Indonesian Journal of Islamization Studies
INJAS
P-ISSN: 3026-5401
E-ISSN: 3026-5398
2026 Vol. 03, No. 02, 138-169
doi: -

Eminent Mathematicians and Their Works in Ottoman State

Professor Salim Ayduz
Sophia Academy, Charl. Lagedijk 563, 3084 LC Rotterdam, Netherlands and Independent Senior Researcher, Manchester, UK, United Kingdom

Submitted 15 August 2025
In Review December 2025
Accepted 2 February 2026
Published 28 February 2026

Abstract

This article examines the development of mathematical sciences in the Ottoman Empire over nearly six centuries, focusing on how mathematics was integrated into the Islamic intellectual and social framework. By analyzing the works of scholars such as Qādīzāda al-Rūmī, Ali al-Qushjī, and Matrakçı Nasūh, the study shows how Ottoman scholars harmonized the rational sciences (al-ʿulūm al-ʿaqliyya) with the religious sciences (al-ʿulūm al-naqliyya). Mathematics became institutionalized within the madrasa system, where arithmetic (hisāb) was considered essential for practical religious duties such as inheritance calculation (farāʾiḍ), waqf administration, and determining prayer times. Through the study of important mathematical texts and institutions such as the Sahn-i Sāmān madrasas, mathematics was viewed not only as a technical discipline but also as a means to pursue wisdom (ḥikma) and reflect on the order of creation. The shift from Arabic and Persian manuscripts to Turkish texts for state officials illustrates the integration of scholarship with administrative needs.

Keywords Ottoman Mathematicians, Ali al-Qushjī, Qādīzāda al-Rūmī, Fathullah al-Shirwānī, Muhammad II, logarithm, arithmetic, hisāb, geometry.

Abstract

Artikel ini mengkaji perkembangan ilmu matematika di Kesultanan Utsmani selama hampir enam abad dengan menyoroti integrasinya dalam kerangka intelektual dan sosial Islam. Dengan menganalisis karya para sarjana seperti Qādīzāda al-Rūmī, Ali al-Qushjī, dan Matrakçı Nasūh, penelitian ini menunjukkan bagaimana para ulama Utsmani menyelaraskan ilmu-ilmu rasional (al-ʿulūm al-ʿaqliyya) dengan ilmu-ilmu keagamaan (al-ʿulūm al-naqliyya). Matematika kemudian mengalami proses pelembagaan dalam sistem pendidikan madrasah, di mana aritmetika (hisāb) dipandang penting untuk pelaksanaan kewajiban praktis seperti perhitungan waris (farāʾiḍ), pengelolaan wakaf, dan penentuan waktu salat. Melalui kajian terhadap karya-karya matematika serta lembaga pendidikan seperti madrasah Sahn-i Sāmān, matematika dipahami tidak hanya sebagai disiplin teknis, tetapi juga sebagai sarana meraih hikmah (ḥikma) dan merenungkan keteraturan ciptaan Tuhan. Selain itu, peralihan dari manuskrip Arab dan Persia ke teks Turki bagi pejabat negara menunjukkan integrasi antara tradisi keilmuan dan kebutuhan administratif pemerintahan.

Keywords Matematikawan Turki Usmani; Ali al-Qushjī, Qādīzāda al-Rūmī, Fathullah al-Shirwānī, Muhammad II; Algoritma; Aritmatika; Ilmu Hitung; Geometri

***Corresponding Author**
Professor Salim Ayduz, sayduz@hotmail.com

Introduction

After the conquest of Istanbul by Muhammad the Conqueror in 1453, Sultan himself began to constitute a science centre in Istanbul. In the Library of the Palace of Sultan there are copies of all books about medicine, arithmetic, geometry, astronomy which were published in other countries at his time. During his reign, Muhammad II invited famous scholars to study in Istanbul in his Madrasas.[1]

The conquest of Constantinople by Mehmed II in 1453 marked a decisive turning point not only in political history but also in the intellectual and scientific development of the Ottoman Empire.[2] Following the conquest, Mehmed II sought to transform the newly captured city into a thriving center of culture, learning, and scholarship. His vision extended beyond administrative consolidation and military strength; he aimed to establish a vibrant intellectual environment that would rival the great centers of knowledge in the Islamic world.[3] As a result, Constantinople, later known as Istanbul, gradually emerged as an important hub for scientific activity and scholarly exchange.

One of the key elements of Mehmed II's intellectual policy was the development of educational institutions and the encouragement of scholarly pursuits. The Sultan invested considerable resources in the establishment of madrasas and scholarly institutions designed to cultivate both religious and rational sciences.[4] Among these institutions, the famous Sahn-ı Seman madrasas played a central role in shaping the intellectual landscape of the Ottoman capital. These institutions attracted scholars from different regions, including Anatolia, Persia, Central Asia, and the Arab world, thereby creating a

[1] A. Tunç Şen, "The Sultan's Syllabus Revisited: Sixteenth-Century Ottoman Madrasa Libraries and the Question of Canonization," *Studia Islamica* 116, no. 1 (2021): 198–235, https://doi.org/10.1163/19585705-12341441.

[2] Kaya Şahin, "Constantinople and the End Time: The Ottoman Conquest as a Portent of the Last Hour," *Journal of Early Modern History* 14, no. 4 (2010): 317–54, https://doi.org/10.1163/157006510X512223.

[3] Habibullah Haqparast and Mohammad Mollah Salangi, "Impact of Islamic Civilization on the European Intellectual Awakening: An Analytical Study," *Sprin Journal of Arts, Humanities and Social Sciences* 3, no. 1 (2024): 57–62, https://doi.org/10.55559/sjahss.v3i1.223.

[4] Ali Riaz, "Madrassah Education in Pre-Colonial and Colonial South Asia," *Journal of Asian and African Studies* 46, no. 1 (2011): 69–86, https://doi.org/10.1177/0021909610387758.

diverse academic environment in which various intellectual traditions could interact and flourish.[5]

In addition to establishing educational institutions, Mehmed II paid special attention to the accumulation and preservation of scientific knowledge. The imperial palace library contained numerous manuscripts covering a wide range of disciplines such as medicine, arithmetic, geometry, and astronomy.[6] These works were collected from various cultural and intellectual centers of the Islamic world and beyond. By assembling such a comprehensive collection of scientific writings, the Ottoman court aimed to preserve earlier scholarly achievements while simultaneously encouraging new forms of intellectual production.[7] This deliberate effort contributed significantly to the transmission of scientific knowledge into the Ottoman scholarly tradition.

The Sultan also actively invited prominent scholars to reside and teach in Istanbul. These scholars were appointed to positions in the madrasas and were encouraged to engage in research, teaching, and the production of scholarly works.[8] Their presence not only enriched the intellectual climate of the capital but also facilitated the dissemination of knowledge across the empire. The interaction between scholars from different backgrounds fostered a dynamic scholarly culture in which traditional Islamic sciences were studied alongside disciplines such as mathematics, astronomy, and philosophy.[9]

Among the various scientific fields cultivated during the Ottoman period, mathematics occupied a particularly significant place. Mathematical knowledge was essential for a wide range of practical and intellectual purposes.[10] It played a crucial role in architecture, engineering, land measurement, timekeeping, navigation, and astronomical observation.

---

[5] M. Hakan Yavuz, "Is There a Turkish Islam? The Emergence of Convergence and Consensus," *Journal of Muslim Minority Affairs* 24, no. 2 (2004): 213–32, https://doi.org/10.1080/1360200042000296627.

[6] Daniele L. R. Marini, "Mathematics and Astronomy from Origin to Eighteenth Century," in *Imago Cosmi*, by Daniele L. R. Marini, Astronomers' Universe (Springer Nature Switzerland, 2023), https://doi.org/10.1007/978-3-031-30944-1_2.

[7] Ekmeleddin Ihsanoglu, *Science, Technology and Learning in the Ottoman Empire: Western Influence, Local Institutions, and the Transfer of Knowledge*, 1st ed. (Routledge, 2024), https://doi.org/10.4324/9781003554042.

[8] Şen, "The Sultan's Syllabus Revisited."

[9] M. Amin Abdullah, "Religion, Science, and Culture: An Integrated, Interconnected Paradigm of Science," *Al-Jami'ah: Journal of Islamic Studies* 52, no. 1 (2015): 175, https://doi.org/10.14421/ajis.2014.521.175-203.

[10] Mahdi Mohamed Abdeljaouad, "Teaching European Mathematics in the Ottoman Empire during the Eighteenth and Nineteenth Centuries: Between Admiration and Rejection," *ZDM* 44, no. 4 (2012): 483–98, https://doi.org/10.1007/s11858-012-0381-6.

Moreover, mathematics formed the theoretical foundation for astronomy, which was closely connected to religious practices such as determining prayer times and calculating the lunar calendar. Consequently, the study of mathematics was considered an important component of the broader scientific curriculum in Ottoman educational institutions.[11]

Ottoman mathematicians inherited a rich intellectual legacy from earlier Muslim scholars such as Al-Khwarizmi, Omar Khayyam, and Nasir al-Din al-Tusi. Building upon this foundation, they produced numerous works that contributed to the development and dissemination of mathematical knowledge within the empire.[12] Their writings covered diverse subjects, including arithmetic, algebra, geometry, trigonometry, and astronomical calculations. Some of these works were original treatises, while others were commentaries or adaptations of earlier mathematical texts.[13] Through these scholarly efforts, Ottoman mathematicians played an important role in preserving and extending the mathematical traditions of the Islamic world.

Furthermore, mathematical scholarship in the Ottoman State was closely connected to other fields of knowledge. Scholars often combined expertise in mathematics with studies in astronomy, philosophy, and religious sciences.[14] This interdisciplinary approach reflected the integrated nature of knowledge in the Islamic intellectual tradition.[15] It also enabled mathematicians to contribute to practical scientific developments, such as astronomical observations and the construction of observatories, which further advanced the study of the natural sciences.

Finding and Discussion

Mathematicians before the Conquest of Constantinople

Most of the scholars during the first two centuries of the Ottomans came from Muslim countries and Turkish municipalities. The first *Madrasa* was

[11] Ekmeleddin İhsanoğlu, *Studies on Ottoman Science and Culture*, 1st ed. (Routledge, 2020), https://doi.org/10.4324/9781003120148.

[12] George Ghevarughese Joseph, "Foundations of Eurocentrism in Mathematics," *Race & Class* 28, no. 3 (1987): 13–28, https://doi.org/10.1177/030639688702800302.

[13] Ravi P. Agarwal and Syamal K. Sen, *Creators of Mathematical and Computational Sciences* (Springer International Publishing, 2014), https://doi.org/10.1007/978-3-319-10870-4.

[14] Bahattin Karagözoğlu, "Contribution of Muslim Scholars to Science and Technology," in *Science and Technology from Global and Historical Perspectives*, by Bahattin Karagözoğlu (Springer International Publishing, 2017), https://doi.org/10.1007/978-3-319-52890-8_6.

[15] Dina Mardiana et al., "Development of Islamic Education: The Multidisciplinary, Interdisciplinary and Transdisciplinary Approaches," *Al-Hayat: Journal of Islamic Education* 4, no. 1 (2020): 58, https://doi.org/10.35723/ajie.v4i1.97.

open around 1337 in Iznik (Nicea), near Bursa[16]. It's first appointed Mudarris Dawud al-Qaysarī[17] was educated in Cairo. After the conquest of Bursa and Edirne, new madrasas and other educational buildings such as medical madrasas and primary schools opened and more scholars started to flock to the Ottoman cities. Scholars, who from different background produced very important books on various subjects including mathematics and astronomy. In this study, we will analyse the eminent Ottoman mathematicians and their works in the sequence of the years.

The history of mathematical and astronomical Literature during the Ottoman period provides the records of numerous copies of astronomical and mathematical works produced in the *madrasa*s and other places. They make it clear that from the 16th until the 19th century[18] there was an increase in their productions number.

Without doubt Qādīzāda's (d. 1432) two works on astronomy and mathematics *Sharh al-Mulakhkhas fī al-Hay'a* and *Tuhfat al-Ra'is fī Sharh Ashkâl al-Ta'sîs* were two basic textbooks for students who wished to study these subjects in the *Madrasas.* There are more than three hundred extant copies of the former and approximately two hundred copies of the latter. Among these copies there are a considerable numbers of reproductions which were copied in the Anatolian and Istanbul *Madrasas.*[19]

Muhammad the Conqueror Reign

Most of the scholars during the first two centuries of the Ottomans came from Muslim countries and Turkish municipalities. The first *Madrasa* was open around 1337 in Iznik (Nicea), near Bursa[20]. It's first appointed

[16] R. Hillenbrand, "Madrasa", *The Encyclopaedia of Islam*, New Edition, Leiden: E. J. Brill, 2000, V, 1144.

[17] Ihsan Fazlioglu, "Davud Kayseri", *Yaşamları ve Yapıtlarıyla Osmanlılar Ansiklopedisi*, İstanbul: Yapı Kredi Yayınları, 1999, I, 370-371.

[18] Katip Celebi (d. 1658) claims that, in his time, the interest in rational sciences decreased, and that in time they were excluded from the *madrasas* teaching. However his viewpoint should be re-examined in the light of historical facts and in the broader context of the development of the cultural and intellectual life in the Ottoman capital, especially in the seventeenth century. The ample evidence we have in the rich Ottoman scientific literature surveys published by IRCICA indicates a progressive curve in the inclusion of the rational sciences and does not confirm Katip Celebi's statement. For a critical evolution of Katip Celebi's words, see Ihsanoglu (1996, p. 39-84) and Ihsanoglu (2004).

[19] For the copies of the first book and the copy records see *OALT* 1. pp. 9-21; for the second book *OMLT I*, pp. 7-18.

[20] R. Hillenbrand, "Madrasa", *The Encyclopaedia of Islam*, New Edition, Leiden: E. J. Brill, 2000, V, 1144.

Mudarris Dawud al-Qaysarī[21] was educated in Cairo. After the conquest of Bursa and Edirne, new madrasas and other educational buildings such as medical madrasas and primary schools opened and more scholars started to flock to the Ottoman cities. Scholars, who from different background produced very important books on various subjects including mathematics and astronomy. In this study, we will analyse the eminent Ottoman mathematicians and their works in the sequence of the years.

The Ottoman science developed due to the personal interest of Muhammad II. After the conquest, new institutions on education, such as Sahn-i Sāmān Madrasas and Enderun School in Istanbul were established. Therefore, some brilliant scholars emerged and made original contributions to science in his reign. Muhammad II patronized Muslim and non-Muslim scholars in Istanbul and ordered the Greek scholars to translate Ptolemy's *Geography* into Arabic and to draw a world map. Beside Muslim scholars from the Muslim world, he also invited European artists and scholars from Italy. Muhammad II also encouraged the scholars of his time to produce works in their fields.

In the Ottoman *madrasa*s mathematics and geometry were educated before the *Hadith* and the Quran studies. Muhammad b. Abu Bakr al-Marashi stated in his book *Tartîb al-'Ulûm* (written in 1715) that in the Ottoman *madrasa*s, the students could learn geometry, cosmology and literature at any time, but arithmetic had to be studied as a compulsory science by all Muslims. It is possible to understand from the autobiographies of Ottoman scholars how the mathematic courses were planned in curriculum. In the autobiography of Sheik al-Islam Feyzullah Efendi (d. 1703) it was stated that arithmetic, geometry and astronomy courses were taught with the courses of *Hiqma* (wisdom) and *Tafsir* (comment on Quran).[22] There are some records stating that arithmetic was also taught in religious institutions such as *takka'*s and *zaviya's (Darwish lodges)*.[23]

In his book "*De La Littérature des Turcs",* Abbé Toderini *(*lived in Istanbul between 1781 – 1786*)* stated that the Turks learnt arithmetic from well-written Turkish -Arabic course books and were well informed as a European mathematician. In the geometry section of his *De La*

[21] Ihsan Fazlioglu, "Davud Kayseri", *Yaşamları ve Yapıtlarıyla Osmanlılar Ansiklopedisi*, İstanbul: Yapı Kredi Yayınları, 1999, I, 370-371.

[22] Cevat lzgi, "Osmanli Medreslerinde Aritmelik ve Cebir Egitimi ve Okutulan Kitaplar", *Osmanli Bilimi Arastirmalari*, no. 3401, (1995).

[23] *Ibid.*

Littérature, Toderini describes geometry instruction in the Ottoman *madrasa*s:

> "Geometry falls under the group of Turkish studies. In academies (*madrasa*), there are professors (*mudarris*) for teaching it [geometry] to young people. The period between mathematics and rhetoric classes is allocated to this mathematical branch... This science is taught in a special manner. I have been to the Valide Madrasa twice, during which time students had gathered to listen to the geometry class. They used an Arabic translation of Euclid. There are many versions as well as commentaries of this book. Naṣīr al-Dīn al-Ṭūsī's commentary, which is regarded as the best of these, has already become popular thanks to the Medicis Publishing House. This copy contains a copy of the Turkish license granted by Sultan Murad III (1574-1595) in Istanbul in 1587.[24] He has granted permission for the sale of this book without any tax or liability within the entire Ottoman territory..."[25]

Students in the Ottoman *Madrasas* took the permission from their teachers to teach arithmetic after a certain education. It means that after theoretical education the students had the possibility to apply their knowledge. It is observed that in the nineteenth century the mathematics education became important also in high schools. It is known that some of the Ottoman scholars learnt higher mathematics and algebra in high schools.

The Ottoman scholars wrote many textbooks on mathematics and also translated some other important ones written in other countries. In arithmetic, principally they used mostly books written by the Muslim mathematicians. For instance *al-Muhammadiyya fī al-Hisāb* written by Ali al-Qushjī and *Hulāsāt al-Hisāb* written by Bahā al-Dīn al-Āmilī were the widespread course books in arithmetic. Today there are more than fourty copies of the book *al-Muhammadiyya* in Persian language in the libraries of various countries. Sixteen Arabic copies are in Turkish libraries and two Arabic copies are in Cairo and in Aleppo.[26]

Hulāsāt al-Hisāb was translated into Turkish by Kuyucaklizāde Muhammed Atif in 1826 during the reign of Mahmud II. This book was studied in the Ottoman State, Persia, India, and Egypt as a textbook and it

[24] This book was printed in Roma: *Kitab Tahrir Usul li-Uqlidis min ta'lif khwaja Nasir al-Din al-Tusi. Euclidis elementorum geometricorum libri tredecim. Ex traditione doctissimi Nasiridini Tusini. Nunc primum Arabice impressi.* Romae: in Typographia Medicea, 1594.

[25] M. L'. Abbè Toderini, *de la Litterature des Turcs, Traduit de l'Italien en Fran*cois *par Tournant*, trs. M. L'abbe De Cournand, vol. I, (Paris: Poincot, 1789), 100-105.

[26] *Ibid.*

was also translated into German in 1843 by Nesselman and into French in 1846 by A. Marre. In some books written in Europe in 19th century there were some quotations from *Hulāsāt al-Hisāb.* The last publications of this book were in Istanbul in 1879 and in Cairo in 1894. There are more than hundred copies of this book in Turkish libraries.

The Ottoman scholars started to write arithmetic books from the beginning of the 15th century onwards. Arithmetical texts were translated into Turkish after astronomical texts, but before geometrical texts. Some of them are *Miftāh al-Hisāb* (anonymous), *Risāla fī ilm-i Hisāb* (anonymous) and *Miftāh al-Mushkilāt* (Muhammed Musa-i Wâfî). The Arithmetic books which were prepared by the *Muhasipler* (account scribes) and *diwan katipleri* (secretaries of the Council of State) were usually written in Turkish.

The book entitled *Majma'-I qawā'id-i 'ilm-i hisāb* written by Hajji Atmaca in 1484 is an example of this. The greatest work among Turkish books of arithmetic, which was written in classical tradition, was *Tuhtfat al-A'dad.* This book was written by Ali b. Veli b. al-Jazāirī al-Maghrībī (d. 1614) and was presented to Sultan Murād III (d. 1595). The other famous arithmetical books are *Nuzhat al-Hussab fī 'ilm al-Hisāb, al-Luma fī al-Hisāb, al-Ma'una fī al-Hisāb al-Heva'l* written by Ibn al-Ha'im (d. 1412) and *Talhis A'mal al-Hisāb* written by Ibn al-Banna (d. 1321). These books were read widespread and translated into other languages.

The Ottoman scholars wrote and translated also course books about algebra. The book *al-Jabr wa'l-Muqabala* written by al-Khwarizmi was also used in the Ottoman *madrasa*s *and* other countries in Western Europe as course textbook, many arithmetic books contain chapters about *algebra*. Some of the algebra books written by the Ottoman scholars are *Al-Yawakit Al-Mufassalāt bi al-La'ali al-Nayyirāt fī A'mâli Zawât al-Asmâ wa al-Munfasilāt* written by Jamal Al-Dīn Muhammed (d. 1631); *Al-Mawâhib al-Saniyya fī ilm al-jabr wa al-Mukâbala and Sharh al-Yasamunniya fī al-Jabr wa al-Muqâbala* written by Ibn Al-Jamal (d. 1662); *Hisāb al-Kusur* written by Gelenbevi Ismail Efendi; *al-Mustahzarat fī Hisāb al-Majhulāt* by Kuyucaklizade Muhammed Atif (d. 1847) and *Tuhfat al-Hisāb* by Ali Bahar Efendi (d. 1805).[27]

The Ottoman scholars were interested in logarithm because of the preparing of the schedule of stars. They wrote and translated some books about logarithm. Sekerzade Feyzullah Sermed (d. 1787) translated the

[27] *Ibid.*

book entitled *Maksadayn fī Hall Al-Nisbatayn* from a Hungarian mathematician in 1780. In this book he defined the logarithm and explained the applications of logarithm in astronomy. The other books written by Ottoman scholars about logarithm are *Sharh al-Jadāwil al-Ansāb* by Gelenbevi Ismail Efendi in 1787*; Logaritma Risālasi* by Huseyin Rifki Tāmānī (d. 1817) and *Logaritma Risālasi* by Muftuzade Osman Saib (d. 1864).[28]

The *Hendesehāne-i Humayun* (Royal Mathematical School) was the first institution that was assigned separately for modern military technical education in the Ottoman State. The *Hendesehāne*, which was called the *'Ecole des Théories'* or the *'Ecoles des Mathématiques'* in French, was established at the Royal Shipyard on 29 April 1775. Baron de Tott and a French expert besides the Ottoman teachers taught courses and this institution had up to ten students and later assumed the name of the *Mühendishāne* (School of Engineering).

A great number of French and few English engineers, teachers and officers came to Istanbul between 1783 and 1788, with the renewed closeness between the Ottomans and the French. All of the French experts and foremen left Istanbul as the result of the alliance formed between Russia and France when the Ottomans entered into war against Russia between 1787 and 1788.[29] It was observed that the Ottoman foremen and workers from other European states (some Swedes) were employed after the French departed. When all of the French experts and officers returned to their country between 1787 and 1788, the applied courses were discontinued and theoretical courses continued to be given by only the Ottoman scholars, such as Gelenbevī Ismāil Efendi and Palabiyik Muhammad Efendi, the famous mathematicians..

The Ottoman mathematicians and works

Most of the scholars during the first two centuries of the Ottomans came from Muslim countries and Turkish municipalities. The first *Madrasa* was open around 1337 in Iznik (Nicea), near Bursa[30]. It's first appointed Mudarris Dawud al-Qaysarī[31] was educated in Cairo. After the conquest

[28] *Ibid.*

[29] Frédérik Hitzél, "Défense de la Place Turque d'Oczakow par un Officier du Génie Francaise (1787)", in *Ikinci Tarih Boyunca Karadeniz Kongresi Bildirileri*, ed. Mehmet Saglam (Samsun 1990), 639-655.

[30] R. Hillenbrand, "Madrasa", *The Encyclopaedia of Islam*, New Edition, Leiden: E. J. Brill, 2000, V, 1144.

[31] Ihsan Fazlioglu, "Davud Kayseri", *Yaşamları ve Yapıtlarıyla Osmanlılar Ansiklopedisi*, İstanbul: Yapı Kredi Yayınları, 1999, I, 370-371.

of Bursa and Edirne, new madrasas and other educational buildings such as medical madrasas and primary schools opened and more scholars started to flock to the Ottoman cities. Scholars, who from different background produced very important books on various subjects including mathematics and astronomy. In this study, we will analyse the eminent Ottoman mathematicians and their works in the sequence of the years.

1. Qādīzāda al-Rūmī (d. c. 1440).

His full name is Salah al-Dīn Musa ibn Muhammad ibn Mahmud Qādīāda al-Bursāwi al-Rūmī. He was born in Bursa, Turkey, (hence his name al-Rūmī, from the Arabic name al-Rum for the Byzantine and Ottoman States). His grandfather and father were judges/Qādī in Bursa. He received his preliminary education in mathematics and cosmology in the province of Bursa and then went to Samarkand. He became the teacher of Ulugh Beg in astronomy and later on he was appointed as the head of the Samarkand observatory. He died there and was buried by Ulugh Beg in the mausoleum of Shâh-i-zinda (Living King) in Samarkand.

Qādīzāda al-Rūmī made the first important contribution to the development of the Ottoman scientific tradition and literature on mathematics and astronomy. He flourished in Anatolia and settled in Samarkand after he compiled his first work. Qādīzāda wrote *Sharh Mulakhkhas fī'l-hay'a* (Commentary on the 'Compendium on Astronomy') and *Sharh Ashkāl al-Ta'sīs* (Commentary on 'The Fundamental Theorems') in Arabic in the fields of astronomy and mathematics and became the chief instructor at the Samarkand *Madrasa* and the director of the observatory founded by Ulugh Beg (d. 1449) in Samarkand. He simplified the calculation of the sine of a one degree arc in his work *Risāla fī Istikhrāj Jaybi Daraja Wāhida* (Treatise on the Calculation of the Sine of a One Degree Arc).

Qādīzāde's two students 'Ali al-Qushjī (d. 1474) and Fathullah al-Shirwānī (d. 1486), influenced the Ottoman science by disseminating mathematics and astronomy in the Ottoman State. In the introduction of his *(Tuhfat al-Ra'is) Sharh Ashkāl al-Ta'sīs [(Gift of the Chief) on Commentary on "Substantional Propositions)]*, he indicated that the philosophers who ponder about the creation and the secrets of the universe, the jurists (*faqihs*) who give *fatwās* in religious matters, the officials who run the affairs of state, and the *qādīs* who deal with judicial matters should know geometry. Thus, he emphasized the necessity of

science in philosophical, religious, and worldly matters. This understanding reflects a general characteristic of Ottoman science.

Apart from the above, he wrote more books on mathematics and astronomy. He also made significant contribution to the preparation of *Ulugh Beg's Zij*.[32] He also wrote many commentaries about astronomy and geometry books.

His works on mathematics.

a. [*Tuhfat al-Ra'is*] *Sharh Ashkâl al-Ta'sîs* ([Gift of the Chief] on Commentary on "Substantional Propositions")[33]. Kādızāde wrote this commentary on Samarkandî's *Ashqâl al-ta'sis* which is a summary of the theorems and the triangles in Euclid's *Usûl al-handasa.* It was completed in 1412 and presented to Ulug Beg. There are approximately two hundred copies of this treatise in the libraries[34].

b. *Risâla dar bayân-i istikhrâj jayb-i yak daraja* (Treatise on Explanation of Determining the Sine of One Degree by operations based on rules that are based on Arithmetic and geometric by principles of the Method of Ghiyāth al-Dīn al-Kāshī. Although it is a commentary on the treatise of al-Kâshî titled *Risâla al-watar wa'l-jayb* (Treatise on Chord and Sine), due to authenticity on the subject, al- Rūmī is often regarded as the author of the treatise.[35] According to Salih Zeki, it is the most important treatise of him.[36]

c. *Dastûr al-'amal wa tashîh al-Jadwal* (Rules of operations and correction of Tables). (Persian): Treatise with the same title containing exposition of treatise (*Risâla al-watar wa'l-jayb*) of al-Kâshî was written by al-Rūmī's grandson Mîrîm Chelebi.

d. *Al-Risāla al-Salāhiyya fī al-qawā'īd al-hisābiyya* (Treatise of Salah al-Dîn on Arithmetic Rules). It is also known as *Risâla fi al-hisâb* (Treatise on arithmetic) and Mukhtasâr *fi al-hisâb (Abridged treatise on arithmetic)*. It is practical and easily understandable treatise on arithmetic. He composed it in 1382-3 while he was in Bursa. It was divided into three chapters. The first one on arithmetic, the second algebra and the last one is on

[32] Rosenfeld, p. 378.
[33] Rosenfeld, no 808, M2.
[34] *OMLT*, I, 6-18.
[35] Rosenfeld, no 808, M3; no. 802, M4.
[36] *OMLT*, I, 3-5.

measurements[37]. *Risâla dar Hisâb* (Treatise on arithmetic). It is Persian version of the treatise.

e. *Risâla fî al-misâha* (Treatise on measurement). (Persian): In the prologue of the treatise al- Rūmī explains why he composed this book saying that: "...some of my friends and tax officials asked me to write a treatise to solve their problems on the measurement calculations. Therefore I composed this treatise...". The treatise was divided into four chapters (Ruqun) and twelve sections (qâidah).[38]

f. *Risāla fī al-hay'a wa'l-handasa:* (Treatise on astronomy and geometry).[39]

2. ʻAlā al-dīn ʻAli al-Qushjī (ca 1402-1474)

His full name is "Qushci-zāda Abu al-Qāsim ʻAlā al-Dīn Ali b. Muhammad." He was born in Samarkand in early 15th century. His father was Ulugh Beg's official falcon trainer; he came to be known as "Qushci-zāde" or "Qushjī." He received very highly education from outstanding scholars like Ulugh Beg, Giyāth Jamshīd al-Kāshī and Qādızāda al-Rumī. He is also known for his contributions to *Ulugh Beg's Zīj*, which was prepared on the basis of the observations conducted at Samarkand Observatory under the guidance of Ulugh Beg.

After Ulugh Beg's demise in 1449, he left Samarkand first for Herat, Tabriz and finally Istanbul. While he was in Tabriz, Uzun Ḥasan sent ʻAli al-Qushjī as an emissary to Muhammad the Conqueror, who was impressed by him. Ali al-Qushjī and Sultan Muhammad had many scientific discussions. Sultan Muhammad was pleased with him deeply and asked him to remain in Istanbul permanently. Accepting the invitation, ʻAli al-Qushjī came to Istanbul with his family after the end of his emissary duty (circa 1472). Appearing before Fatih Sultan Muhammad, he presented the Sultan with the mathematical treatise *al-Muhammadiyya,* which was heralded in his name. Then he was educated and researched in the *Madrasa* of Sultan Muhammad. He died in 1474 in Istanbul.

Having been appointed as a Mudarris of the Hagia Sophia Madrasah, ʻAli al-Qushjī spent the last couple of years of his life in Istanbul. Having prepared many students during his life, ʻAli al-Qushjī was a polymath

[37] Suleymaniye Library, Sehit Ali MS 1992/1, folios 1b-52b.

[38] Suleymaniye Library, Esad Efendi, MS 2023/2, folios 35a-43a; OMLT, I, 5.

[39] Bursa Inebey Library, 25.

scholar and a particularly authority on astronomy and mathematics as well as many different disciplines like language, religion, philosophy and mathematical sciences. He introduced new ways of understanding and exploring said disciplines. His works made an impact on scientific activities in both the Muslim and European worlds.

His Works: 'Ali al-Qushjī authored many works in mathematics, astronomy, philosophy, language, etc. some of which were voluminous research, while others were textbooks for Madrasas, or treatises focusing on specific problems. He wrote twelve works on mathematics and astronomy. One of them is his commentary on the *Zīj-i Ulug Beg* in Persian. His two works in Persian, namely, *Risāla fī al-Hay'a* (Treatise on Astronomy) and *Risāla fī al-Hisāb* (Treatise on Arithmetic) were taught as a course book in the Ottoman *Madrasas*. He revised these two works in Arabic with some additions under new titles, *al-Fathiyya* (Commemoration of Conquest) and *al-Muhammadiyya* (The Book Dedicated to Sultan Muhammad), respectively. Both books won approval and were translated into other languages. Many commentaries were written about them. Ali al-Qushjī wrote altogether 32 books and treatises.[40]

In addition to the following list of his important works, 'Ali al-Qushjī has other works which have not survived. Copies of some of those works have survived, making their way into modern-day libraries. But some of them are regrettably lost.

a. *Al-Risāla al-Muhammadiyya fī al-hisāb* (Arabic): Treatise on Arithmetic. It attributed to Sultan Muhammed II. On the introduction of al-Qushjī terms "muthbat" and "manfi" for added and subtracted quantities instead later terms "Zā'id" and "nāqis". Al-Qushjī's terms are translations of Chinese terms and are presently used for positive and negative quantities in Iran, Turkey, Central Asia, and Azerbaijan; European terms for these quantities came from al-Qushjī's terms through Byzantine mathematicians[41].

b. *Risāla dar ilm-i hisāb* (Persian): Treatise on the Science of Artihmetic. Also known as Balance of Arithmetic: Mīzān al-hisāb and Essence of Artihmetic: Zubdat al-hisāb. It contains three books: 1) Indian arithmetic 2) sexagesimal fractions, 3) geometry.

[40] A. Süheyl Ünver, Ali Kuşçu Hayatı ve Eserleri, İstanbul University, Faculty of Science, Monograph, no. 1, (1948).

[41] Rosenfeld, p. 286.

c. *Risāla-yi kusūr (Persian): Treatise on fractions.*

d. *Khulāsat al-hisāb: Essence of Arithmetic*

e. *Risāla dar handasa (Persian): Treatise on Geometry.*

f. *Risāla fī al-qawā'id al-hisābiyya wa'l-dalā'il al-handasiyya: Treatise on Arithmetic Rules and Geometric Indications.*

g. *Risāla dar hisāb u handasa (Persian): Treatise on Arithmetic and Geometry.*

h. *Risāla fī istikhrāj maqādir al-zawayā min maqādīr al-adlā' fī al-muthallathāt al-ghayr qā'imāt al-zawāyā al-hāditha min qisiyy al-dawā'ir al-'izām: Treatise on Determining the Magnitudes of Angels of a Triangle by the Magnitudes of Sides in Non-Rectangular Triangles Consisting of Arcs of Great Circles [of a Sphere*].(Suleymaniye Library, Carullah 2060).

3. Khalil al-Husayni (Hayruddin Halil b. Ibrahim) (15th century).

Khayr al-Dīn Abū 'Abdullāh Khalīl ibn Ibrāhīm al-Husaynī was another mathematician, worked in Istanbul at the court of Muhammad the Conqueror (1451-1481).[42] There is very limited information about his life and death. Two of his significance works on mathematic have reached today. His works were:

a. *Miftāh-i kunūz-i arbāb-i qalam wa misbāh-i rumūz-i ashāb-i raqam*: (Persian) (Key to Treasures of the Masters of the Pen and Lamp of Symbols of Rulers of Figures). Also known as *Risāla fī al-hisāb* (Treatise on arithmetic). Treatise is dedicated to Muhammad the Conqueror and divided into an introduction (*muqaddimah*) and ten chapters and one epilogue (*khātimah*). Chapters; 1-4) different kinds of multiplication, 5-6) different kinds of division, 7) problems, 8-10) extraction of roots of 2nd, 3rd, and 4th powers.[43] This is his very well known and circulated treatise between the state (*diwān*) accountants. It was composed for their daily use for account calculations. The name of Muhammad II was cited in the introduction (*muqaddima*). It was translated by his student Pīr Mahmud Sidkī al-Edirnevī into Turkish. The section on "khataayn" (double mistake) was translated by Muhyi al-Dīn Hajji Atmaca al-Katib into Turkish.[44]

[42] Rosenfeld, p. 287.

[43] Rosenfeld, p. 287.

[44] To see the copies of the MSS see: *OMLT*, I, 34-35.

b. *Mushkil gushā-yi hisāb u mu'dil numā-yi kitāb* (Persian): (Book of Difficulties in Artihmetic Solutions and those that are Incomprehensible). Also known as *Mukhtasar fī al-hisāb* (Concise [Book] on Arithmetic).[45] It was dedicated to the Sultan Beyazid II (1481-1512) and divided into an introduction, six *fasl*s (sections and an epilogue (*khātimah*).[46]

c. *Risāla-i Jabr u Muqābala* (Persian). It was not cited by any sources and there is only one copy at Nuruosmaniye Library, MSS 2980/2.[47]

4. Yusuf Sinan Pasha (Sinan Pasha) (d. 1486)

Sinān al-Dīn Yūsuf ibn Khidr Beg ibn Jalāl al-Dīn (d. 1486), known by the names "Sinan-Pasha" and "Khwājā Pāshā"; vizier of Ottoman Sultan Muhammad II (1451-1481); worked in Istanbul and Edirne; well known historian, theologian, mathematician and astronomer.[48]

His works on mathematics.

a. *Hāshiya alā al-Risāla al-Fathiyya* (*Commentary on Geometric Section in Treatise of Conquest of 'Ali al-Qushjī).* Mathematical commentary on al-Qushjī's work *al-Risāla al-Fathiyya* (Treatise of Conquest).

b. *Risāla fī Istihrāci Zāviye Hadde 'Izā Furida Harakatu Ahadi* or *Risāla fī al-munfarija ta'sīru hādda qabla an ta'sīra qā'ima*; (Treatise that Obtuse (Angle) can become Acute without being Right).[49] Ihsan Fazlioglu worked on this short treatise and published with a large analyze.

5. Hajji Atmaca al-Kātib (Scribe) (d. after 1494).

Muhyi al-Dīn al-Hajjī Muhammad ibn al-Hajji Atmāja al-Kātib (15-16th c). Mathematician[50]. We have no information about his life. Most probably, he was one of accountant for the State *Dīwān*.[51] He used to live during the Muhammad II and Bayezid II reigns. He has two works on arithmetic:

---

[45] Rosenfeld, p. 288.

[46] To see the copies of the MSS see: *OMLT*, I, 35.

[47] OMLT, I, 36.

[48] Rosenfeld, p. 290 (nr. 858).

[49] Istanbul, Koprulu Library, Mehmed Asım Bey, MSS 721. İhsan Fazlioglu, "Ali Kuşçu'nun bir hendese problemi ve Sinan Paşa'ya nispetedilen cevabı, Tenkidli metin ve çalışma", *Divan*, 1996, I, 85–106.

[50] *KZ*, V, 404; *OM*, III, 252; *MAMS*, II, 535-536; *OMLT*, 29-31; *SSM*, 170.

[51] Rosenfeld, p. 310 (nr. 918).

a. *Majma'-i qawā'id-i 'ilm-i hisāb/Jāmi' al-qawāid* (Turkish). (Collection of rules of the science of Arithmetic's). It was completed in 1494 and dedicated to the Sultan Bayezid II. It is an account book which was composed for scribes and accountants who were working for *Dīwān*. In the epilogue, he explains (*Muqaddima*) why he prepared this book saying that in the *Dīwān*, apprentices of accountants need to learn account mathematics through this book. He also indicates that most of the book on this area written in both Arabic and Persian, hence new staff need a book in Turkish in this subject to understand the subject easily.[52] It contains three chapters and a prologue (*tatimma*): first chapter about integers; second chapter about calculations with rational numbers and the in the third chapter, there are forty problems with solutions. It was very commonly used among court scribes until the last centuries of the Ottomans.[53]

b. *'Ilm al-hisāb* (Science of Arithmetic). It is a treatise on mathematics[54].

c. He also translated Khayr al-Dīn's books *Miftāh*'s sixteenth chapter as an independent treatise with the title *Tarjamat al-fasl al-sādith 'ashara fī bayn al-hatā'ayn min miftah-i kunûz-i arbāb-i kalām wa misbāh-i rumûz-i ashāb-i raqam.*[55]

6. Lutfullah al-Toqātî (Molla Lutfî) (d. 1495)

His full name is Lutfullah Muhammad bin Ḥasan al-Toqati "Molla Lutfi" also known as Molla Lutfi (d. 1494): he was born in Tokat (Turkey). There is very limited information about his life; he studied mathematics under Sinan Pasha and later on improved with Ali al-Qushjī. When Sinan Pasha was appointed as a Grand viziers to the Sultan Muhammad II, he was also appointed as the librarian of Sultan Muhammad II (1451-1481) in his private library at the palace. Upon the supervisor Sinan Pasha was exiled to Sivrihisar, he was also removed from his post and companied Sinan Pasha. When Bayezid II ascended to the throne, they were forgiven and Molla Lutfi was appointed to a *madrasa* in Bursa as a *mudarris*. Later on, he moved to Edirne as a *mudarris*, back to Bursa again and after a while he went

[52] Marmara University, Theology Faculty Library, Genel Yazmalar nr. 185, folios 1b-2a; Suleymaniye Library, Esad Efendi MSS 3176.

[53] *OMLT*, I, 29-31; M. K. Özergin, "Hacı Atmacağolu ve Eseri", *İslam Düşüncesi*, V, İstanbul 1968, 312-316.

[54] Budapest Török MS 0177.

[55] *OMLT*, I, 31.

back to Istanbul, and appointed as a mudarris at Sahn Saman Madrasas. Due to his extremist and liberal ideas on Islamic matters, he was accused as a heretic and was executed in January 1495.[56] He wrote a treatise about the classification of sciences titled *Mawdūāt al-Ulūm* (Subjects of the Sciences) in Arabic. In terms of Mathematics, he compiled a book: *Risāla fī tad'īf al-madhbah* (Treatise on Duplication of the Altar). It is a geometry book and about a problem known as Delos Problem.[57]

7. Mīrīm Celebi (d. 1525)

Mahmud ibn Muhammad ibn Qādīzāda al-Rūmī "Mirim Çelebi" (d. 1525), grandson of Qādīzāda al-Rūmī (from his son) and of Ali al-Qushji (from his daughter), born in Samarkand; worked in Gelibolu, Edirne, and Bursa (all in Turkey), died in Edirne in 1525.[58] He studied mathematics under Ali Ali al-Qushjī and was educated in various Madrasas in Istanbul.

Mīrīm Celebi who was a well-known astronomer and mathematician of this period. Made great contributions to the establishment of the Ottoman scientific traditions of mathematics and astronomy and was renowned for the commentary he wrote on the *Zīj* of Ulugh Beg and his treatises on astronomy. He composed books on mathematics and cosmology.

a. *Risāla (A treatise): Mathematical Part of Dastûr al-'amal wa tashîh al-jadwal* (Rules of Actions and Corrections of the Table).

b. *Risāla (A Treatise): Trigonometrical part of Dastûr al-'amal wa tashîh al-jadwal* (Rules of Actions and Corrections of the Table) containing exposition of determining sine 1^0 according to the works of Qādīzâda al-Rūmī and al-Qushji.[59]

8. Aliya Mizrahi (ca 1450-1526).

Aliya Mizrahi was born and lived in Istanbul under sultans Muhammad II (1451-1481), Bayezid II (1481-1512), Yavuz Sultan Selim (1512-1520) and Suleyman I (1520-1566). He was Jewish scholar, descendant of Byzantine Jews (Romaniot): he possessed the highest rabbinical authority

[56] *OMLT*, I, 37-40.
[57] Suleymaniye Library, Esad Efendi 35961. *OMLT*, I, 37-39.
[58] Rosenfeld, no. 940.
[59] Rosenfeld, no. 940, M1.

of his time and chief rabbi in the Ottoman State from 1498 onwards; also mathematician, astronomer, physicist, and philosopher.[60]

a. *Sefer ha-mispar* (Book of Number). Mizrahi knew decimal fractions from the Istanbul mathematicians and was a link between them and the mathematicians of Western Europe.

b. *Commentary on Euclid's "Elements"*.[61]

9. Nasūh 'Alī al-Silāhī al-Matrāqī (d. 1564)

Nasūh b. Karagöz al-Bosnawī or Nasūh b. Abdullah al-Silahī al-Matraqī or for short "Matrakçı Nasūh". His family origins back to Bosnia. His father or grandfather was drafted into the state service. He was a court official and renowned in the 16th century as a mathematician, historian, geographer, cartographer, topographer, musketeer, and was an outstanding knight, calligrapher and engineer. Because he was a musketeer, he was also called *al-Silāhī* (the musketeer or gunman). He was a polymath thinker, writer, an artist (he pioneered a particular artistic style for depicting cities) and a theoretician. He wrote books in these fields, all in Turkish. A brief discussion of these books follows. He received the nickname "Matrakçı" after he created the game called *Matrak*. *Matrak* means 'amazing' in Turkish and 'çı' is a suffix. Therefore his nickname means "who plays (invents) the amazing game".[62]

Matrakci Nasūh was educated and trained in the Palace school *Enderun*, during the reign of the Bayezid II (1481-1512) and studied with Sāī Çelebi, one of Sultan Bayezid II's teachers. During the reign of Sultan Selim I (1512-1520), he started to distinguish himself as a knight. He went to Egypt in 1520, for advanced studies and attended military games, at which he became unrivalled. He was given a decree on war games indicating his outstanding talent.

In the field of mathematics, Al-Matraqī wrote two books in Turkish with the purpose of facilitating the work of clerks of the state council (*Divan kātipleri*) and the state accountants (*muhasebeciler*). These two books are important in understanding the development of Ottoman Turkish as a language to a level where it was suitable for use as a mathematical language. They are also important in following the history of the Ottoman solution of accountant's mathematical problems. It is the

[60] Rosendfeld, no. 943; E. Wiedemann, "Über physikalische Aufgaben bei Elia Misrachi", in *Monatsschrift für Geschichte und Wissenschaft des Judentums* (Breslau), 54 (1910), Heft 2, pp. 224-232; (208), I, 434-442.

[61] Rosendfeld, no. 943.

[62] Salim Ayduz, "Nasūh Al-Matrakī, A Noteworthy Ottoman Artist-Mathematician of the Sixteenth Century", http://muslimheritage.com/topics/default.cfm?ArticleID=853.

second most important book after aforementioned Hajji Atmaca's work in this field.

a. *Jamāl al-Kuttāb wa Kamāl al-Hussāb (Beauty of Reckoners in the Perfectness of arithmetic).* Al-Matraqī wrote this first book, in 1517 and dedicated it to Sultan Selim I (1512-1520). *Jamāl al-Kuttāb* included two chapters. The first one is about Indian numerals, mathematical operations, fractions, scales, and measurements. Although he says that the second chapter is devoted to "miscellaneous matters", there is no extant manuscript.[63]

b. *Umdat al-Hussâb/hisāb fī furūd al-muqaddar/maqdira bi'l-kulliyāt (Support of arithmetic in proposition of all Magnitudes).* His second book written in 1533. *Umdat al-Hussâb* is an expanded version of the previous book in two chapters. The title of the first chapter is "miscellaneous subjects"; it has twenty-two sub chapters (*fasl*). 1) siyâqât figures, 2) Indian figures, 3) addition of integers, 4) fractions, 5-6) duplication and mediation, 7-8) application of fractions in craft and trade, 9-11) multiplication and division of integers and fractions, 12-15) measures of length, volume, and weight, 16) drawings, 17) proportions, 18) taxes, 19) rule of "two errors", 20) addition of fractions, 21) double-false, 22) jam'i kusūr ma'a kusūr.[64] The second chapter is entitled "solution of the 50 problems". Some figures and diagrams were added in this version. In addition to the subjects mentioned, this book also contains weights, measurements (*zira*, *endaze*, *kilajāt*, *qantar*, *misqal*, *dirham*), ratio, division with proportion and geometric methods, all essential for accountants. After every subject, Al-Matraqī gives examples offering new measurement divisions which were unknown before. In the first part, the six fundamental operations of classical arithmetic are extensively investigated for positive integers and rational numbers. In addition, the "double-false" rule used to find an exact solution for a linear equation is analysed. In the second part, several issues are explored. According to Al-Matraqī, these issues were rarely mentioned in previous manuscripts; but accountants should definitely learn them. The book deals with various subjects, such as inheritance and tax, essential to accountants; they are studied through examples of calculations. When Al-Matraqī wrote the second book, the first one had been almost forgotten. While we have about fifteen copies of

[63] Rosenfeld, no. 1001 M1; *OMLT*, I, 69.

[64] Rosenfeld, no. 1001 M2; *OMLT*, I, 70-73.

the second book, only four copies remain of the first one. This indicates how common and well used by accountants the second book was.

10. Taqī al-dīn ibn Ma'rûf al-Rāsid (1520 - 1585)

Taqī al-Dīn ibn Maʿrūf was a major Ottoman scientist who excelled in science in the second half of the 16th century. From 1571, he settled in Istanbul, the capital of the Ottoman State and excelled in several scientific fields such as mathematics, astronomy, engineering and mechanics, and optics. As the greatest astronomer of this period was Taqī al-Dīn al-Rāsid who combined the Egypt–Damascus and Samarkand traditions. He wrote more than thirty books in Arabic and Turkish on the subjects of mathematics, astronomy, mechanics, and medicine.

He was born in Damascus and he completed his education there. He moved from Egypt to Istanbul for third time in 1570. He was respected and appreciated by Hoja Sa'ad al-Dîn Efendi (d. 1599), the tutor of Sultan Murād III (1574–1595). In 1571, he was appointed as *munajjimbashi* (chief astronomer) by Sultan Selīm II (1566–1574). Shortly after Sultan Murād III's accession to the throne, he started the construction of the observatory of Istanbul under the patronage of the Sultan. It is understood from his *Zīj* titled *Sidrat Muntahā'l-Afkār* (The Nabk Tree of the Extremity of Thoughts) that he made observations in the year 1573. It is generally agreed that the observatory was demolished on 22 January 1580. Therefore, it can be estimated that he carried out observations from 1573 until 1580.

In addition to the instruments of observation which were used until his time, Taqī al-Dīn invented new ones such as the *Mushabbaha bi'l-manātiq* (sextant) and *Dhāt al-awtār* in order to determine the equinoxes. Moreover, he also used mechanical clocks in his observations. Taqī al-Dīn developed a different method of calculation to determine the latitudes and longitudes of stars by using Venus and the two stars near the ecliptic.

Starting with Ptolemy in the second century AD and continuing until Copernicus in the sixteenth century, the Western world used chords for measuring angles. For this reason, the calculation of the value of the chord of 1º has been an important matter for astronomers. Thus, while Copernicus used the method based on the calculation of the chord of 2º that yielded an approximate value, Taqī al-Dīn used trigonometric functions such as the sine, cosine, tangent, and cotangent to measure the values of angles, in line with the tradition of Islamic astronomy. Inspired by Ulugh Beg, Taqī al-Dīn developed a different method to calculate the

sine of 1º. Furthermore, he applied decimal fractions, which had been previously developed by Islamic mathematicians such as al-Uqlidīsī and al-Kashī, to astronomy and trigonometry prepared sinus and tangent tables accordingly, and used them in his work titled *Jarīdat al-Durar wa Kharīdat al-Fikār*.

Taqī al-Dīn wrote many books about mathematics and astronomy. Here are his works on mathematics:

a. *Kitāb al-nisab al-mutashākkala fī 'l-jabr wa-'l-muqābala* (Book on coinciding ratios in algebra):[65] It was divided into a prologue, three sections and an epilogue.
b. *Bughyat al-tullāb fī 'ilm al-hisāb* (Aim of Pupils in the Science of Arithmetic):[66] and in *The History of Mathematical Literature during the Ottoman Period*. It is enclosed also in *Al-Hisāb al-hindī*, a hand book which contains the book *Hisāb al-muanjjimīn wa-'l-jabr wa al-muqābala*.[67] The codex had three chapters: 1) on arithmetic decimal figures, 2) on arithmetic with hexadecimal figures, 3) on algebra.
c. *Kitāb tastīh al-ukar* (Book on Projecting Spheres onto a Plane) = *Dastūr al-tarjīh fī qawā'id al-tastīh* (Preferred Rule in Foundations of Projecting on a Plane).[68] It is mentioned under the first title in *Kashf al-Zunūn* of Hajji Khâlifa (II, 288; III, 226). Treatise on stereographic projection; could be part of an astronomical work. The book is dedicated to Hoja Sa'ad al-Dîn Efendi and has two chapters.
d. *Sharh risālat al-Tajnīs fī 'l-hisāb* (Commentary on "Treatise on Classification in Arithmetic"): is mentioned in *Kashf al-Zunūn* (II 208; III 376).
e. *Kitāb al-Tajnīs fī 'l-hisāb* (Commentary on the treatise Book on Reduction of the Common Denominator in Arithmetic of al-Sakhāwandī).
f. *Risāla fī tahqīqi mā qālahu 'l-'ālim Giyāth Jamshīd fī bayāni 'l-nisba bayna 'l-muhīt wa-'l-qutr* (A). Taqī al-Dīn discusses here the ideas of Giyāth Jamshīd al-Kāshī's book *al-Risālat al-muhitiyya*.[69]

[65] Cairo (Miqat 557/3, 4 f., Taymur Riyada. 140/10), Oxford (I 88/3).

[66] Cairo (Riyada. 1023), Rome (Vatican Sbath 496/2). It is quoted in *Qāmūs al-Riyādhiyyāt* of Salih Zeki (vol. II, p. 59).

[67] Süleymaniye library, Carullah, MS 1454, 55 folios.

[68] Cairo (Tal'at miqat 135 - anonymous), Istanbul (Kandilli 415/5, 12 folios.

[69] Istanbul, Kandilli, nr. 208/8, 5 f.

g. Exposition of "Book on Spheres" of Theodosius (*Tahrīr Kitāb al-ukar li-Thawudhūsiyūs*): Hajji Khâlifa mentioned in *Kashf al-Zunūn* (I, 390).

11. Muhammad Istanbulī

Muhammad b. As'ad al-Yanyawī al-Islāmbulī (Istanbūlī) (17-18. C.) from Istanbul. He was a Mathematician and astronomer which had wrote:[70]

a. *Kitāb tathlīth al-zāwiya wa tasbī' al-dā'ira* (Book on Trisection of an Angle and Division of a Circle in Seven Parts).

b. *Kitāb 'amal al-musabba' wa ghayrihī min dhawāt al-adlā al-kathīra fī al-dāira* (Book on the Construction of Heptagon and other Polygons Inscribed in Circle).

c. *Sharh ba'd maqālāt Uqlidis* (Commentary on some books of Euclid)

d. *Sharh Khulāsat al-hisab* (Commentary on "Essence of Artihmetic")

12. Khalil Fāid Efendi (Cābi-zāde Halil Fāiz).

Khalil Fā'id Efendi (1674-1722), Turkish mathematician and astronomer, worked in Istanbul.[71] He had:

a. *Fadhlaka al-hisāb* (Concise Exposition of Arithmetic)

b. *'Ilm riyādīdan hisāb* (from the science of Mathematics – Arithmetic)

c. *'Ilm riyādidan –Jabr* (From the science of Mathematics –Algebra)

13. 'Abd Al-Rahīm Al-Mar'ashi (Abdurrahim al-Mar'aşi) Efendi (d. 1736).

'Abd Al-Rahīm ('Abd al-Rahmān) ibn Abī Bakr al-Mar'ashī. Turkish theologian and mathematician. He wrote some commentaries to many works in mathematics. He was appointed as the governor of the province of Maras by Sultan Ahmet III. He educated the mathematicians Kalfaoglu and Gelenbevi. His Works:

a. *Sharh al-Risāla al-Bahā'iyya* (Commentary on the Treatise of Bahā' (Al-Din).
b. *Tartīb al-Aqsām 'alā madhhab al-imām al-Shāfi'i* (Order of division of Inheritances by the Method of a Shafi'I Imam).

[70] Rosenfeld, no. 1291.
[71] Rosenfeld, no. 1314.

14. As'ad Efendi al-Yanyawī (Yanyali Esad Efendi)

As'ad Efendi ibn 'Ali ibn 'Uthman Al-Yanyawī (17-18. c.), Ottoman mathematician.[72] His treatise was:

a. *Kitāb 'amal al-murabba' al-musāwī li'l-dāira* (Book on the Construction of a Square Equal to a Circle).

b. His translation of the book on philosophy from Latin dealing with squaring the circle.[73]

15. Ibrāhim of Aleppo *(Aleppo, ? – Istanbul May 1776)*.

His full name is Ibrahim b. Mustafā b. Ibrahim Madarī al-Halabī known as "Raghib Pasha Khwājasi" or "Imam of Koca Ragib Pasha" due to the fact that he was imam of Rais al-Kuttab Koca Ragib Pasha. He was from Aleppo, he received his preliminary education in Aleppo, and his first teacher was Salih b. Mawāhibī, sheikh of Qadirī Tarikah. He went to Egypt, following his teacher's advices, to improve his education and stayed there seven years. He studied narrative and rational sciences under the mudarris of al-Azhar named Sayyid Ali al-Zarîr al-Sivâsî al-Khanâfî. He also got education from Ḥasan Al-Jabartī (d. 1774) on astronomy.[74] When he went back to Aleppo, he was told that he was still in need to take more lessons on narrative sciences. During his trip to pilgrimage, he took more lessons from Abd al-Ghani al-Nablusi and Abu al-Mawahib b. Abd al-Baqī in Damascus. He continued his lessons during his visit in Makka. After pilgrimage he went to Cairo twice. He became associated to Ali al-Sivasi at al-Azhar and gave lessons on Hanafi jurisprudence.

He became imam for Yusuf Kethuda and hence he supported him financially and spiritually until his death. After his death, he got support from Ameer Osman, who was a veteran Sancak Bey (District ruler). He went to Istanbul as a head of committee which was organized by some Egyptian people who had some problems with the governor of Egypt Azmizade Suleyman Pasha (1740). He stayed in Istanbul and became the imam of Koca Ragib Pasha. He copied many manuscripts for him and also taught him different sciences. He died in Istanbul and his tomb in Eyup district.[75]

---

[72] Rosenfeld, no. 1327.

[73] Cairo (Taymur riyada 140-16- a fragment).

[74] Rosenfeld, no. 1367.

[75] Cevdet, *Tarih*, IV, 214; Muradī, *Silkü'd-dürer fī a'yāni'l-karni'l-hādī aşer*, Bulak, 1301, c. I, 37-39; *GAL*, II, 311, *GAL²*, II, 428; Ziriklī, I, 69; Kehhale, I, 112, 113; *İzāhu'l-meknûn*, II, 240, 429; İsmail Paşa, I, 39; *İ'lāmu'n-nübelā*, VII, s. 93-95; *Kamusülalam*, I, 568, 569; *SO*, I, 136; Ebulula II, 273; İzgi, I, 232, 328, 386; A. Özel, *Hanefî Fıkıh Âlimleri,* Ank., 1990, s. 144; İ. Fazlıoğlu, "Hendese", *DİA*, XII, 206; *OMLT*, I, 222-227. Salim Aydüz,

His Works:

a. *Sharh al-mas'ala al-sha'iriyya min sharh al-Mulahhas li-Qadi-zāda* (Arabic). It is an explanation some part of Qadızada Rumī's book *Sharh al-mulahhas fī al-hay'a* section titled "Mas'ala al-sha'iriya".[76]
b. *al-Girbāl fī al-hisāb* (Arabic). This MS contains various mathematical tables. 5940 of the boxes filled by symbols.[77]
c. *Hawāshī 'ala Raqāiq al-haqāik fī hisāb al-darj wa al-daqāiq* (Arabic) (Comments on "Subtleties of Truths on Arithmetic of Degrees and Minutes". It is a commentary of Sibt al-Maridīnī's book[78] which about to calculate of degrees and minutes according to the sixty base mathematics[79].
d. *Risāla fī kayfiyya istihrāj iddat al-ihtimālāt al-tarkībiyya min ayyi adad kāna* (Arabic). It is about a book on the combinatory analysis which is the largest work on this subject in the Ottomans.[80]
e. *Risāla fī al-awzān wa al-makāyīl* (Arabic) (Treatise on Weights and measures). It is a treatise about measurements and weights.[81]
f. *Risāla fī al-handasa* (Arabic). It is about geometry[82].
g. *Sarh al-Hāwī fī al-Hisāb li Ibn al-Hā'im* (Arabic) (Commentary on "Comprehensive arithmetic" of Ibn Hā'im). It is a commentary on the commentary of Ibn Al-Hā'im's commentary[83] of Ibn al-Banna's book *al-Hāwī fī al-Hisāb.*[84]
h. *Sharhu mas'alati taz'īf al-mazbah* (Arabic).[85]

"Ibrahim Halebī", *Yaşamları ve Yapıtlarıyla Osmanlılar Ansiklopedisi*, İstanbul 1999, I, 627-628.

[76] Süleymaniye library., Laleli, MSS 2126/3, 8 folios.

[77] Süleymaniye library., Yazma Bağışlar, MSS. 2060, 50 Folios.

[78] Rosenfeld, no. 873, M1.

[79] Süleymaniye Library, Esad Efendi, MSS 1953, 61 Folios.

[80] Süleymaniye library, Kasidecizade, MSS 679, 22 folios. It was printed in Paris in 1998.

[81] Garrett, No. 4845, 5 vr.

[82] Süleymaniye library, Arif Hikmet, MSS. 144/3, 18 folios.

[83] Rosenfeld, No, 783, M22.

[84] Süleymaniye Library, Hamidiye, MSS. 873/4, 86 folios.

[85] Köprülü Library, III. Kısım, MSS 709/6, 5 folios.

16. Gelenbevi Ismail Efendi (1730-1790).

Isma'il Efendi ibn Mustafa ibn Mahmoud al-Galanbawī (or Kalanbawī) al-Hanafī. He was born in Gelenbe near Manisa (Turkey); Turkish mathematician and astronomer, Madrasa teacher.[86] The most famous mathematician of the Ottoman State in the 18th century was Gelenbevi Ismail Efendi. He was born in the town Gelenbevi in 1737. In his family, there were also famous scholars.

As a family tradition, he came to Istanbul to study science. In Istanbul he studied shari'a (Islamic law canonically), mathematics and physics. He taught mathematics in the marine engineering school which was established by Sultan Abdul Hamid I. The number of his scientific works is more than 30. The some of them were:

a. *Adlā'-i Muthallathāt* (Sides of a Triangle). In Turkish.
b. *Sharh-i lugūritma* (Explanation of Logarithms) or *Sharh Jadāwil al-ansāb-i lugūritma* (Explanation of Tables of Ratios of Logarithms). In Turkish.
c. *Kusurāt Hisābı or Hisāb al-kusūr* (Arithmetic of Fractions). Also known as *Risāla fī al-Jabr wa'l-muqābala* (Treatise on Algebra and Al-muqābala). In Turkish.
d. *Risāla fī al-rub' al-mujayyab al-musammā bi'l-marāsid (Arabic) (Treatise on the Sine Quadrant called observatorial). Ma'rifat al-rub' al-mujayyab (Knowledge of the Sine Quadrant). Al-Marāsid (observatorial).* It is a calculation treatise for trigonometrically functions.[87]

17. Kalfazâda/Khalifazāda Ismail Efendi (d. Istanbul 1790).

Kalfazâda Ismail Efendi lived in the second half of the 18th century in Istanbul as a muwaqqit (Time keeper). We have very limited information about his early life and education. He was an officer in the Ottoman army and attended many expeditions. He received preliminary astronomy education while he was very young. When he completed his education he was appointed as muwaqqit to Laleli Mosque Muwaqqitkhāna (Time keeping house) in 1767 until 1789. He composed many books on mathematics and astronomy, and made some translations from European languages. He also made two sundials on the wall of Laleli Mosque and one on the table in the garden of mosque. Beside Arabic, Persian he also

[86] Rosenfeld, no. 1390.

[87] Hüsnü Hamit, "Islam Riyazatında Turklerin Mevkii", *Main Lines in History of Turks*, series 11, no. 4/a.

knew French. Hence, he translated Clariaut's (d. 1765) almanac *Théorie de la Lune* into Turkish as *Tarjama-i Zij Haqīm Clairaut* in 1767-8.[88]

Kalfazâda Ismail Efendi's other translation is J. Cassini's (d. 1756) almanac Tables Astronomiques into Turkish as Tukhfa-i Bahīj-i Rassīnī Tarjama Zij-i Cassini. He added some of his own commentaries to the translation and dedicated them to Sultan Mustafa III in 1772-3. He added logarithmic tables at the beginning of the translation and explained how to use them. It was the first treatise in Turkish about logarithm.[89] Upon the translation of this book, Ottoman astronomers left Ulugh Beg's Zij and started to use this almanac to calculate their astronomical work in 1900 by the order of Sultan Selim III.[90]

18. Huseyin Rifki Tamani (d. Madina, 1817)

Huseyin b. Muhammad b. Kırım Gazī was born in Taman, a province of the Crimea. He came to Istanbul at unknown date and entered the *Muhandishāne-i Berrî-i Hümâyûn* (Imperial School of Military Engineering) in 1795 as a teacher and later he was appointed to be the chief instructor there in 1806 until his death. In 1816 he first went to Balkan Peninsula and later to Medina for renovating some buildings there. During his last duty, he passed away in Medina. Beside Arabic and Persian, he also knew French, Italian and Latin languages.[91] His son Emin Pasa was governor of Damascus and later on studied at Cambridge University. He worked a long time as a teacher and an instructor in the War Academy. He first established the Military Schools. And wrote a book about variations calculations.

Rifki Tamani wrote and translated many books. He was one of the pioneer scholars on the transmission of western's science into the Ottoman world via his translations. Many of his books were on physics, mathematics, military subjects and geometry. Most of his books were textbooks at his school.

---

[88] Kandilli Rasathanesi Ktp., nr. 190, 30 v.

[89] Kandilli Rasathanesi Ktp., nr. 200, 199 v.

[90] Salih Zeki, *Kamûs-ı Riyāziyyāt,* I, s. 327-330; *OM*, III, s. 259-260; *SO*, I, s. 371-372; Uzunçarşılı, *Osmanlı Tarihi*, IV/II, s. 537; *OALT*, s. 530-536; Adıvar, s. 199-201

[91] Mehmed Esad, *Mirat-ı Mühendishāne-i Berrī-i Hümāyûn,* İst., 1312, s. 27, 32, 33; A. Sayılı, "Turkish contributions to and reform in Higher education and Hüseyin Rıfkı and his work in geometry", *Ankara Üniversitesi Yıllığı*, XII (1966), s. 90-98; S. Tekeli, *Hüseyin Rıfkı Tamanī,* Arap Bilimler Tarihini Araştırma Cemiyeti tarafından düzenlenmiş olan ikinci Uluslararası konferansta sunulan tebliğ, 5-6 Nisan 1977; *TA*, XIX, s. 425; K. Beydilli, *Türk Bilim ve Matbaacılık Tarihinde Mühendishāne ve Mühendishāne Matbaası ve Kütüphānesi (1776-1826),* İst., 1995, s. 50-56, 284, 309-311; M. Kaçar, *Osmanlı Devleti'nde Bilim ve Eğitim Anlayışındaki Değişmeler ve Mühendishānelerin Kuruluşu,* İÜ Sosyal Bilimler Ens., doktora tezi, 1996, s. 151, 205.

Here are his books on mathematics.

a. *Tarjamat Usūl-i Handasa* (Turkish). It is the translation of English mathematician J. Bonnycastle's book *Euclid's Elements* published in 1789. It was dedicated to Sultan Selim III.[92]

b. *Logaritma Risālasi* (Turkish). Contains logarithm and problems with solutions. It was written in 1793.[93]

c. *Imtihan Al-Muhandisīn (*Turkish*)*[94]*.* It is a treatise on geometry and contains 88 propositions with theoretical and practical applications and solutions. It was written in 1802. There are 180 diagrams at the end of the book.

d. *Mejmua al-Muhandisīn (*Turkish*).* It is about military art and geometry and it was written in 1802. It mentions how to apply the theoretical geometry in practical areas. Applicable geometry and measurements also mentioned in it. At the end of the book, in epilogue he provides very important information on cannon casting and various types of cannons use by the Ottomans.[95]

e. *Talkhis al-Ashqāl fī ma'rifat tarfi'I al-askāl fī fann al-lagim.* (Turkish). It is a treatise on geometry and most probably one of his early works. He compares French and the Ottoman weight rates.

19. Hoca Ishak Efendi (Bashhoca Ishak Efendi)

Ishak Efendi Bashhoja (1774-1836): Ottoman mathematician, astronomer, and engineer; one of the pioneers of modern sciences in the Ottoman Empire.

He was born in the province of Karlova, Bulgaria. He worked as chief instructor in the Imperial School of Engineering (Muhandiskhāna Bahrî-i Humâyûn). He knew Arabic, Persian, French, Greek and Latin. He translated many books from western languages into Turkish. He was also an engineer.

Among his thirteen books, which he wrote using Western and particularly French sources, *Mecmūat-i 'ulūm-i Riyādiyya* (Compendium of Mathematical Sciences, four volumes) is of special importance, since it is the first attempt in any language of the Muslim world to present a comprehensive textbook on different sciences such as mathematics,

[92] TSMK, Hazine, no. 602/1, 167 vr.
[93] Kandilli Rasathanesi Ktp., no. 216, 15 vr.
[94] TSMK, Hazine, no. 604, 70 vr
[95] TSMK, Hazine, no. 601, 143 vr.

physics, chemistry, astronomy, biology, botany, and mineralogy in one compendium. Ishak Efendi's efforts to find the equivalents of the new scientific terminology and his influence on the transfer of modern science spread in other Islamic countries beyond Ottoman Turkey.

He had a leading role in the transfer of modern science into Islamic world. He was instrumental in introducing modern sciences to the Islamic world through his numerous translations, adaptations and compilations from European languages, thus furthering the progress of education. He made significant contributions to Ottoman science by developing modern scientific terminology. Apart from mathematical books, he wrote some books about military building and production.[96] His books on mathematics were:

a. *Majmu'āt-i 'ulūm riyādiyya* (Collection of Mathematical sciences). In this work, he explained all mathematical concepts and methods with their applications to engineering and science. It was an important course book set for the general and applied mathematics to its own time.
b. *Ajsam nāriyya wa muthalathāt kuriyya* (Fire solids and Spherical Triangles).

20. Hüseyin Tevfik Pasha of Vidin (1832-1893).

In the 19th century, scientific studies during the westernization process, in the Ottoman world did not go beyond translation of European scholar's books into Turkish. In this atmosphere, Tevfik Pasha of Vidin (mostly known as Vidinli Tevfik Paşa in Turkish literature) made research on the very new area in mathematics quaternion and he published a research book on this subject entitled "Linear Algebra" in English. It was first published in 1882 (169 pages) and second edition: revised and enlarged version was published by A. H. Boyajian in 1892 (188 pages) in Istanbul. He was the first person to make innovative research on Linear Algebra and published a book ever in the history of the Ottomans on the subject of basic sciences.

According to the sources that mention his life we know he wrote some more books which we cannot place so far. *Jabr-i Hattī (Algebra on surface?), Usūl-i İlm-i hisāb* (T) (Method on the science of calculation) and *Jabr-i a'lā* (T) (High Algebra).

a. *Linear Algebra* (in English). Dealing with Linear Algebra. It is a very original work in which a very new subject of the time of

[96] Rosenfeld, no. 1407.

mathematics; quaternion. Quaternions were first invented by Irish mathematician-astronomer W. R. Hamilton (d. 1843) and became very important when quaternions were applied to physics. This book mainly writes on this subject and at the end of the book he established the three dimension algebra, which contains complex numbers' algebras and also formed with the three dimensions space vectors league. He also showed the application of this method to various problems which belong to elementary geometry. It was first published in 1882 and secondly in 1892 as an edited and revised version. Hüseyin Tevfik's book was the one of the earliest printed book on this subject in the world and it preserved originality on this area until the 1920's.

b. **"***Hisāb Muthanna" (Dual Algebra).* It was another article about Algebra written by Hüseyin Tevfik in English and it was published in the journal *Mebāhis Al-İlmiye Mecmuası* in 1866.
c. *Zayl Usūl al-Jabr* (Appendix on the method of Algebra) (Turkish). An appendix about derivatives upon Tahir Paşa's book *Usūl al-Jabr* and also about Mc. Lauren Taylors's series. (İstanbul 1278/1861).
d. *Yeni Ölçülerin Menāfi ve İstimāline Dāir Risāla-i Muhtasara* (An Abridged treatise on the advantages and usage of the new measurements) (Turkish). It is a Turkish book that explains how to solve problems on weights and measurements newly applied (Istanbul 1882).

21. Salih Zeki (1845-1921)

Salih Zeki is a mathematician who wrote extensively on musical subjects, pointed out that whereas the "science" of music, and its analytical methods, was common to all people, the music itself was peculiar to each people alone

He studied electric engineering in Paris. After coming back he worked as an engineer in the Mail and Telegraph Administration and as a mathematics teacher. However, he left his job as engineer after a certain time and he set his life aside to teach and to spread the mathematics. He worked also as the director of observatory. He established the mathematics department in science faculty. He wrote many books on mathematics. Some of his works about mathematics are *Asari Baqiya, Kāmūsu Riyādāt, Hiqmati Tabiiyai Umūmiya, Hisābi Ihtimālāt, Mīzan Tafakkur.*

Asari Baqiye is about arithmetic, trigonometry, geometry and cosmology. *Kāmūsu Riyādāt* is an encyclopaedia for mathematics. *Hiqmati*

Tabiiyai Umūmiya, is about the general physics. *Mīzan Tafakkur* is an important book about logic of algebra. Salih Zeki was also a science historian.

Conclusion

The mathematics studies in the Ottoman State mainly began with Ali al-Qushjī in Istanbul until Salih Zeki's period. These works were divided into two parts as traditional and Western Styles. With Gelenbevi's works the first part ended and with Salih Zeki's work the second part finalised. The Ottoman mathematic studies continued five centuries, but this tradition could not keep in step with the developments in mathematics in Europe since the 18th century. In the Ottoman school, some mathematicians produced original works but the others were satisfied with the education and the publishing of mathematics. But the most of works in the Ottoman school were not studied in detail from the point of view of mathematics history. There are two reasons for this. The first reason is that there are very few people having interest in the subject and the second reason is that the young people in Turkey cannot read and understand the texts written in Arabic language. Because of these facts, I think that it will take a long time to study the Ottoman texts. I hope that if the Ottoman texts written in the 15th, 16th and 17th centuries are studied in detail, it will be possible to find out the level of the Ottoman mathematics and contributions to the world civilization.

The Ottoman scholars lived always with mathematics. They were informed of the productions of other scholars on the world. They made many original contributions to the mathematical research and education. Some of their contributions were translated into other languages and were used as the guide works. So they took their places in the history of world classical. As a tradition, all Ottoman mathematicians were interested also in the other scientific branches like astronomy, science, engineering and made important contributions to these fields. Unfortunately, the history of the Ottoman mathematics is one of least researched fields in the history of mathematics in the Islamic civilisation. There are many original works of Ottoman mathematicians in the libraries of Turkey which are not studied in detail from the perspective of scientific history. I think if they are studied in detail, a better picture of Ottoman mathematics will become visible.

Author

Salim Ayduz is a senior lecturer at the Istanbul Medeniyet University and Fatih University, known for his expertise in development Islamic science, technology, and particularly history of Ottoman Science, Technology and Civilization. Now, he active in Sophia Academy, Charl. Lagedijk 563, 3084 LC Rotterdam, Netherlands and Independent Senior Researcher, Manchester, UK, United Kingdom

References

Abdeljaouad, Mahdi Mohamed. "Teaching European Mathematics in the Ottoman Empire during the Eighteenth and Nineteenth Centuries: Between Admiration and Rejection." *ZDM* 44, no. 4 (2012): 483–498. https://doi.org/10.1007/s11858-012-0381-6.

Abdullah, M. Amin. "Religion, Science, and Culture: An Integrated, Interconnected Paradigm of Science." *Al-Jami'ah: Journal of Islamic Studies* 52, no. 1 (2015): 175–203. https://doi.org/10.14421/ajis.2014.521.175-203.

Agarwal, Ravi P., and Syamal K. Sen. *Creators of Mathematical and Computational Sciences*. Springer International Publishing, 2014. https://doi.org/10.1007/978-3-319-10870-4.

Ayduz, Salim. "Nasūh Al-Matrakī, A Noteworthy Ottoman Artist-Mathematician of the Sixteenth Century." http://muslimheritage.com/topics/default.cfm?ArticleID=853.

Fazlıoğlu, İhsan. "Davud Kayseri." In *Yaşamları ve Yapıtlarıyla Osmanlılar Ansiklopedisi*. Istanbul: Yapı Kredi Yayınları, 1999.

Ghevarughese Joseph, George. "Foundations of Eurocentrism in Mathematics." *Race & Class* 28, no. 3 (1987): 13–28. https://doi.org/10.1177/030639688702800302.

Haqparast, Habibullah, and Mohammad Mollah Salangi. "Impact of Islamic Civilization on the European Intellectual Awakening: An Analytical Study." *Sprin Journal of Arts, Humanities and Social Sciences* 3, no. 1 (2024): 57–62. https://doi.org/10.55559/sjahss.v3i1.223.

Hillenbrand, Robert. "Madrasa." In *The Encyclopaedia of Islam*, New Edition. Leiden: E. J. Brill, 2000.

Hitzél, Frédérik. "Défense de la Place Turque d'Oczakow par un Officier du Génie Française (1787)." In *İkinci Tarih Boyunca Karadeniz Kongresi Bildirileri*, edited by Mehmet Sağlam. Samsun, 1990.

İhsanoğlu, Ekmeleddin. *Science, Technology and Learning in the Ottoman Empire: Western Influence, Local Institutions, and the Transfer of Knowledge*. 1st ed. Routledge, 2024.

İhsanoğlu, Ekmeleddin. *Studies on Ottoman Science and Culture*. 1st ed. Routledge, 2020.

İzgi, Cevat. "Osmanlı Medreselerinde Aritmetik ve Cebir Eğitimi ve Okutulan Kitaplar." *Osmanlı Bilimi Araştırmaları* (1995).

Karagözoğlu, Bahattin. "Contribution of Muslim Scholars to Science and Technology." In *Science and Technology from Global and Historical Perspectives*. Springer International Publishing, 2017.

Marini, Daniele L. R. "Mathematics and Astronomy from Origin to Eighteenth Century." In *Imago Cosmi*. Astronomers' Universe. Springer Nature Switzerland, 2023.

Mardiana, Dina, et al. "Development of Islamic Education: The Multidisciplinary, Interdisciplinary and Transdisciplinary Approaches." *Al-Hayat: Journal of Islamic Education* 4, no. 1 (2020): 58–70. https://doi.org/10.35723/ajie.v4i1.97.

Riaz, Ali. "Madrassah Education in Pre-Colonial and Colonial South Asia." *Journal of Asian and African Studies* 46, no. 1 (2011): 69–86. https://doi.org/10.1177/0021909610387758.

Şahin, Kaya. "Constantinople and the End Time: The Ottoman Conquest as a Portent of the Last Hour." *Journal of Early Modern History* 14, no. 4 (2010): 317–354. https://doi.org/10.1163/157006510X512223.

Şen, A. Tunç. "The Sultan's Syllabus Revisited: Sixteenth-Century Ottoman Madrasa Libraries and the Question of Canonization." *Studia Islamica* 116, no. 1 (2021): 198–235. https://doi.org/10.1163/19585705-12341441.

Toderini, M. L'. *De la Littérature des Turcs*. Translated from Italian into French by Tournant and M. L'Abbé De Cournand. Vol. 1. Paris: Poincot, 1789.

Ünver, A. Süheyl. *Ali Kuşçu: Hayatı ve Eserleri*. Istanbul University, Faculty of Science, 1948.

Yavuz, M. Hakan. "Is There a Turkish Islam? The Emergence of Convergence and Consensus." *Journal of Muslim Minority Affairs* 24, no. 2 (2004): 213–232. https://doi.org/10.1080/1360200042000296627.

.