 1880-1881* (Istanbul: Patriarchal Printing, 1881), pp. 168-174.

9. The permanent space for the storage of the instruments in the new building was an additional motivation for donors.

10. Grigorios Palamas, *Report of Mental and Physical Condition of the Patriarchal Great School of the Nation during the School Year 1879-1880* (Istanbul: Patriarchal Printing, 1880), p. 114.

11. Kougas, *op. cit.*, note 1, p. 178.

12. For more, see Vasileios Stavridis, Η Ιερά Θεολογική Σχολή της Χάλκης, *1923* μέχρι σήμερον [The Holy Theological School of Halki: 1923 to the present], Vol. II (Athens, 1968), p. 15.

13. Until then clerics had been educated either in monasteries (though not in a systematic way) or at the Great School of the Nation (Phanar Greek Orthodox College); the latter institution would gradually change into a European-style gymnasium over the course of the 19th century.

14. Mexis (see note 16), pp. 22-43

15. The inhabited islands are Proti, Antigoni, Halki and Pringipos.

16. Apostolos Mexis. Η εν Χάλκη Ιερά Θεολογική Σχολή. Ιστορικά σημειώματα *(1844-1935)* [The Holy theological school on Halki: Historical notes (1844-1935)]. (Constantinople, 1933), p. 71. This meant that the School produced its first graduates in 1848.

17. However, it was not taught, at least to the first cohort of students. Mexis (note 16), p.57.

18. *The recently issued Letter with the Patriarchal and Synodical Seal on the subject of the Holy Theological School of Halki of the Great Church of Christ of the Holy Monastery of the Holy Trinity on Halki*, *also including the internal regulations of that School* (Constantinople: Patriarchal Press), p. 14. Like every subject on the curriculum, the class was taught for one hour per week.

19. George Metallinos, Varvara Kalogeropoulou-Metallinou. *Archives of the Holy Theological School of Halki, the Theological School of the Great Church of Christ. During the headship of Metropolitan Konstantinos (Typaldos-Iakovatos) of Stavropolis 1844-1864.* Vol. III, pp. 92-93. See also n. 51.

20. *Ibid*., Vol. III, pp. 232-233.

21. Mexis (note 16), pp. 86-88.

22. *Regulations of the Holy Patriarchal Theological School of the Great Church of Christ at Halki* (Constantinople: Patriarchal Press, 1853), pp. 15 and 17. An error, probably typographical, in Mexis' book (note 16) should be noted: while the work refers on p. 84 to physics, geography and chronology being taught in the 2nd year, the classes actually taught were physical geography and chronology.

23. *Regulations of the Holy Patriarchal Theological School of the Great Church of Christ at Halki* (Constantinople: Patriarchal Press, 1857), pp. 12-13.

24. Metallinos, *op. cit*. (note 19), Vol. V, pp. 45-46.

25. Kyriakidis would teach at the School from 1855 to 1864. See Vasileios Stavridis, *The Holy Theological School of Halki: A Supplement 1985-2000* (Athens: Kyriakidis Bros, Athens, 2001), p. 12.

26. Mexis (note 16), pp. 115-116.

27. The School's archives have been published up to and including 1864.

28. Metallinos (note 19), Vol. V, p. 27. The same instrument is also referred to as a 'barometer with a thermometer' in *ibid*., Vol. I, p. 65. Donated to the School by Konstantinos Spantonis, Elisavet Spantoni and Eleni Zano. The same benefactors had donated the 'Geographical Charts' the previous year.

29. *Ibid*., Vol. V, pp. 45-46.

30. *Regulations of the Holy Patriarchal Theological School of the Great Church of Christ at Halki* (Constantinople: Patriarchal Press, 1874), p. 10.

31. Lianopoulos also taught physics and mathematics at the Halki Commercial School and at the Phanar Greek Orthodox College. He continued to teach at the School virtually continuously until his death in 1922 (as a professor emeritus after 1919).

32. Mexis (note 16), pp. 120-121.

33. *Ibid*., p. 133.

34. *Ibid.*, p. 158.

35. *Ibid*., p. 125.

36. *Ibid*., p. 128.

37. *Ibid*., p. 128. The School remained closed throughout the 1895-1896 academic year, when it operated on a temporary basis at the Home for Retired Clerics in the Monastery of the Transfiguration on the island of Proti.

38. *Efimeris ton Syzitiseon*, No. 265, 18.08.1894, p. 2.

39. Fotiadis also designed the building of Zografeion School.

40. Mexis (note 16), p. 142.

41. *Ibid*., p. 152.

42. *Regulations of the Holy Patriarchal Theological School of the Great Church of Christ at Halki* (Costantinople: Patriarchal Press, 1903), p. 25.

43. We note that Experimental Physics was taught in the 1897-1898 academic year, but was only included in the official curriculum in 1903.

44. *Regulations*, *op. cit.*, note 42, p. 25.

45. *Ibid*., pp. 49-52.

46. *Report by the Director of the Theological School, Archimandrite Georgios Strinopoulos, for the year 1910-1911* (Constantinople: Patriarchal Press, 1911), p. 13.

47. Metropolitan Georgios Strinopoulos of Selefkia, *Report on the 1912-1913 Academic Year* (Constantinople: Patriarchal Press, 1913), p. 14.

48. Mexis, (note 16), pp. 177-178.

49. Stylianos Stasinopoulos (1865-?) was born in Constantinople, graduated from the Great School of the Nation and earned a degree in Mechanical Engineering and Metallurgy from the University of Paris. He taught at the Halki Theological School, the Phanar Greek Orthodox College, the Zografeion and both the Zappeion and Ioakeimeion schools

for girls. He taught Physics and Mathematics at the Halki Theological School until 1948. For more on Stasinopoulos, see Psaropoulou-Dokou, I, Ζάππειον Παρθεναγωγείον Κωνσταντινουπόλεως *1875-2004* [The Zappeion School for Girls, Constantinople, 1875-2004] (Athens: Tsoukatos Editions, 2014).

50. Alexandros Iatropoulos (1892-1970) was born in Herakleion, Nikomedeia. He graduated from the Great School of the Nation, going on to study Chemical Engineering in Lausanne on a School scholarship He taught at the Halki Theological School, the Zografeion, the Zappeion School for Girls, the Ioakeimeion School for Girls and the Commercial School of Languages. He remained on the teaching staff at the Halki Theological School until 1950. For more on Iatropoulos, see *The Teachers of Constantinople, A Memorial to the Spirit, Second Series. Association of Great School of the Nation Alumni in Athens* (Athens, 1998).

51. Mexis (note 16), p. 197.

52. Stavridis (note 12), p. 102.

53. *Regulations of the Holy Theological School of Halki* (Constantinople: Patriarchal Press, 1953), p. 30. The regulations were also published in Turkish.

54. Stavridis (note 12), p. 14).

55. *Ibid*., p.103.

56. The number of CENCO instruments acquired 1950-1960 by Greek schools in Constantinople is noteworthy and a suitable subject for further research. Indeed, with only isolated exceptions, the schools do not seem to have been supplied by any other manufacturer of scientific instruments.

57. For information on the spectroscope, see https://www2.humboldt.edu/scimus/HSC.54-70/Descriptions/BunSpcScp.htm

58. Paolo Brenni, *Volta's electric lighter and its improvements: The birth, life and death of a peculiar scientific apparatus which became the first electric household appliance*, in Marco Beretta, *et. al*., eds, *Musa Musaei. Studies on Scientific Instruments and Collections in Honour of Mara Miniati* (Florence, 2003), pp. 371-394.

59. William Jensen, 'Of Beehives and Babo Generators: The Adventures of a Museum Curator', *Bull. Hist. Chem*, **8** (1990), pp. 34-35.

60. Polyvios Strantzalis, *The Virgin Mary School (1833) and Zografeios High School (1893)* (Athens, 2003), p. 92.

61. Christakis Zografos (1820-1896) was born in Kestorati ιν Northern Epirus and was one of the most important bankers in Istanbul, with particularly high activity and donations to educational institutions and associations.

62. In 1962 two floors were added to the building in order to accommodate the increased student population

63. Strantzalis, op. cit., note 59, p.136.

64. *Schools of Greek Orthodox Stavrodromi Community. An analytical program of six-grade schools and Zografeion Gymnasium* (Istanbul, 1903), p. 49.

65. At the closing of 19th century German instrument makers have overpassed their French colleagues.

66. Eugene Ducretet. *Catalogue raisonné des instruments de precision de E.Ducretet* (Paris, 1905), p. 307.

67. A note, dated back to 1951, in the book of the material of Zografeion school refers that an air pump and a small astronomical telescope have been transferred there from the Phanar Greek Orthodox College. It is very likely that this is the particular air pump. The Phanar Greek Orthodox College has other instruments made by this manufacturer, but Zografeion has not.

68. *Regulation of National Zappeion School for Girls in Istanbul*, S.I.Voutyras Istanbul, 1885. pp. ιδ'-ιε'.

69. For a detailed description of the building and the opening ceremony see: 'The opening of the Zappeion', July 10, 1885 newspaper *Neologos*, Istanbul, 1885.

70. See note 21, p. 23.

71. Zappeion has become a mixed school since 2000.

72. *Regulation of National Zappeion School for Girls in Istanbul* (Istanbul, 1879), pp. 52-54.

73. *Regulation of National Zappeion School for Girls in Istanbul* (Istanbul: Gerardi Brothers, 1906), pp. 16-17.

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