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INTEGRATING ISLAMIC CULTURAL VALUES IN MATHEMATICS: A HISTORICAL REFLECTION ON THE ISLAMIC GOLDEN AGE

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ABSTRACT

This research examines the important role of Islam in enriching knowledge, particularly in the field of mathematics. Using a qualitative historical method, this study investigates how Islamic cultural values were applied during the Islamic Golden Age (8th–13th centuries CE). The findings reveal that core Islamic values such as tawhid (the oneness of God), ijtihad (independent reasoning), balance, and responsibility played a key role in encouraging innovation and the growth of scientific knowledge. Institutions like Bayt al-Hikmah became research centers that combined spiritual values with scientific exploration. Mathematics developed not only as a technical science but also as a discipline with deep philosophical and ethical meaning. Muslim scholars like Al-Khwarizmi, Al-Battani, and Umar Khayyam used mathematics to understand the signs of Allah in the universe. The principle of tawhid served as the foundation for their scientific thinking, promoting harmony between spiritual and worldly knowledge. The spirit of ijtihad encouraged freedom of thought and the courage to explore new scientific discoveries. This research concludes that Islamic cultural values contributed significantly to scientific progress and enriched the intellectual heritage of global civilization.

KEYWORDS*: Islamic Culture, Mathematics, Islamic Golden Age, Tawhid, Islamic Values*

ABSTRAK

Penelitian ini mengkaji peran penting Islam dalam memperkaya pengetahuan, khususnya di bidang matematika. Dengan menggunakan metode historis kualitatif, studi ini menyelidiki bagaimana nilai-nilai budaya Islam diterapkan selama Masa Keemasan Islam (abad ke-8 hingga ke-13 Masehi). Temuan menunjukkan bahwa nilai-nilai Islam inti seperti tawhid (kesatuan Tuhan), ijtihad (pemikiran independen), keseimbangan, dan tanggung jawab memainkan peran kunci dalam mendorong inovasi dan pertumbuhan pengetahuan ilmiah. Institusi seperti Bayt al-Hikmah menjadi pusat penelitian yang menggabungkan nilai-nilai spiritual dengan eksplorasi ilmiah. Matematika berkembang tidak hanya sebagai ilmu teknis tetapi juga sebagai disiplin dengan makna filosofis dan etis yang mendalam. Cendekiawan Muslim seperti Al-Khwarizmi, Al-Battani, dan Umar Khayyam menggunakan matematika untuk memahami tanda-tanda Allah di alam semesta. Prinsip tawhid menjadi landasan pemikiran ilmiah mereka, mempromosikan harmoni antara pengetahuan spiritual dan duniawi. Semangat ijtihad mendorong kebebasan berpikir dan keberanian untuk menjelajahi penemuan ilmiah baru. Penelitian ini menyimpulkan bahwa nilai-nilai budaya Islam berkontribusi secara signifikan terhadap kemajuan ilmiah dan memperkaya warisan intelektual peradaban global.

KATA KUNCI: Budaya Islam, Matematika, Zaman Keemasan Islam, Tawhid, Nilai-Nilai Islam

INTRODUCTION

Mathematics, as one of the fundamental branches of knowledge, has undergone significant development since the era of Islamic civilization, particularly during the Islamic Golden Age[1]. During this period, the Islamic world became a vibrant center of intellectual activity, where scholars actively collected, translated, and expanded upon the knowledge inherited from earlier civilizations such as the Greeks, Indians, and Persians[2]. The historical development of mathematics was marked by the emergence of new disciplines, including algebra, which was pioneered by Al-Khwarizmi, as well as the adoption and dissemination of the Hindu-Arabic numeral system, which replaced the more cumbersome Roman numerals in Europe. Significant advancements were also made in geometry and trigonometry by scholars like Alhazen, Al-Battani, and Abu al-Wafa. Mathematics during this golden era was not limited to theoretical exploration but was applied extensively in various practical fields such as astronomy, architecture, economics, and Islamic jurisprudence, especially in calculations related to prayer times, zakat, and inheritance. This historical reality demonstrates how Islamic civilization played a crucial role in shaping the foundations of modern mathematics through the accumulation of knowledge, scientific innovation, and the integration of rational inquiry with spiritual values.

In this period, Muslim mathematicians not only focused on the development of mathematical theories but also integrated Islamic cultural values into its practice and application. Amidst rapid scientific advancements, mathematics served as an important tool to understand the order of the universe, believed to be the creation of Allah[3]. This study aims to explore how Islamic values, such as justice, beauty, and order, are reflected in the mathematical works produced during this period[4]. The pursuit of

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[1] Ibnu Imam Al Ayyubi et al., "Improving Students' Creative Thinking Skills Assisted by GeoGebra Software," *Noumerico: Journal of Technology in Mathematics Education* 2, no. 1 (2024): 23–34, https://doi.org/https://doi.org/10.33367/jtme.v2i1.4244; Ibnu Imam Al Ayyubi et al., "Pengaruh Model Pembelajaran Kontekstual Terhadap Hasil Belajar Siswa Di Pondok Pesantren Roudlotul Ulum," *Al-Wasathiyah: Journal of Islamic Studies* 3, no. 1 (2024): 1–13, https://doi.org/https://doi.org/10.56672/alwasathiyah.v3i1.198; Ibnu Imam Al Ayyubi et al., "Implementasi Model Problem Based Learning Pada Pembelajaran Matematika," *Tadrusuun: Jurnal Pendidikan Dasar* 3, no. 1 (2024): 206–16, https://doi.org/https://doi.org/10.62274/tadrusuun.v3i1.121; Ibnu Imam Al Ayyubi et al., "Increasing Student Learning Motivation through the Application of Problem-Based Learning Models," *International Journal Humanities Perspective* 1, no. 1 (2024): 13–18, https://ejournal.papanda.org/index.php/ijhp/article/view/591; Ibnu Imam Al Ayyubi et al., "Pendidikan Humanis Paulo Freire Dalam Pembelajaran Matematika MI," *Wulang: Jurnal Pendidikan Guru Madrasah Ibtidaiyah* 1, no. 1 (2024): 1–15, http://ojs.staisdharma.ac.id/index.php/wjp/article/view/178.

[2] David A King, "Notes on the Sources for the History of Early Islamic Mathematics," ed. F Sezgin, *Journal of the American Oriental Society* 99, no. 3 (July 16, 2025): 450–59, https://doi.org/10.2307/602381.

[3] Victor J Katz, "Ideas of Calculus in Islam and India," *Mathematics Magazine* 68, no. 3 (June 1, 1995): 163–74, https://doi.org/10.1080/0025570X.1995.11996307.

[4] Devina Juniar Ruhiat et al., "Sejarah Konsep Matematika Dalam Peradaban Islam Dan Implementasinya Dalam Kehidupan," *Awwaliyah: Jurnal Pendidikan Guru Madrasah Ibtidaiyah* 5, no. 2 (2022): 129–36, https://doi.org/https://doi.org/10.58518/awwaliyah.v5i2.1116.

knowledge (*'ilm*) was regarded as an act of worship (*ibadah*), and scholars viewed scientific inquiry as a way to draw closer to the Creator by uncovering the intricate balance and precision within His creation. Concepts like *mizan* (balance), *hisab* (calculation), and the structured patterns found in nature were seen as manifestations of divine wisdom. Mathematical principles were applied not merely for worldly benefit but also to fulfill social justice, such as in the accurate calculation of inheritance (*faraid*), fair distribution of wealth (*zakat*), and determination of prayer times. This harmonious relationship between science and faith encouraged responsible scientific exploration, ensuring that mathematical development aligned with ethical and spiritual values that promote the well-being of humanity and the glorification of Allah

Previous research has shown that Muslim scholars of the Golden Age, such as Al-Khwarizmi, Al-Farabi, and Ibn al-Haytham, made significant contributions to mathematics, especially in algebra, geometry, and astronomy[5]. hey emphasized not only the technical aspects of these sciences but also sought to connect mathematics with the philosophical and spiritual values embedded in Islamic teachings[6]. For example, Al-Khwarizmi, in his works, did not just discuss mathematical solutions but also highlighted the importance of clarity and order, aligning with Islamic teachings about the cosmic order and harmonious life. In this context, mathematics was seen not merely as a tool for calculation but as a pursuit of truth, which is considered an act of worship to Allah[7].

Furthermore, research on the influence of religion on the development of science in Islamic civilization reveals that Muslim scholars often viewed science as an effort to understand Allah's creation and to manifest His greatness. This concept is clearly seen in mathematical discoveries that were not only practically useful but also rich with philosophical and theological meanings. Building upon previous studies, the main objective of this research is to analyze how Islamic cultural values, such as the principle of monotheism (Tawhid), the perfection of Allah's creation, and the pursuit of knowledge as part of worship, can be applied in the mathematical works of the Islamic Golden Age[8].

By examining the implementation of Islamic cultural values in mathematics during the Golden Age, this research aims to provide a deeper understanding of the role Islam played in enriching knowledge, particularly mathematics. The study seeks to contribute

[5] Hamid Sakti Wibowo, *Ilmuwan Muslim: Kontribusi Berharga Mereka Untuk Peradaban Dunia* (Tiram Media, 2023).

[6] Habibur Rahman and Sudirman Sudirman, "From Bayt Al-Hikmah to Algebra: The Intellectual Legacy of the Islamic Golden Age," *Journal of Islamic Thought and Philosophy* 3, no. 2 (2024): 170–86, https://doi.org/https://doi.org/10.15642/jitp.2024.3.2.170-186.

[7] Najla Nur Salima, "Analisis Perkembangan Matematika Dengan Sejarah Islam Yang Dibawakan Tokoh Islam, Al-Khawarizmi," *Religion: Jurnal Agama, Sosial, Dan Budaya* 3, no. 3 (2024): 309–18, https://doi.org/https://doi.org/10.55606/religion.v3i3.1013.

[8] Rizqon Halal Syah Aji, "Khazanah Sains Dan Matematika Dalam Islam," 2014; Ghajali Rahman, "Kontribusi Peradaban Islam Pada Dunia," *Jurnal Syntax Transformation* 2, no. 10 (2021): 1406–12, https://doi.org/https://doi.org/10.46799/jst.v2i10.428.

to the development of a more holistic approach to science by considering the spiritual and ethical dimensions in its pursuit. Additionally, it is hoped that this research will increase awareness that the development of mathematics during the Islamic Golden Age was greatly influenced by Islamic values, which emphasized the balance between scientific knowledge and moral life. Thus, the contributions of Muslim scholars in that era not only impacted the development of mathematics but also influenced the growth of knowledge based on moral and spiritual principles.

METHOD

The type of historiography applied in this study combines analytical and interpretive historiographical approaches[9]. Analytical historiography enables the researcher to go beyond mere chronological narration by critically examining the causes, processes, and outcomes related to the development of mathematics in the Islamic Golden Age. This approach focuses on how various factors including cultural, religious, and intellectual influences interacted to produce a distinctive mathematical tradition. At the same time, an interpretive historiographical lens is employed to understand the deeper meanings behind the mathematical achievements of Muslim scholars, especially in how they incorporated Islamic cultural and spiritual values into their work. The analysis not only investigates historical progress in terms of technical advancements but also seeks to interpret the worldview of Muslim mathematicians, viewing knowledge as a means to understand divine order and fulfill social responsibilities. Through this dual historiographical strategy, the study aims to provide a rich, contextualized understanding of both the factual and value-laden dimensions of mathematical development during this influential period.

To ensure the authenticity of historical data and to draw valid conclusions, the study applies rigorous verification procedures based on historical-critical methods. Source authenticity is established through both external and internal criticism, where the legitimacy of manuscripts and classical texts is verified by examining their provenance, transcription history, and scholarly validation in credible academic circles. Internal criticism focuses on the accuracy and consistency of the content, cross-referencing classical works with modern research to detect potential biases or inaccuracies. For data analysis, the study applies a systematic thematic categorization process by identifying key themes such as the role of Islamic values, the practical applications of mathematics, and the intellectual contributions of specific scholars. These themes are then examined within their socio-historical context using a critical interpretive approach, allowing the researcher to analyze how cultural values like justice, balance, and divine order shaped mathematical thought. This method facilitates a comprehensive exploration of both the historical reality and the underlying

[9] Sugiyono, *Metode Penelitian Kuantitatif Kualitatif Dan R&D* (Bandung: Alfabeta, 2021).

philosophical dimensions that influenced the flourishing of mathematical sciences in the Islamic world.

In this study, primary data, including manuscripts and classical texts authored by prominent Muslim scientists, as well as historical documents from institutions like the Bayt al-Hikmah, were meticulously analyzed using a combination of thematic and historical-critical approaches. The thematic approach was employed to identify recurring patterns, key ideas, and dominant themes surrounding the development of mathematics during the Islamic Golden Age. This included tracing the contributions of influential figures such as Al-Khwarizmi, Al-Battani, and Al-Kindi, examining the evolution of mathematical branches like algebra, geometry, and trigonometry, and understanding how mathematics was applied within Islamic society, particularly in religious, legal, and scientific contexts. By identifying these themes, the study was able to capture not just isolated historical facts but the broader intellectual currents and cultural dynamics that shaped the mathematical tradition in the Islamic world. In parallel, the historical-critical method was applied to scrutinize the origin of these texts, assess their authenticity, and critically interpret their significance within the broader historical narrative, allowing for a deeper understanding of how these works reflected and reinforced Islamic cultural and intellectual values.

Secondary data such as books, scholarly articles, and modern historical studies were utilized to complement and enrich the analysis of primary sources by providing contemporary interpretations and historiographical perspectives. These secondary sources offered critical insights that helped contextualize primary data, bridging historical accounts with modern academic discourse. The analytical process also involved a systematic categorization of data based on prominent scholars, chronological periods, geographical regions, and specific scientific fields, enabling a comprehensive and structured reconstruction of the mathematical landscape in Islamic civilization. Data collection techniques included literature study, which involved extensive library research of both classical and modern works; documentation, which focused on gathering archival materials, historical images, and records; and historical context analysis, which explored the socio-cultural, religious, and political environments that fostered the growth of mathematics. Through this multilayered methodology, the study seeks to present not merely a chronological account of mathematical progress, but a rich and integrated historical synthesis that highlights the profound influence of Islamic cultural values on the flourishing of mathematical sciences during the Islamic Golden Age.

RESULTS AND DISCUSSION

The Development of Mathematics During the Islamic Golden Age

During the Islamic Golden Age (8th to 13th centuries), the Islamic world experienced a highly productive period in terms of scientific development. Mathematics flourished due to the significant contributions of Muslim scholars who not only formulated fundamental mathematical theories but also created profound innovations in various fields, including algebra, geometry, and astronomy. In Islamic civilization, mathematics was regarded not just as a purely rational discipline but also as a tool to understand Allah's creation and the order of the universe. Muslim scholars did not develop mathematics solely for practical purposes but also to explore the philosophical and spiritual meaning embedded in life and the cosmos[10].

The development of mathematics during this period was greatly influenced by the civilizations of Greece, India, and Persia. However, Muslim scholars adapted and expanded upon this knowledge with a more systematic and organized approach[11]. For instance, they introduced the Arabic numeral system, which was more efficient than the Roman numeral system previously used in the Western world. Additionally, the numerical system used in algebra, developed by al-Khwarizmi, became the foundation for modern mathematics. Thus, the mathematical advancements during this period not only enriched existing knowledge but also laid the groundwork for future scientific developments, both in the Islamic world and in Europe. Moreover, Muslim scholars during the Islamic Golden Age recognized that mathematics played a central role in understanding the physical world and the cosmos created by Allah. The understanding of numbers and space was considered a way to express the natural order, believed to be the creation of God. They saw the world as operating under definite laws, and mathematics was the key to revealing these natural laws[12]. For example, in astronomy, this knowledge was not only used for practical purposes such as determining prayer times and the qibla (direction of prayer) but also to understand the movement of planets and stars, which were believed to reflect the order of God's creation.

The significant role of mathematics in daily life in the Islamic world was also evident in trade and administration. In this context, mathematics was used to calculate profits, determine inheritance shares, and plan and develop well-

[10] Marni Basir, Bahaking Rama, and Muhammad Yahdi, "Madrasah Dan Dinamikanya Dari Masa Ke Masa," *Edu Sociata: Jurnal Pendidikan Sosiologi* 6, no. 2 (2023): 1235–42, https://doi.org/https://doi.org/10.33627/es.v6i2.1640; Lismaya Lubis et al., "Warisan Ilmiah Kuno Dan Pendidikan Islam (Sebuah Kajian Literasi Dalam Sejarah Pendidikan Islam)," *EDU-RILIGIA: Jurnal Ilmu Pendidikan Islam Dan Keagamaan* 8, no. 2 (2024), https://doi.org/http://dx.doi.org/10.47006/er.v8i2.20304.

[11] Bahrum Subagiya, "Ilmuan Muslim Polimatik Di Abad Pertengahan," *Ta'dibuna: Jurnal Pendidikan Islam* 11, no. 1 (2022): 112–25, https://doi.org/https://doi.org/10.32832/tadibuna.v11i1.7075.

[12] Ahmad Ahmad, Habib Perwira, and Hani Nurlaeli Wijayanti, "Mengungkap Misteri Angka: Jejak Keterkaitan Antara Matematika Dan Angka Dalam Bahasa Arab," 2023, https://doi.org/https://doi.org/10.57215/matluba.v1i2.378; M A Zuwardi and Hardiansyah Padli, "Sejarah Perkembangan Akuntansi Syariah; Tinjauan Literatur Islam," *ILTIZAM Journal of Shariah Economics Research* 4, no. 2 (2020): 69–84.

organized cities. The use of algebra by Muslim scholars, first introduced by al-Khwarizmi, is a concrete example of how mathematics was applied in everyday life. Algebra, with its symbols replacing unknown numbers, provided a more efficient method to solve complex problems encountered in economic and social activities[13].

In addition to its practical applications, mathematics during the Islamic Golden Age also made significant advances in theory. Scholars like al-Farabi, Ibn al-Haytham, and al-Biruni studied geometry, optics, and trigonometry with a more refined and systematic approach than earlier scholars. They developed new concepts in geometry and trigonometry that were not only useful for practical applications but also deepened humanity's understanding of space and form. For example, Ibn al-Haytham is renowned for his contributions to optics, which included studies on the reflection and refraction of light, ultimately linking these findings to geometry[14].

Furthermore, astronomy was one of the fields that saw rapid development due to the application of mathematics during the Islamic Golden Age. Muslim scholars such as al-Battani and al-Farabi developed more accurate astronomical models than previous theories. They used trigonometry to calculate the positions of celestial bodies and developed theories about planetary motion, which laid the foundation for the development of astronomy in the Western world. This advancement in astronomy demonstrates how mathematics served not only in theoretical fields but also in the observation of the physical world on a larger scale[15].

The importance of mathematics in Islamic civilization during the Golden Age is also reflected in the establishment of educational institutions that focused on the sciences, including mathematics[16]. Bait al-Hikmah (The House of Wisdom) in Baghdad, for instance, became a central hub for teaching and scientific research. Here, Muslim scholars collaborated with scholars from various cultures, including Greek, Indian, and Persian, to develop new theories in science. The existence of such institutions shows that mathematics was considered an essential element in the education and intellectual development of the Islamic society.

In addition to pure science, Muslim scholars also applied mathematical knowledge in the fields of art and architecture. The highly intricate geometric patterns found in Islamic art, for example, were often based on mathematical

[13] Fatia Rahmanita, Durrotun Nashihah, and Muhammad Fadli Ramadhan, "Al-Khawarizmi Serta Kontribusinya Untuk Perkembangan Sains Modern," *Ulumuddin: Jurnal Ilmu-Ilmu Keislaman* 13, no. 2 (2023): 297–312, https://doi.org/https://doi.org/10.47200/ulumuddin.v13i2.2045; Hamid Sakti Wibowo, *Al-Khawarizmi: Bapak Aljabar Dan Algoritma*. (Tiram Media, 2023); Ilmuwan Islam and Riana Afliha Eka Kurnia, "Teori Aljabar Al-Khawarizmi," n.d.

[14] Zikri Noer and Indri Dayana, *Buku Sains Dasar* (Guepedia, 2021); Achmad Syahid, "Manusia-Manusia Polymath," 2021.

[15] Arwin Juli Rakhmadi Butar-Butar, "Esai-Esai Astronomi Islam," *Kumpulan Buku Dosen*, 2020.

[16] Ahmad Mudzakkir, Wahyuddin Naro, and Muhammad Yahdi, "Sejarah Pendidikan Islam: Karakter Pendidikan Islam Klasik & Modern," *Indonesian Journal of Islamic Educational Review* 1, no. 3 (2024): 176–86, https://doi.org/https://doi.org/10.58230/ijier.v1i3.268.

principles that reflected the order and symmetry of God's creation. Similarly, in the architecture of mosques and other significant buildings, the use of geometry and mathematics in design reflected perfection and beauty in alignment with Islamic teachings. This shows that mathematics in the Islamic world during the Golden Age was not only a scientific tool but also a spiritual expression[17].

Another major contribution was the understanding of numbers and numeral systems. The Arabic numeral system, which we use today and originated in India but was further developed by Muslim scholars, made various mathematical calculations easier. The use of the decimal system and the concept of zero facilitated computations and accelerated scientific progress in fields like astronomy and physics. This system replaced the more complex and inefficient Roman numeral system, greatly impacting the development of mathematics worldwide[18]. Furthermore, the importance of mathematics in Islamic civilization can also be seen in the contributions made by Muslim scholars to the foundations of other sciences, such as physics and chemistry. The mathematical concepts applied by Muslim scholars also influenced the development of theories in physics, particularly in understanding fundamental principles such as force, motion, and energy. Therefore, the development of mathematics during the Islamic Golden Age played a foundational role in the scientific knowledge we have today[19].

Overall, the development of mathematics during the Islamic Golden Age not only played a critical role in generating new discoveries in science and technology but also had a significant impact on Western civilization. Much of the knowledge developed by Muslim scholars during this period was translated into Latin and served as the basis for the advancement of scientific knowledge in Europe, especially during the Renaissance. This contribution proves that the Islamic world not only played a role in developing knowledge but also in disseminating it to various parts of the world.

The Influence of Islamic Cultural Values on the Development of Mathematics

The influence of Islamic cultural values on the development of science, including mathematics, during the Islamic Golden Age was immense[20]. In Islam,

[17] Delia Situmorang et al., "\Pengaruh Matematika Arab Terhadap Ilmu Pengetahuan Eropa Pada Abad Pertengahan," *Innovative: Journal Of Social Science Research* 4, no. 5 (2024): 6701–9, https://doi.org/https://doi.org/10.31004/innovative.v4i5.15714; Cecep Hidayat, "Perkembangan Sains Dalam Sejarah Peradaban Islam," *AT-THARIQ: Jurnal Studi Islam Dan Budaya* 4, no. 02 (2024).
[18] Aufa Nawallia and Nila Mishriya, "Kontribusi Ilmuwan Muslim Dalam Pembentukan Matematika Dan Perkembangan Matematika Dalam Sejarah Peradaban Islam," *Religion: Jurnal Agama, Sosial, Dan Budaya* 3, no. 2 (2024): 202–12, https://doi.org/https://doi.org/10.55606/religion.v3i2.934.
[19] M Taufiq Rahman, *Filsafat Ilmu Pengetahuan* (Prodi S2 Studi Agama-Agama UIN Sunan Gunung Djati Bandung, 2020); Rian Hidayat, "Harmonisasi Pengetahuan: Menelusuri Interaksi Islam Dan Filsafat Dalam Pengembangan Ilmu Pengetahuan: Menelusuri Interaksi Islam Dan Filsafat Dalam Pengembangan Ilmu Pengetahuan," *EL-FIKR: Jurnal Aqidah Dan Filsafat Islam* 5, no. 1 (2024): 37–53, https://doi.org/https://doi.org/10.19109/el-fikr.v5i1.21680.
[20] Ibnu Imam Al Ayyubi et al., "Equilibrium of Faith and Logic: Integrating Islamic Moral Values and Mathematics Education in Various Contexts," *IJEMR: International Journal of Education*

knowledge is considered a path to understanding Allah's creation and drawing closer to Him. Therefore, Muslim scholars viewed mathematics not only as a discipline focused on numbers and formulas but also as a tool for exploring and understanding the order of the universe, which is believed to be created by God's will. The principle of tawhid (the oneness of God), which teaches about the unity and order of Allah's creation, became a crucial foundation for the development of mathematics in the Islamic world. For Muslim scholars, mathematics was not just about finding rational answers but also about uncovering the beauty and order behind God's creation[21].

One of the central values in Islamic culture that influenced the development of mathematics is the concept of tadabbur (reflection) on Allah's creation. The Qur'an contains many verses encouraging Muslims to contemplate the wonders of the universe as signs of God's greatness. This concept motivated Muslim scholars to delve deeper into the natural laws they encountered. In mathematics, they saw numbers, geometry, and the structure of the universe as evidence of the order and perfection created by God. This served as a significant motivation for scholars to develop mathematical theories that were not only useful in daily life but also ways to understand the universe and the meaning of life.

The aesthetic values of Islam also greatly influenced the development of mathematics during this period. In Islamic tradition, art and beauty were highly valued, and this concept of beauty extended beyond visual art and architecture to mathematics. In many Islamic art forms, such as mosaics and calligraphy, intricate and symmetrical geometric patterns were used, reflecting deep mathematical principles. Symmetry, balance, and beauty in these geometric designs were not only seen as artistic elements but also as manifestations of the order and perfection of God's creation. Therefore, the development of geometric and algebraic theories by Muslim scholars was not just aimed at solving practical problems but also at creating works of art that reflected orderly and symmetrical beauty.

Furthermore, Islam teaches the importance of beneficial knowledge that is useful not only to individuals but also to society as a whole. This concept was especially relevant in the development of mathematics, which at the time was applied to various practical needs, such as trade, inheritance calculations, and city

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Management and Religion 1, no. 2 (2024): 127–44, https://doi.org/https://doi.org/10.71305/ijemr.v1i2.167; Ibnu Imam Al Ayyubi et al., "The Influence of Manipulative Media Usage on Students' Understanding of Fraction Operations in Elementary Schools," *Noumerico: Journal of Technology in Mathematics Education* 3, no. 1 (2025): 11–25, https://doi.org/https://doi.org/10.33367/jtme.v3i1.6700; Nurhikmah Nurhikmah et al., "The Interpretation of Patterns and Symmetry in the Qur'an: Does Mathematics Serve as Proof of Divinity or Merely an Aesthetic Interpretation?," *Borneo International Journal of Islamic Studies* 7, no. 1 (2025): 35–60, https://doi.org/https://doi.org/10.21093/bijis.v7i1.10061.

[21] Kusno Kusno, "Islamisasi Matematis VS Matematisasi Islam Dalam Pembelajaran Matematika," 2021, https://doi.org/https://seminarmat.ump.ac.id/index.php/semadik/article/view/313; Memen Permata Azmi and Azwir Salam, "Konstruksi Integrasi Islam Dan Ilmu Matematika Dalam Implementasi Kurikulum Pendidikan Matematika UIN Suska Riau," *Juring (Journal for Research in Mathematics Learning)* 5, no. 2 (n.d.): 119–28, https://doi.org/http://dx.doi.org/10.24014/juring.v5i2.14892.

planning. For instance, algebra developed by al-Khwarizmi was used to calculate the division of inheritance and manage financial issues in society. In this way, Islamic values about useful knowledge motivated Muslim scholars to develop mathematics that was both practical and relevant to the social and economic needs of the time.

The influence of Islamic cultural values is also evident in how Muslim scholars viewed the relationship between science and religion. In Islam, science and religion are not seen as separate but as complementary paths in the search for truth. Knowledge, including mathematics, is not viewed as disconnected from the spiritual or religious aspects of life. Muslim scholars often linked their scientific discoveries with their religious beliefs, seeing them as manifestations of God's greatness and will. This can be seen in their scientific works, which not only explained natural phenomena mathematically but also provided interpretations of the relationship between these phenomena and God as the Creator.

Moreover, Islamic values also emphasize the importance of ijtihad (independent reasoning), which encourages critical thinking and the effort to find solutions to problems[22]. Muslim scholars during the Islamic Golden Age applied this principle in their approach to mathematics. They did not simply accept existing theories but sought to develop new theories and refine the knowledge they had. For example, al-Khwarizmi not only developed algebra as a tool for solving calculation problems but also created a new notation system that made solving equations easier and more efficient. This is an example of how the value of ijtihad spurred the development of more advanced and effective scientific knowledge[23].

Islamic culture during this time also valued collectivity and cooperation in the development of knowledge. Institutions such as Bait al-Hikmah (The House of Wisdom) in Baghdad became places where scholars from diverse cultural and religious backgrounds gathered to share knowledge and collaborate on scientific projects. This cooperation created an intellectual atmosphere that led to significant discoveries in mathematics and other sciences. At Bait al-Hikmah, Muslim scholars not only developed scientific theories but also translated the works of Greek, Indian, and Persian scientists into Arabic, which later became an essential resource for the development of science in both the Islamic world and the West.

The Islamic cultural value that promotes the pursuit of knowledge throughout life also significantly influenced how Muslim scholars advanced mathematics. In the Islamic world, knowledge was viewed as something that never ends and is always

[22] Mumu Zainal Mutaqin et al., "Factors in Religious Culture to Increase Tolerant Attitude of Gen-Z Among Urban Muslims," *Akademika: Jurnal Pemikiran Islam* 29, no. 1 (2024): 73–86, https://doi.org/https://doi.org/10.32332/akademika.v29i1.9145.

[23] Nurfitria Sari et al., "Ijtihad in Islamic Education: Renewal by Muhammad Abduh and Azyumardi Azra: Ijtihad Dalam Pendidikan Islam: Pembaharuan Oleh Muhammad Abduh Dan Azyumardi Azra," *Al-Mustawa: Jurnal Pendidikan Dan Konseling Islam* 1, no. 1 (2024): 47–62.

open to new discoveries[24]. This spirit is reflected in the enthusiasm of Muslim scholars to continue learning, discussing, and sharing knowledge throughout their lives. They often focused not only on the practical applications of mathematics but also on the deeper understanding of the fundamental principles of mathematics and the universe. This spirit of inquiry allowed them to create new, advanced theories for their time.

Additionally, education in the Islamic world during the Golden Age was deeply influenced by cultural values that valued knowledge and wisdom. Madrasahs and other educational institutions played a vital role in transferring mathematical knowledge to the next generation. In madrasahs, students were taught not only mathematical theory but also how to think critically and analytically to solve problems. This mathematical education prepared them to become scholars, engineers, and administrators who could contribute to the advancement of society.

Over time, the application of Islamic cultural values in mathematics not only influenced the Islamic world but also had a significant impact on the development of science in the West. The works of Muslim scholars were translated into Latin and introduced to European scholars, who then used them as a foundation to develop their own scientific knowledge. This demonstrates that the influence of Islamic culture on mathematics was not confined to the Islamic world but also contributed to the advancement of science globally.

In conclusion, Islamic cultural values played a crucial role in the development of mathematics during the Islamic Golden Age. Concepts like tawhid, reflection on Allah's creation, aesthetics, and beneficial knowledge provided a strong foundation for Muslim scholars to develop mathematics that was not only practical but also philosophical and spiritual. These values encouraged them to delve deeper into the laws of the universe and to create discoveries that were not only beneficial for Muslims but for the advancement of human civilization as a whole.

The Pivotal Role of Muslim Scholars in the Development of Mathematics During the Islamic Golden Age

During the Islamic Golden Age, Muslim scholars played a crucial role in advancing mathematics and carrying forward the scientific traditions inherited from earlier civilizations. These scholars not only inherited knowledge from Greek, Persian, and Indian civilizations, but also expanded it with new innovations that made mathematics more developed and applicable. Muslim scholars such as al-Khwarizmi, al-Farabi, al-Biruni, and Ibn al-Haytham made significant contributions across various fields of mathematics, from algebra and geometry to trigonometry

[24] Murharyana Murharyana et al., "The Effects of Islamic Religious Education Learning on Students' Motivation," *At-Tadzkir: Islamic Education Journal* 3, no. 1 (2024): 1–14, https://doi.org/https://doi.org/10.59373/attadzkir.v3i1.44.

and astronomy[25]. Their contributions were not limited to the development of theory but also to the practical application of mathematics in various aspects of daily life, including trade, inheritance calculations, and city planning.

One of the most influential figures in the development of mathematics during the Islamic Golden Age was al-Khwarizmi. Known as the "Father of Algebra," he authored the groundbreaking work Al-Kitab al-Mukhtasar fi Hisab al-Jabr wal-Muqabala (The Compendious Book on Calculation by Completion and Balancing), which became the foundation for the development of algebra. Al-Khwarizmi introduced the basic concepts of algebra, allowing calculations with symbols representing unknown numbers, a revolutionary concept at the time. His work taught systematic methods for solving linear and quadratic equations, which had previously been difficult to solve. Additionally, al-Khwarizmi introduced algorithms for calculation, which later became the foundation for modern mathematics. In this context, al-Khwarizmi not only developed mathematical theory but also provided more efficient methods for solving complex mathematical problems.

In addition to al-Khwarizmi, other Muslim scholars, such as al-Farabi, made significant contributions to both mathematics and philosophy. Al-Farabi is known for his efforts to compile and integrate the philosophical thoughts of the Greeks, particularly Aristotle, with Islamic teachings. In his works, al-Farabi discussed the relationship between logic, mathematics, and philosophy. He developed influential theories in geometry and trigonometry, especially in their application to astronomy. Al-Farabi also played a key role in linking mathematics with ethics, showing how mathematics could be used to understand and appreciate the order of the universe created by God[26].

On the other hand, al-Biruni, a Persian Muslim scholar, made substantial contributions to astronomy and mathematics. One of his famous works involved the highly accurate measurement of the Earth's circumference. Al-Biruni used mathematical methods to calculate the Earth's circumference with remarkable precision, an achievement unimaginable at the time. He also developed theories in trigonometry that were used to calculate the positions of stars and planets, laying the groundwork for the development of astronomy in the Western world. Al-Biruni's works demonstrated that Muslim scholars not only developed mathematics for

[25] Nurhikmah, "Maqashid Al-Shariah : Kerangka Adaptif Hukum Islam Untuk Menjawab Tantangan Kontemporer," *Journal of Dual Legal System* 1, no. 2 (2024): 103–17, https://doi.org/10.58824/jdls.v1i2.226.

[26] Widya Lestari, Rahmi Alya, and Herlini Puspika Sari, "Pandangan Filsafat Islam Terhadap Pendidikan Ilmu Pengetahuan; Analisis Pemikiran Ibnu Sina Dan Al-Farabi," *IHSAN: Jurnal Pendidikan Islam* 2, no. 3 (2024): 167–76, https://doi.org/https://ejournal.yayasanpendidikandzurriyatulquran.id/index.php/ihsan/article/view/367; Andri Ardiansyah, "Pemikiran Filsafat Al-Farabi Dan Ibnu Sina," *TAJDID: Jurnal Pemikiran Keislaman Dan Kemanusiaan* 4, no. 2 (2020): 168–83, https://doi.org/https://doi.org/10.52266/tadjid.v4i2.520; Guntoro Guntoro, "Kontribusi Al-Farabi Dalam Bidang Keilmuan," *Al-Hikmah: Jurnal Theosofi Dan Peradaban Islam* 5, no. 1 (2023).

practical purposes but also expanded human understanding of the universe through detailed observation and mathematical calculations[27].

Ibn al-Haytham, another Muslim scholar and mathematician, is known for his contributions to optics and geometry. He introduced highly advanced theories of light, which became the basis for modern optics. One of his most important discoveries was the reflection and straight-line propagation of light. Although he is better known for his work in physics and optics, his contributions to geometry were also significant, particularly in the development of analytic geometry. Ibn al-Haytham also applied mathematical principles to analyze natural phenomena, such as light reflection and refraction, making major contributions to the development of both physics and mathematics[28].

Muslim scholars' contributions to the development of mathematics also involved the translation and development of works from other great civilizations, especially from Greece and India. This translation process was carried out meticulously by Muslim scholars, who not only translated these works but also added their explanations and commentaries. One of the most famous examples is the translation of the works of Euclid, Ptolemy, and Archimedes into Arabic. Muslim scholars did not merely preserve the old theories but also further developed them and adapted this knowledge with their own insights. This translation movement became a key pillar in linking ancient knowledge with modern scientific knowledge, which was later transmitted to Europe through translations into Latin.

In addition, Muslim scholars played a significant role in the practical application of mathematics. For example, they used mathematics for calculations in trade, wealth distribution, and building planning. The mathematics used in the planning of major cities in the Islamic world, such as Baghdad, Damascus, and Cordoba, demonstrated the direct application of mathematical principles in everyday life. Muslim scholars also developed methods for inheritance calculations, which were meticulously regulated by Islamic law. These inheritance calculations required a deep understanding of mathematics, as they had to account for the division of wealth according to the rules set out in the Qur'an and Hadith. This is one example of how mathematics was applied in social and religious practices.

The importance of education in the Islamic world also contributed significantly to the development of mathematics. Educational institutions such as madrasahs and Bait al-Hikmah became important centers for teaching and research. Here, scholars and students gathered to study mathematics, astronomy, and various other fields of knowledge. The collaboration between Muslim scholars from diverse backgrounds and cultures facilitated the exchange of knowledge that enriched existing mathematical theories. This well-structured education ensured that mathematical knowledge was not only preserved but also continued to evolve.

[27] Hamid Sakti Wibowo, *Al Biruni: Ilmuwan Dan Cendekiawan Persia* (Tiram Media, 2023).
[28] Usep Mohamad Ishaq, *Filsafat Sains: Menurut Ibn Al-Haytham* (Prenada Media, 2020).

Overall, the role of Muslim scholars in advancing mathematics during the Islamic Golden Age was of immense significance. They did not just inherit and translate knowledge from other civilizations but also developed it in innovative and practical ways. Their contributions to algebra, geometry, trigonometry, and astronomy provided a solid foundation for the development of modern science. More importantly, they demonstrated how mathematics could be used as a tool to understand the world and the universe and to apply scientific principles in everyday life. Without the major contributions of Muslim scholars during the Islamic Golden Age, the development of mathematics and other sciences in the Western world may not have occurred as swiftly.

The Importance of Algebra in the Development of Mathematics During the Islamic Golden Age

Algebra is one of the most important and influential branches of mathematics that flourished during the Islamic Golden Age. The success in the development of algebra can be attributed to the groundbreaking work of Muslim scholars, particularly al-Khwarizmi, who is often referred to as the "Father of Algebra." Al-Khwarizmi's monumental work, Al-Kitab al-Mukhtasar fi Hisab al-Jabr wal-Muqabala (The Compendious Book on Calculation by Completion and Balancing), paved the way for the development of algebra worldwide. In this work, al-Khwarizmi introduced fundamental algebraic concepts, such as the use of symbols for variables representing unknown quantities, and systematic methods for solving various types of equations, including linear and quadratic equations. This was a key milestone in the history of mathematics, as algebra became more accessible and applicable in various fields, from astronomy to economics.

The development of algebra in the Islamic world during this period also had a significant philosophical and spiritual dimension. Muslim scholars viewed algebra not merely as a mathematical tool for solving practical problems but also as a means to explore the order and harmony of the universe, which was created by God. Algebra was used to describe the mathematical order inherent in the structure of the universe, reflecting the perfection of God's creation. Thus, mathematics, particularly algebra, was seen as a bridge to understanding the beauty and harmony of God's creation. In this view, algebra functioned not only as a technical tool but also as a means to approach a deeper understanding of divine order.

Algebra during the Islamic Golden Age also played a crucial role in solving practical problems faced in daily life, particularly in social and economic contexts. One of the most significant applications of algebra was in the calculation of inheritance according to Islamic law, known as fara'id. The division of inheritance in Islam involves detailed allocations based on rules specified in the Qur'an. This calculation process required the use of algebraic concepts to ensure that each heir received their rightful share. Al-Khwarizmi, in his work, provided systematic explanations for solving these inheritance problems using algebraic principles.

Additionally, algebra was used in trade, where merchants applied algebraic theory to calculate profits, losses, and price comparisons. This demonstrates how algebra played a key role in various sectors of social and economic life in the Islamic world at the time.

Moreover, the contribution of algebra to the development of astronomy during the Islamic Golden Age was also significant. Muslim astronomers, such as al-Battani, al-Farabi, and al-Tusi, used algebra to calculate the positions of celestial bodies, predict planetary movements, and compile accurate astronomical tables. They applied algebraic methods to solve complex mathematical equations related to celestial motion and calendar calculations. The use of algebra in astronomy illustrates how mathematics was applied to the understanding of a broader and more complex universe. This success was also a result of the integration of algebraic knowledge with Islamic philosophy, which viewed scientific knowledge as a means to understand the laws of God as written in the universe.

Algebra also flourished due to the interaction between Muslim scholars and scientists from other civilizations. During this period, works from Greek, Persian, and Indian scholars were translated into Arabic, and many existing mathematical concepts were updated with new discoveries made by Muslim scholars. Muslim scholars not only translated scientific texts from other civilizations but also developed them by adding new, more systematic, and comprehensive approaches. For instance, al-Khwarizmi adopted theories from Greek and Indian civilizations, but he developed a more structured approach to solving mathematical equations. As a result, algebra became broader and more applicable, not only as a tool for mathematical calculations but also as a method for solving more complex real-life problems.

On the other hand, the development of algebra had a significant impact on education in the Islamic world. Educational institutions such as Bait al-Hikmah in Baghdad became scholarly centers that taught algebra and various other branches of science. Muslim scholars collaborated to develop this knowledge and pass it on to the next generation. The teaching of algebra in Islamic madrasahs was not limited to theoretical instruction but also focused on the practical application of this knowledge in daily life. Furthermore, algebra was taught in a broader context, linking it to logic, astronomy, and philosophy, which enriched students' understanding of mathematics' role in the pursuit of truth and knowledge.

The development of algebra during the Islamic Golden Age also laid the foundation for the later development of mathematics in the Western world. Through the translation of works by Muslim scholars into Latin, such as al-Khwarizmi’s Al-Kitab al-Mukhtasar fi Hisab al-Jabr wal-Muqabala, algebra was introduced to Europe during the Middle Ages. This knowledge became a key pillar in the development of mathematics in the West. European scientists, such as Fibonacci and Cardano, were heavily influenced by the works of Muslim scholars and further advanced algebraic

theory. The algebra introduced by Muslim scholars during the Islamic Golden Age not only provided a strong foundation for the development of mathematics in the West but also shaped a more systematic and analytical scientific mindset that later influenced various fields of knowledge, from physics to economics.

In conclusion, algebra played a vital role in the development of mathematics during the Islamic Golden Age. Muslim scholars, particularly al-Khwarizmi, made significant contributions by introducing and developing fundamental algebraic concepts that were not only useful in the practical applications of social and economic life but also served as a means to understand the order of the universe created by God. The impact of algebra developed by Muslim scholars during this period was not confined to the Islamic world but also had a profound effect on the development of scientific knowledge in the West. Therefore, algebra is not only an important branch of mathematics in history but also symbolizes how scientific knowledge can bridge the gap between the human world and a deeper understanding of divine order.

The Role of Geometry in Islamic Mathematics and the Application of Islamic Values

Geometry played a crucial role in Islamic civilization, particularly in the fields of architecture, astronomy, and art. During the Islamic Golden Age, scholars such as al-Biruni, al-Farabi, and Ibn al-Haytham advanced various geometric theories that not only focused on numerical concepts and mathematical formulas but also linked them to philosophical values that govern the structure of the universe. Geometry was seen as a tool to understand the order and harmony present in God's creation. In this regard, Muslim scholars regarded geometry not just as a science concerned with the measurement of space and form, but also as a means to explore the essence of the order manifested in the universe. The application of geometry in the measurement of celestial bodies and calculations in astronomy, for instance, illustrated the close relationship between mathematical knowledge and the understanding of God's creation.

As one of the most highly regarded branches of knowledge in Islamic tradition, geometry became the foundation for many scientific achievements related to measurement and construction. Muslim scholars such as al-Biruni and al-Farabi used geometric principles to solve various practical problems in science. Al-Biruni, for example, applied geometric concepts to measure the distance and height of celestial bodies, as well as to calculate the Earth's circumference with remarkable accuracy for his time. Ibn al-Haytham, on the other hand, used geometric principles in his optical studies, particularly in analyzing the properties of light and reflection. Thus, geometry became a tool not only for understanding the physical world but also for delving deeper into the higher natural laws believed to originate from God.

Additionally, geometry was closely linked to the application of aesthetic values in Islamic culture, particularly in art and architecture. In Islamic art, geometry was widely used to create symmetrical patterns and beautiful designs that reflected the

order and perfection of God's creation. Geometric patterns found in mosaic designs, calligraphy, and mosque architecture not only served as aesthetic elements but also carried deep symbolic meanings. Symmetry in these designs, for example, reflects the idea of divine unity and infinite order. Therefore, geometry in Islamic art was not just viewed as an artistic technique, but also as a reflection of the Islamic worldview, which sees beauty and order as signs of God's power and presence in the world.

The application of geometry in mosque architecture and other places of worship also demonstrates how Islamic aesthetic values were integrated with the development of mathematical science. Many mosques built during the Islamic Golden Age, such as the Masjid al-Haram in Mecca and the Masjid al-Aqsa in Jerusalem, showcased the deep use of geometric principles. The architecture of these mosques was designed with symmetrical patterns involving geometric concepts such as circles, squares, and polygons, aiming to create harmonious and balanced spaces. In this context, geometry was not only used for practical purposes, such as measuring sizes and constructing buildings, but also had a spiritual purpose—creating a space that invites a sense of tranquility and closeness to God. Thus, geometry in Islamic architecture became a means to unite the worldly and spiritual aspects in a single beautiful whole.

Geometry was also vital in the context of Islamic astronomy. Scholars like al-Tusi and al-Battani developed geometric theories to model the movement of celestial bodies, which were essential for making more accurate calculations in astronomy. In this regard, geometry was used to describe the motion of planets and other celestial objects in mathematical models that increasingly approached reality. Geometry in astronomy was also used to improve the accuracy of the Islamic calendar, which was critical for determining times for worship and religious celebrations. Thus, geometry played a significant role in the development of knowledge related to a deeper understanding of the structure of the universe, which was considered to be God's creation.

Geometric principles were also applied in the science of navigation, which was crucial for sea and land travel in the Islamic world. Scholars like al-Farabi used geometric concepts to create more accurate maps and improve navigation techniques used by Muslim sailors and traders. This use of geometry facilitated safer and more efficient travel, which, in turn, contributed to the spread of Islamic knowledge and culture across various regions of the world. The use of geometry in navigation also highlighted the importance of science in the practical life of Islamic society, which reflected the Islamic cultural values that emphasize the benefits of knowledge for humanity[29].

[29] Lawdya Ika Bella and Widha Anggraeni, "Peran Pendidikan Agama Islam Terhadap Pembelajaran Matematika," *Religion: Jurnal Agama, Sosial, Dan Budaya* 3, no. 2 (2024): 640–50; Maya Nurjanah, "Integrasi Nilai-Nilai Islam Dalam Pembelajaran Matematika Di Madrasah Ibtidaiyyah," *Al-Qalam:*

Overall, the application of geometry in various scientific, artistic, and architectural fields during the Islamic Golden Age demonstrates the close relationship between mathematics and Islamic cultural values. Geometry was not only used as a practical tool for understanding the physical world, but also as a means to approach a deeper understanding of God's creation. Through the use of geometric principles in art and architecture, science was not only focused on technical aspects but also on deep aesthetic and spiritual values. Thus, geometry in the Islamic world became a symbol of humanity's search for order, beauty, and perfection in this world as manifestations of God's power.

The Use of Mathematics in Daily Life as a Manifestation of Islamic Values

The use of mathematics in the daily lives of Muslims during the Islamic Golden Age reflects how knowledge, particularly mathematics, was applied to support the moral and spiritual principles in the lives of the people. One of the most obvious examples of this application is in the calculation of inheritance (fara'id), trade, and infrastructure development. Mathematics, especially algebra and geometry, became essential tools that enabled Muslims to manage their worldly affairs in accordance with religious regulations, while integrating values such as justice, balance, and obedience to Islamic laws in every transaction and decision.

In the context of inheritance calculation, Muslims developed a highly detailed system to distribute inheritance according to the provisions outlined in the Qur'an and Hadith[30]. This just division of inheritance requires meticulous calculations, and in this regard, mathematics played a significant role. The Islamic inheritance system regulates who is entitled to a particular share of the estate based on blood relations and religious provisions. Although inheritance calculations can be quite complex, especially when many heirs are involved with different proportions, the use of algebra provided an effective solution to this problem. Algebra allowed the formulation and solving of equations that represent fair distribution, ensuring that each heir receives their rightful share according to Islamic law. Therefore, mathematics became not just a practical tool but also a means to uphold the principle of justice in the social life of the Muslim community.

Additionally, calculations in trade were closely monitored in Islamic society. Islam teaches the importance of honesty and integrity in economic transactions, or muamalah. Therefore, in trade, mathematical principles were applied to ensure that every transaction was conducted with fairness and without deception. Muslim scholars developed various mathematical methods to calculate prices, measure goods, and ensure that transactions were carried out with transparency[31]. For

Jurnal Kajian Islam Dan Pendidikan 13, no. 2 (2021): 38–45, https://doi.org/https://doi.org/10.47435/al-qalam.v13i2.741.

[30] I Nursalam., Nurhikmah., & Purnamasari, N, "Nilai Pendidikan Karakter Dalam Teks Sastra Lisan Kelong Makassar," *Jurnal Lingue : Bahasa, Budaya, Dan Sastra* 1, no. 1 (2019): 88–95.

[31] Nurhikmah Nurhikmah, "Character Education Islam From the Views of Imam Al-Ghazali," *Jurnal Al Burhan* 4, no. 1 (2024): 53–66, https://doi.org/10.58988/jab.v4i1.300.

example, the calculation of interest, which is prohibited under the practice of riba, was avoided in favor of alternative methods for calculating fair profits, considering the value of the goods sold and the costs incurred during the trade process. In this case, mathematics supported Islamic teachings that emphasize balance and fairness in all aspects of life, including commerce.

The application of mathematics in daily life was also evident in infrastructure development, such as city planning, building construction, and transportation routes. In Islamic society, city planning and infrastructure were carried out with great attention to order and harmony. The use of geometry and mathematics in the design of mosques, hospitals, and schools demonstrated how aesthetic and functional values in Islam were integrated with technical knowledge. For example, large mosques built during the Islamic Golden Age often incorporated highly intricate geometric principles, with symmetrical designs and spatial arrangements that allowed Muslims to worship with devotion[32]. Muslims' understanding of the order and perfection of God's creation. Thus, the application of mathematics in infrastructure development was not only to fulfill practical needs but also to create harmonious spaces that brought the community closer to God.

In everyday life, mathematics was also used in the calculation of zakat, one of the key pillars of Islam. Zakat is an obligation for financially able Muslims to set aside a portion of their wealth and give it to those in need[33]. The calculation of zakat requires a good understanding of proportions and percentages, allowing Muslims to donate the correct amount according to religious guidelines. The use of mathematics in zakat calculations helps ensure that this obligation is fulfilled fairly and accurately, allowing the recipients of zakat to receive the benefits they are entitled to. Here, mathematics serves as a tool to support Islamic social principles, such as solidarity and care for others[34].

Overall, the application of mathematics in the daily lives of Muslims during the Islamic Golden Age demonstrates how this knowledge was not only practically valuable but also served as a manifestation of Islamic cultural values, emphasizing justice, balance, and obedience to God's laws. Whether in inheritance calculation, trade, infrastructure development, or zakat, mathematics played an essential role in ensuring that Islamic principles were correctly applied in social life. Thus, mathematics was not only a tool for achieving worldly goals but also a means to draw closer to God and carry out His commands in daily life.

[32] Sainee Tamphu et al., "Building Bridges to the Future of Learning : Exploring Artificial Intelligence Research Using R- Studio Assisted Bibliometrics," *Cogent Education* 11, no. 1 (2024), https://doi.org/10.1080/2331186X.2024.2417623.
[33] Syamsuddin Nurhikmah, Indo Santalia, "Membangun Kefahaman: Landasan Epistemlogi Kefilsafatan Dalam Islam," *Setyaki: Jurnal Studi Keagamaan Islam* 1 (2023): 87–96, https://doi.org/https://doi.org/10.59966/setyaki.v1i4.736.
[34] Maya Nur Safana and Nisrina Luthfia Atika, "Integrasi Nilai-Nilai Islam Pada Pembelajaran Matematika: Kajian Literatur," *Religion: Jurnal Agama, Sosial, Dan Budaya* 3, no. 2 (2024): 114–25, https://doi.org/https://doi.org/10.55606/religion.v3i2.926.

Tabel 1. Islamic values towards the development of mathematics

Category	Description
Historical Period	Islamic Golden Age (8th to 14th centuries CE), marked by flourishing intellectual, scientific, and cultural advancements centered in major Islamic cities like Baghdad.
Key Figures	Al-Khwarizmi (founder of algebra), Al-Battani (astronomy and trigonometry), Al-Farabi (logic and geometry), Al-Biruni (geodesy and astronomy), Ibn al-Haytham (optics and geometry), Umar Khayyam (algebra and number theory).
Major Contributions	Systematization of algebra, development of geometry and trigonometry, introduction of the Hindu-Arabic numeral system including zero, creation of algorithms, accurate astronomical models, and practical applications of mathematics in daily life.
Scientific Institutions	Bayt al-Hikmah (House of Wisdom) in Baghdad as a center for translation and research; madrasahs as formal educational institutions disseminating scientific knowledge.
Islamic Values Influence	Islamic cultural values such as *tawhid* (unity of God), *ijtihad* (intellectual striving), *tadabbur* (reflection on God's creation), justice (*'adl*), balance (*mizan*), and beneficial knowledge (*'ilm nafi'*) drove the integration of mathematics with spiritual and ethical dimensions.
Applications of Mathematics	Inheritance law (*faraid*), zakat calculation, astronomical observations (prayer times, qibla direction), commerce and trade calculations, architectural design of mosques and cities, Islamic art (geometrical patterns), navigation techniques, and calendar development.
Scientific Impact	Laid foundational knowledge for modern mathematics, influenced the European Renaissance through Latin translations, promoted a synthesis of rational science and spiritual ethics.
Scientific Implications and Future Directions	Highlights the ethical dimension of scientific inquiry, calls for rediscovery of neglected Islamic mathematical texts, encourages comparative civilizational studies, and suggests further exploration of how faith-based values can enhance contemporary scientific development.

Tabel 2. Mathematical Branches and Applications in Islamic Civilization

Mathematical Branch	Key Focus Areas	Applications in Islamic Civilization
Algebra	Symbolic representation, equation solving, inheritance calculations.	Used in *faraid* (inheritance law), commercial transactions, taxation (zakat).

Geometry	Study of space, shapes, proportions, and symmetry.	Architecture (mosques, palaces), Islamic art (geometrical patterns), urban planning.
Trigonometry	Calculation of angles and celestial measurements.	Astronomy (qibla direction, prayer times), navigation, calendar computations.
Arithmetic	Number theory, basic operations, Hindu-Arabic numerals including zero.	Daily trade calculations, administrative accounting, market regulation.
Astronomy (Mathematical Astronomy)	Modeling celestial movements, observational astronomy.	Determining Islamic calendar, astronomical observations for worship, navigation at sea.
Optics (linked with Geometry)	Reflection, refraction, light properties.	Optics in architecture (illumination techniques), scientific optics (vision theory).
Algorithm Development	Systematic methods of calculation and computation.	Basis for modern computational methods, efficient problem-solving in administration and finance.

CONCLUSION

During the Islamic Golden Age (8th to 14th centuries CE), mathematics flourished due to the influence of Islamic cultural values based on the teachings of the Qur'an and Hadith. Muslim scholars such as Al-Khwarizmi, Al-Battani, and Umar Khayyam used mathematics as a means to understand the signs of Allah's greatness in the universe. The value of *tawhid* (the oneness of God) served as the philosophical foundation for their scientific approach, where every research effort was aimed at achieving a balance between worldly and spiritual knowledge. As a result, significant contributions were made to mathematics, particularly in the fields of algebra, geometry, and trigonometry, which later became the foundation for the development of modern science.

Islamic cultural values, such as the spirit of *ijtihad* (innovation) and the courage to seek scientific truth, encouraged Muslim scholars to explore, develop, and disseminate knowledge. In this context, institutions like Bayt al-Hikmah in Baghdad played a key role as centers for research and the translation of manuscripts from various civilizations, including Greek, Indian, and Persian. The implementation of Islamic values such as justice, collaboration, and responsibility to the community was also evident in the application of mathematics to solve real-world problems, such as timekeeping, infrastructure development, and navigation. Thus, the implementation of Islamic cultural values not only enriched the development of mathematics during the Islamic Golden Age but also demonstrated how scientific knowledge could be harmoniously developed alongside spiritual and ethical values. This study emphasizes that Islamic culture played a major role in establishing the foundations of knowledge, which now form an intellectual heritage for humanity. The integration of Islamic values in science during this period serves as a concrete example of how religion and science can complement and enrich each other.

From a scientific perspective, these findings imply that integrating cultural and spiritual values into scientific inquiry can enhance both the ethical orientation and the practical relevance of scientific knowledge. This study demonstrates the potential for cultural frameworks, such as Islamic civilization, to foster scientific excellence while maintaining a focus on human dignity, justice, and communal benefit. However, this research is limited by its reliance on historical texts that have undergone transmission and interpretation over centuries, which may introduce certain historiographical biases. Moreover, the focus on key figures and institutions may overlook lesser-known contributions from other regions or scholars. Therefore, future research could expand this study by incorporating comparative analyses with other civilizations or by investigating underexplored mathematical manuscripts from peripheral regions of the Islamic world. Further interdisciplinary research combining historical, philosophical, and scientific approaches is also encouraged to deepen our understanding of how ethical values can continue to shape scientific progress in contemporary contexts.

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