Next Scientists
Journal of Social Sciences and Humanities Research Fundamentals

TYPE Original Research
PAGE NO. 155-157
DOI 10.55640/jsshrf-05-05-40

The Role of Central Asian Scholars' Scientific Heritage in the Development of Global Science

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OPEN ACCESS

SUBMITTED 29 March 2025
ACCEPTED 25 April 2025
PUBLISHED 30 May 2025
VOLUME Vol.05 Issue05 2025

Abstract: This article explores the scientific heritage of Eastern, particularly Central Asian scholars, focusing on the intellectual contributions of sages, thinkers, and scholars from this ancient land. It highlights their literary and scientific works, as well as the tangible and intangible cultural values they left behind, emphasizing their significant role in the development of world civilization.

Keywords: Philosophical schools, spiritual perfection, humanity, thinker, academy.

Introduction: The East has long been recognized as a cradle of science, spirituality, and enlightenment. Humanistic ideals, the pursuit of education, and the quest for knowledge have held a central place in the social, spiritual, and philosophical worldview of Eastern societies. The invaluable text Avesta [2] is imbued with the principles of Zoroastrianism, and explores themes of morality, human dignity, and intellectual development. It discusses issues of moral and intellectual upbringing, education, and knowledge-seeking, placing particular emphasis on the upbringing of both girls and boys.

Modern pedagogical laws and categories are rooted in the ideals of human perfection, promoting values such as humanity, patriotism, family devotion, spirituality, and enlightenment, as well as appreciation for virtuous intentions and noble deeds. Like many other Eastern peoples, the Uzbek nation justifiably takes pride in its rich cultural, educational, and scientific heritage.

According to the Avesta, from the earliest days of Zoroastrianism, schools were established alongside fire temples. A structured educational system developed by priests provided religious, ethical, and physical training,

as well as instruction in reading and writing. Education began at the age of seven with the ceremonial donning of a "sacred robe" made of white silk [3, p. 104b], in the presence of elders, priests, and parents. Teachers also wore white silk robes with sashes woven from silk in 72 different colors. During the ritual of donning the sacred robe—called sidrapushlik—students and teachers stood facing the sun in reverence.

Students took oaths together with priest-teachers to remain faithful to the ideals of goodness, knowledge, and respect for benevolent deities described in the Avesta, while renouncing all forces of evil. The educational process emphasized truthfulness, moral purity, and sincere intentions. Zoroaster himself was revered as a role model of scholarship. Teachers were expected to instill love for one's faith, people, and homeland, to teach the value of honest labor, and to cultivate noble character traits. Good teachers were regarded as bearers of wisdom and honored as valuable members of society, while those who lacked dedication and pedagogical competence were severely criticized.

Particular attention was paid to the education of girls. They were taught household management, etiquette, and intellectual skills necessary for raising healthy future generations and maintaining harmonious family life. Instruction also included training in physical and martial skills [3, pp. 107–108b].

Scientific Advancement in Central Asia

The tradition of scientific development gained momentum through the study and commentary on Greek philosophical texts. As a result, science and learning flourished in the region of Transoxiana. By the mid-8th century, territories such as Iran, Syria, Palestine, Egypt, North Africa, the Iberian Peninsula, Sicily, Southern Italy, and parts of Northwestern India were incorporated into the Abbasid Caliphate [4]. Under Caliph Al-Mansur, the capital was moved from Damascus to Baghdad, where libraries and scientific centers filled with rare texts were established.

At the Bayt al-Hikma (House of Wisdom) academy in Baghdad, led by Central Asian scholar Muhammad ibn Musa al-Khwarizmi (783–857), works from Greece, Syria, China, and India were translated into Arabic. Invited scholars from around the world contributed to the institution, which became known as the "House of Scholars." At the request of Caliph Al-Ma'mun (ca. 830), al-Khwarizmi wrote Al-Kitāb al-Mukhtaṣar fī ḥisāb al-jabr wa-l-muqābala (The Compendious Book on Calculation by Completion and Balancing) [5]. The work includes methods for solving first- and second-degree equations, rules for algebraic operations, and techniques for using algebraic tools in problem-solving.

The terms al-jabr (restoration) and al-muqābala (balancing) refer to algebraic manipulations used to simplify equations—a foundation for modern algebraic methods. Today, the technique of transposing terms across the equality sign to simplify equations originates from al-Khwarizmi's approach. He viewed education, learning, and the acquisition of knowledge as essential to human development and emphasized their role in shaping moral and intellectual values, thus contributing significantly to the evolution of pedagogical thought.

Al-Khwarizmi advocated for the use of visual demonstrations, Q&A techniques, and the systematic development of skills and competencies. He distinguished between knowledge acquired through sensory perception and that gained through logical reasoning, making a vital contribution to the theory of knowledge. He showed that scientific discoveries are often driven by observation and practical needs. In his writings, he also addressed issues of ethics and morality, emphasizing the role of knowledge in cultivating both intellectual and moral growth.

Ahmad al-Farghani, a contemporary of Al-Khwarizmi, conducted scientific research alongside him at the Bayt al-Hikma (House of Wisdom). His full name was Abū al-ʿAbbās Aḥmad ibn Muḥammad ibn Kathīr al-Farghānī (approx. 798–865 CE). He actively participated in the construction of the observatories in Baghdad and Damascus and led the Baghdad School of Astronomy. Al-Farghani authored several scholarly works in the fields of astronomy, mathematics, and geography. His most well-known work is Kitāb al-Ḥarakāt al-Samāwīyah wa Jawāmiʿ ʿIlm al-Nujūm ("Book on Celestial Motions and the Summary of Astronomy"), which was translated into Latin in 1145 and again in 1175. In Europe, he became known as "Alfraganus."

Al-Farghani made substantial contributions to world science. In 812, he accurately predicted a solar eclipse. He determined that the Earth is spherical and calculated the Earth's meridian length to be 40,008 km. He designed an instrument to measure the water level of the Nile and was among the first to conceptualize the solar clock. A navigation map used by Columbus during his voyage to the Americas, preserved in the Baghdad Library, contributed to Al-Farghani's global recognition.

Al-Farghani's legacy exemplifies the harmony of intellectual excellence and personal integrity, highlighting the importance of intrinsic motivation, creativity, and the pursuit of virtue in groundbreaking discoveries. His scholarly contributions serve as an enduring example for youth, inspiring a pursuit of knowledge and intellectual inquiry.

As noted by the President of Uzbekistan, "It suffices to

recall the book Elements of Astronomy by our great ancestor Ahmad al-Farghani, which was translated into Latin and Hebrew as early as the 12th century. The unique structure known as the 'Miqyas al-Nil,' built under his supervision to measure the water level of the Nile, still stands in Egypt today. Another prominent figure, Burhan al-Din al-Marghinani, authored Al-Hidayah, a work that has remained a principal legal reference in Islamic jurisprudence for centuries. Studying the priceless legacy of such outstanding thinkers and preserving their memory brings us a deep sense of national pride" [1, p. 45].

Another Central Asian scholar who significantly contributed to world science is Abu Nasr al-Farabi, born in 873 in the city of Otrar (Farab) on the banks of the Syr Darya. He initially studied in Shash (Tashkent) and Bukhara and later continued his education in Baghdad. Al-Farabi mastered various sciences and languages. His seminal work The Virtuous City was written in Baghdad. An expert in Hellenistic philosophy, Al-Farabi authored commentaries on the works of Plato, Aristotle, Ptolemy, Alexander of Aphrodisias, Galen, Epicurus, Zeno, Euclid, and Porphyry. These contributions earned him the title "The Second Teacher of the East" (after Aristotle). One of his most famous works, Great Book on Music, added significantly to the understanding of music and logic developed by the Greeks. His commentaries on Aristotle's Metaphysics gained widespread acclaim in academic circles.

Abu Ali Ibn Sina (Avicenna, 980–1037) is another Central Asian encyclopedic scholar. Born in Afshona village near Bukhara into a noble family, his full name was Abu Ali Husayn ibn Abdullah ibn Sina. He exhibited exceptional talent from a young age and was particularly interested in medicine. At just 17, he gained fame for successfully treating Amir Nuh ibn Mansur and was granted access to the Samanid royal library, where he expanded his knowledge in science, philosophy, and medicine.

Of the approximately 450 works attributed to Ibn Sina, around 240 have survived. These include 40 texts on medicine, 30 on natural sciences, and 185 covering philosophy, logic, psychology, geology, and ethics, in addition to three on music. In 1002, Ibn Sina moved to Khwarazm and joined the Khwarazm Ma'mun Academy, where he collaborated with Al-Biruni. His best-known works, such as The Canon of Medicine and The Book of Salvation, were highly influential in both the East and the West, serving as foundational texts in medical education for centuries. The Institute of Oriental Studies of the Academy of Sciences of Uzbekistan, named after Abu Rayhan al-Biruni, preserves 60 manuscripts of Ibn Sina's 50 works on various topics.

CONCLUSION

The evidence presented underscores that the ancient East was a bastion of humanistic thought and moral-ethical values. Each of the scholars discussed focused in their works on the education and upbringing of the younger generation. Their pedagogical ideas were deeply shaped by the socio-political, economic, and cultural contexts of their time. Thoroughly studying their legacy and applying their progressive ideas is one of the key tasks of modern science. In today's globalized world, integrating the educational ideals of these thinkers with the achievements of world civilization plays a vital role in the moral development of future generations.

Studying the scientific heritage of Central Asian scholars nurtures in future primary school teachers an understanding of spiritual and moral education, while promoting a sense of historical continuity and the ability to draw upon both universal and national values.

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