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Mizwala in the Islamic Tradition: A Historical Overview, Its Contributions, and Its Relevance in the Contemporary Era

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ABSTRACT

This study explores the history, contribution, and contemporary relevance of the mizwala (sundial) in the development of Islamic astronomy ('ilm al-falak). The mizwala is a classical astronomical instrument used by Muslim scholars since the 9th century CE to determine the direction of the qibla and prayer times based on the position of the sun. The aim of this research is to retrace the scientific foundations of Islamic astronomy and to highlight the continuity between classical Islamic science and modern knowledge. The research adopts a qualitative-descriptive method with historical and analytical approaches through the examination of primary and secondary literature. The findings reveal that the mizwala functioned not only as a scientific measuring device but also as a symbol of the integration between scientific inquiry and religious devotion in Islamic tradition. In contemporary contexts, the mizwala remains relevant as a verification tool for qibla direction and as an educational medium for practical astronomy. Moreover, it represents a sustainable technology that operates solely using solar energy, independent of digital systems. Therefore, preserving and revitalizing the mizwala is crucial to maintaining the continuity of Islamic scientific heritage while fostering innovation in modern astronomical studies.

ARTICLE INFO ABSTRACT

Penelitian ini membahas sejarah, kontribusi, dan relevansi mizwala (jam matahari) dalam pengembangan ilmu falak dan astronomi Islam. Mizwala merupakan instrumen klasik yang digunakan oleh para ilmuwan Muslim sejak abad ke-9 Masehi untuk menentukan arah kiblat dan waktu salat dengan memanfaatkan posisi matahari. Tujuan penelitian ini adalah untuk menelusuri kembali akar keilmuan Islam dalam bidang instrumentasi falak, sekaligus menunjukkan kesinambungan antara sains klasik dan ilmu pengetahuan modern. Metode yang digunakan dalam penelitian ini adalah kualitatif-deskriptif dengan pendekatan historis dan analitis melalui kajian literatur primer dan sekunder. Hasil penelitian menunjukkan bahwa mizwala tidak hanya berperan sebagai alat ukur astronomi, tetapi juga mencerminkan integrasi antara nilai-nilai ilmiah dan religius dalam tradisi keilmuan Islam. Dalam konteks kontemporer, mizwala masih relevan digunakan sebagai alat verifikasi arah kiblat dan media edukasi astronomi berbasis observasi langsung. Selain itu, instrumen ini juga memiliki nilai ekologis karena memanfaatkan energi matahari secara berkelanjutan tanpa ketergantungan pada teknologi digital. Dengan demikian, pelestarian dan pengembangan mizwala penting dilakukan untuk menjaga kesinambungan warisan ilmiah Islam sekaligus menginspirasi inovasi dalam studi astronomi modern.

INTRODUCTION

The urgency of retracing the history of the mizwala stems from the importance of understanding Islam's intellectual heritage in the field of astronomy. The mizwala is one of the classical astronomical instruments created to determine the direction of the qibla with a level of accuracy that was quite advanced for its time.[1] Its existence demonstrates that, from the very beginnings of Islamic civilization, Muslim scholars have

[1]Safna Farah Dila, "A Comparative Analysis of Qibla Direction Accuracy Using a Theodolite, Mizwala, and Right-Angle Triangle at As-Sakinah Mosque, Surabaya," *Astroislamica: Journal of Islamic Astronomy* 4, no. 2 (December 31, 2025): 395–412, https://doi.org/10.47766/astroislamica.v4i2.4796.

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sought to develop measuring instruments capable of combining scientific and religious functions. According to David A. King,[2] The existence of the mizwala is known to date back to the Greco-Roman era, and it was not until the 9th century CE that Al-Khawarizmi became the first figure to write a systematic treatise on this device. During its heyday, this device was widely used across various Islamic regions to determine the correct direction of the qibla, utilizing sunlight.[3]

However, as time has passed, its existence has become less well-known and has even been forgotten by some people. In fact, studying this tool can provide a deeper understanding of the methods Muslim scientists used to solve religious issues through a scientific approach.[4] The history of the mizwala also serves as a gateway to understanding the dynamics of classical astronomy and its contributions to modern science. By tracing its history, we can see how science and religion coexist harmoniously within Islamic tradition. Today, the term "mizwala"—particularly in Indonesia—is more commonly used to refer to a qibla indicator, which is a modified version of the sundials of the past.[5]

Contemporary empirical studies in the field of astronomical instrumentation indicate that the mizwala still plays a significant role in determining the direction of the qibla in the modern era. Through his research in Pademawu District, Pamekasan, Hosen found that the use of the mizwala yields the direction of the qibla with a very small margin of error when

[2]David A. King, "Astronomy in the Service of Islam," in *Handbook of Archaeoastronomy and Ethnoastronomy* (New York, NY: Springer New York, 2015), 181–96, https://doi.org/10.1007/978-1-4614-6141-8_13.

[3]Ahmad Izzuddin, *Ilmu Falak Praktis; Metode Hisab-Rukyat Praktis Dan Solusi Permasalahannya* (Semarang: PT. Pustaka Rizki Putra, 2012).

[4]David A. King, *Islamic Astronomy and Geography*, *Islamic Astronomy and Geography*, 2022.

[5]Siti Tatmainul Qulub, *Ilmu Falak : Dari Sejarah Ke Teori Dan Aplikasi* (Depok: PT RAJAGRAFINDO PERSADA, 2017).

compared to modern methods such as digital compasses and satellite mapping applications.[6]

Meanwhile, research by Ayu Putri, Fadli Ahmad, and Rendy Santoso on testing the qibla direction of the Qowiyuddin Mosque in Surabaya shows that measurements taken using a mizwala have a level of accuracy close to that of measurements taken with a theodolite. Anisah Budiwati and Muhammad Wahyu Firdaus, in a comparative analysis between Google Earth and the mizwala, demonstrated that integrating these two methods can yield more precise qibla direction data with minimal error tolerance.[7]

Based on these findings, it can be concluded that the mizwala remains relevant as an accurate astronomical instrument, even though technology for determining the direction of the qibla has advanced significantly. However, most existing studies are still applied in nature and have not yet comprehensively explored the historical aspects and scientific evolution of the mizwala. Therefore, this study aims to fill this gap by re-examining the history, function, and contribution of the mizwala to the development of Islamic astronomy. Thus, this study is expected to enrich the body of astronomical knowledge and revive awareness of the importance of classical instruments in the development of Islamic astronomy.

METHOD

This study employs a qualitative approach using a historical-descriptive method. This approach was chosen because the study aims to trace the history and development of the mizwala as a classical astronomical instrument in Islamic

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[6]Hosen and Ghafiruddin, "Akurasi Arah Kiblat Masjid Di Wilayah Kecamatan Pademawu Kabupaten Pamekasan Dengan Metode Mizwala Qibla Finder," *Al-Ihkam: Jurnal Hukum Dan Pranata Sosial* 13, no. 2 (December 21, 2018): 364–81, https://doi.org/10.19105/al-lhkam.v13i2.1837.

[7]Anisah Budiwati, Muhammad Wahyu Firdaus, and Galih Cipto Raharjo, "Integration Method for Measuring Qibla Direction (Comparative Analysis of Google Earth and Mizwala)," *Indonesian Journal of Interdisciplinary Islamic Studies* 5, no. 3 (December 30, 2022), https://doi.org/10.20885/IJIIS.VOL.5.ISS3.ART2.

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civilization. The historical method is used to examine the origins, evolution, and changing functions of the mizwala over time based on primary and secondary sources.[8] Primary data was obtained from the works of Muslim scholars, including Al-Khawarizmi, Al-Biruni, and Al-Tusi, while secondary data was derived from modern research by scholars such as David A. King and Siti Tatmainnul Qulub. Data analysis was conducted through internal and external source criticism to assess the validity and authenticity of the information. A descriptive approach was used to present the findings narratively in order to illustrate the socio-intellectual context of each historical period. This study is a library research project emphasizing the interpretation of the scientific and religious meanings of mizwala.

The research process began with the collection of literature data related to the history and function of the mizwala. The sources used included books, journal articles, and classical manuscripts relevant to the study of Islamic astronomical instruments. The data was then classified by historical period, ranging from the Greco-Roman era to its current use in Indonesia. Content analysis was employed to interpret the scientific ideas and approaches of Muslim scholars regarding the mizwala. The results of this analysis were compared with findings from modern research to assess the relevance and accuracy of classical methods in the digital age. This study also examined the socio-cultural and religious contexts underlying the use of the mizwala across different eras. Data validity is strengthened through triangulation of sources between the perspectives of classical and modern scholars. Thus, this study is expected to yield a comprehensive understanding of the historical, scientific, and spiritual value of the mizwala in the development of Islamic astronomy.

[8]Ahmad Musonnif, "Pendekatan Dalam Penelitian Ilmu Falak DI Indonesia" 24, no. 01 (2024): 151–70, https://doi.org/10.21274/dinamika.2024.24.01.35-52.

RESULTS AND DISCUSSIONS

The History and Development of Mizwala

As technology advances and the flow of information increases, various innovations have emerged that modify classical astronomical instruments. One example is the redesign of the sundial and the gnomon. The sundial, which originally served only to tell time, has gradually been engineered into a device with broader functions, even differing from its original purpose. Among these developments are the mizwala qibla finder and the istiwaaini, which are used to determine the direction of the qibla.[9]

The mizwala has long been known since ancient times as a device that uses the sun's shadow to tell time. As a type of sundial, this instrument was already in use in various pre-Islamic civilizations such as Egypt, Babylon, and Greco-Roman societies. In ancient Egypt, for example, there were shadow clocks dating back to the 8th century BCE that used a vertical pole or gnomon. The Arabic term mizwalah or al-mazawil was later adopted in classical Islamic astronomical literature.[10]

In Egypt and Mesopotamia, muwaqqits (mosque timekeepers) used the sun's shadow to determine prayer times and the direction of the qibla. One physical example is the vertical sundial found at the tomb complex of Sultan al-Ashraf Inal in Cairo, dating from 871 AH/1466 CE. This instrument is referred to as a mizwala munharifah (vertical sundial) in Witkowski's study.[11] In ancient times, sundials were created to meet people's need to tell and keep track of time, as complex

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[9]Maulidin Maulidin and Abdullah Abdullah, "Uji Komparasi Instrumen Arah Kiblat Antara Qibla Tracker Dan Mizwala Qibla Finder," *Astroislamica: Journal of Islamic Astronomy* 1, no. 1 (June 30, 2022): 73–96, https://doi.org/10.47766/ASTROISLAMICA.V1I1.899.

[10]Observatorium Ilmu Falak Universitas Muhammadiyah Sumatera Utara, "Jam Matahari (Instrumen Outdoor), 2023.

[11]Maciej G. Witkowski, "Vertical Sundial from the Madrasa of Al-As Hraf Inai (No. 158) on Cairo Northern Necropolis," *Etudes et Travaux* 27, no. 158 (2014): 459–75.

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timekeeping technologies such as mechanical clocks did not yet exist.

There are several main reasons why sundials were created. First, the basic need to tell time. Ancient societies needed a way to know when to start and end activities, when to work or rest, and when to perform religious ceremonies. The sun is the easiest indicator of time to observe. The sun is a natural time marker. The sun's shadow moves regularly throughout the day. Changes in the shadow's position can indicate: morning, noon, afternoon, the passage of time, and the sun's altitude and position. This regularity makes the sundial a highly effective tool.[12]

Second, for agricultural purposes. Agrarian societies need accurate timekeeping to: determine planting and harvesting times, observe seasonal changes, and adjust activities to the length of day and night. Third, for religious and ritual purposes. Many ancient civilizations (Egypt, Babylon, Greco-Roman) had rituals whose timing was determined by the position of the sun. As the first astronomical tool, before the advent of modern astronomical instruments, the sundial was a tool for studying the sun's daily motion, a means of understanding the length of the day, and the foundation for the creation of early calendars. Fourth, easy to make and inexpensive. Sundials do not require complex technology. All that is needed is a stick (gnomon), a flat surface, and basic knowledge of the sun's direction.[13]

In the 9th century CE, figures such as Al-Khawarizmi are recorded as having written treatises on the sundial, though they did not always refer to it as a mizwala. This indicates a scientific interest in this instrument within the early Islamic tradition. Al-

[12]Arwin Juli Rakhmadi and Hasrian Rudi Setiawan, "Pemanfaatan Instrumen Astronomi Klasik Mizwala Dalam Pengukuran Dan Pengakurasian Arah Kiblat," *Maslahah: Jurnal Pengabdian Masyarakat* 1, no. 2 (October 7, 2020): 152–63, https://doi.org/10.56114/MASLAHAH.V1I2.69.

[13]G.S. Amangeldiyeva, V.B. Grigorkevich, and M.A. Zhumatayeva, "The Basics of Copywriting: The History of the Origin and Types," *Bulletin of L.N. Gumilyov Eurasian National University. JOURNALISM Series* 148, no. 3 (2024): 20–34, https://doi.org/10.32523/2616-7174-2024-148-3-20-34.

Khawarizmi became the first scientist to describe methods for using shadow-casting instruments in the context of astronomy. Although not all of his treatises have survived, the literature indicates that Al-Khawarizmi wrote in the 9th century CE with a mathematical-astronomical orientation. Recognition of Al-Khawarizmi demonstrates the continuity of the Greco-Roman legacy in Islamic science.

Thus, the development of the mizwala in the Islamic world became part of the continuity of scientific knowledge through local adaptation. The golden age of Islamic astronomy (10th–14th centuries CE) saw the spread and modification of the mizwala in Al-Andalus, Persia, Egypt, and South Asia. Muslim astronomers adapted the designs of the dials and gnomons to suit geographical latitudes and religious functions. In modern literature, the term "sundial" is often translated from mizwala. These instruments were installed in madrasas, mosques, and observatories to indicate time and direction.

Research indicates that over 100 Islamic sundials have been discovered in Tunisia. In the Nusantara region, the mizwala was adapted by Islamic astronomers as part of the Islamic scholarly tradition. Literature notes that astronomical instruments such as the mizwala or Jam Bencet were commonly found in mosques and Islamic boarding schools. The use of the mizwala extended beyond determining prayer times to serving as an educational tool and a symbol of scholarly knowledge. Communities developed modifications based on the latitude and direction of the qibla in their respective regions. Thus, the mizwala in the Indonesian archipelago serves as a bridge between the global tradition of Islamic astronomy and local culture. The physical collection of mizwala in major mosques stands as material evidence of the development of this instrument.[14]

At Al-Aqsa Mosque, there is a mizwala still installed in the southern corner of the mosque complex. This instrument is

[14]Reza Akbar, Aslan Aslan, and Riza Afrian Mustaqim, "Qibla Direction Calculation Methods in Islamic Astronomy References in Indonesia," *AHKAM : Jurnal Ilmu Syariah* 22, no. 2 (December 31, 2022), https://doi.org/10.15408/ajis.v22i2.20422.

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known as a sa'ah syamsiyyah and features a shadow scale and a gnomon used to determine prayer times. The mizwala's structure remains intact and has been in use since the early 20th century CE. The presence of this instrument at an important religious site demonstrates that the mizwala is part of Islam's religious and scientific heritage.

From the perspective of astronomy and technology, the mizwala has undergone several transformations. First, muwaqqits adapted it to local latitude and azimuth. Second, additional functions, such as determining the direction of the qibla, were added. Third, in the modern era, Al-Azhar University reconstructed the mizwala as part of its efforts to preserve the astronomical heritage. Thus, the mizwala has evolved from a simple tool into a multifunctional instrument.[15] This transformation reflects the ability of traditional instruments to adapt to scientific and ritual needs. In modern research, the mizwala is once again being studied empirically.

In Indonesia, measurements taken with the mizwala show only minor deviations from modern instruments. Modifications such as the Mizwala Qibla Finder have been developed as shadow-based tools for determining the direction of the qibla. Studies like this demonstrate the relevance of classical instruments in the technological age. The research also highlights the potential of the mizwala as an educational tool in schools and Islamic boarding schools. Epistemologically, the mizwala represents a synthesis of science and religion in Islamic astronomy.

Observing nature through the sun's shadow serves as a means of worship in determining prayer times and the qibla. Islamic scholars used spherical geometry and trigonometry to design mizwala to meet ritual needs. Studies of the mizwala offer a rich historical perspective on Islamic science and epistemology.

[15]Sharifah Nurul and Syef Zafar, "The Evolution of Astronomical Instruments from the Classical Era to Digital" 2, no. 3 (2025): 192–203, https://doi.org/https://doi.org/10.33096/jah.v2i3.26679.

Nevertheless, the challenges of preservation remain significant. Many ancient mizwala are damaged, lost, or stored without documentation. At Al-Azhar Mosque, one of the mizwala units was moved to a warehouse of the Egyptian Ministry of Antiquities. Much research remains limited to technical aspects and fails to explore historical-philosophical dimensions.[16]

This situation highlights a gap in research and the importance of systematic documentation. Moving forward, research on the mizwala can focus on physical reconstruction, digital modeling, and comparisons with modern instruments. Integrating the mizwala into astronomy education is a key priority. With satellite mapping technology, the principles of the mizwala can be accurately reapplied. The Suryakala Nusantara program highlights the documentation of sundials in Indonesia, including mizwala variants.[17] Studies such as this strengthen the connection between the classical Islamic heritage and contemporary science.

In conclusion, the history of the mizwala reflects the journey of Muslim scientists in developing astronomical instruments that combine scientific and religious functions. From its ancient roots in Egypt to the Indonesian archipelago, the mizwala demonstrates the continuity of Islamic knowledge. This instrument is relevant both technically and symbolically as a synergy between science and religion. Further research is needed to enrich the body of Islamic astronomical knowledge. Studies of the mizwala contribute to the history of science and the preservation of the Islamic intellectual heritage.

Mizwala's Contributions to Islamic Astronomy

The mizwala is a classical astronomical instrument that played a significant role in the development of Islamic astronomy. Originally designed as a timekeeping device, its function evolved into a scientific tool for precisely determining

[16]Arwin Juli Rakhmadi Butar-Butar, "Mizwala Masjid Al-Azhar", OIF Universitas Muhammadiyah Sumatera Utara (2024).

[17]R. Priyatikanto, "Suryakala-Nusantara: Documenting Indonesian Sundials", Prodi Astronomi Institut Teknologi Bandung, Juni (2021), p. 4.

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the direction of the qibla and prayer times. Through the mizwala, Muslim scientists were able to integrate astronomical observations with the religious needs of the Muslim community. The process of observing the sun's shadow in the mizwala introduced the concepts of spherical geometry, elevation angle, and azimuth to astronomers.[18]

From this simple instrument emerged an awareness of the importance of accurately determining the sun's position relative to the local horizon. This later became the basis for calculations used to determine prayer times and eclipses. Historically, the mizwala played a major role in introducing the basic principles of trigonometry and celestial geometry in astronomical calculations. Scientists such as Al-Khawarizmi and Al-Biruni used the sun's shadow instrument to calculate the angle of elevation and the length of the shadow at a specific latitude. These measurements were then linked to astronomical coordinate systems such as declination and hour angle.

This demonstrates that the mizwala fosters quantitative and mathematical thinking in Islamic astronomy. The use of the mizwala also introduced the concepts of latitude and longitude, which are crucial for determining the time of zawal or noon. In other words, the mizwala helps to concretize the relationship between celestial observation and mathematical calculation. This is what gives this instrument its high scientific value in the development of Islamic astronomy.[19]

Another contribution of the mizwala is evident in the development of a systematic methodology for determining the direction of the qibla. Before the advent of modern instruments such as the theodolite and GPS, astronomers relied on the sun's shadow to determine the direction of the Ka'bah. The mizwala

[18]Muhammad Thoyfur, "Digitalization Of Local Rashdul Qibla By Qibla Diagram," *Al-Hilal: Journal of Islamic Astronomy* 3, no. 1 (2021), https://doi.org/10.21580/al-hilal.2021.3.1.7697.

[19]Arwin Juli Rakhmadi Butar-Butar, "Astronomi Islam Era Dinasti Mamalik (1250-1517)," Afkaruna 9, no. 1 (2013): 26–36, https://doi.org/10.18196/aiijis.2013.0017.26-36.

operates by calculating the sun's azimuth at a specific time and converting it into the direction of the qibla. This technique later became the foundation for various methods of calculating the the direction of the qibla in contemporary astronomy.

Thus, the mizwala made not only a technical but also a methodological contribution. Shadow-based measurements have become a scientific tradition that persists to this day in the Islamic world. The relevance of the mizwala remains strong because the concepts of azimuth and declination it employs are still identical to those in modern astronomical systems. The mizwala also served as a tool for teaching astronomy and celestial mechanics in Islamic scholarly institutions. During the golden ages of Baghdad and Al-Andalus, the mizwala was used in madrasas and observatories as a demonstration tool for the sun's position. Through this instrument, students could understand how the sun's movement affects changes in daylight hours.[20]

Ilmuwan Muslim menggunakan *mizwala* sebagai media to explain the concepts of local time, latitude, and celestial coordinate systems. Through these practical applications, the mizwala serves as a pedagogical tool for teaching astronomy empirically. It functions not only as an observational instrument but also as an educational tool that instills scientific and spiritual values. This didactic role positions the mizwala as a bridge between the theoretical principles of astronomy and its observational practice.

In the context of measurement technology, the mizwala laid the foundation for the development of other astronomical instruments in the Islamic world. The principle of the sun's shadow applied to the mizwala inspired the design of other instruments such as the astrolabe and the rubu' mujayyab. Both instruments adopt similar geometric principles in determining the positions of celestial bodies. Thus, the mizwala serves as the

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[20]Ismail Ismail, "Standar Operasional Prosedur (SOP) Kalibrasi Arah Kiblat Masjid Di Era Digital," *Al-Marshad: Jurnal Astronomi Islam Dan Ilmu-Ilmu Berkaitan* 5, no. 1 (June 20, 2019): 90–110, https://doi.org/10.30596/jam.v5i1.3126.

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mother instrument for more complex Islamic astronomical devices.[21]

The mizwala also contributed to the Islamic concept of time and calendar system. By observing the daily movement of the sun's shadow, Muslim scientists understood variations in the length of the day and the changing of the seasons. This data was then used to refine the solar calendar system and assist in calibrating the lunar and solar calendars. The mizwala enabled direct observation of the solstices and equinoxes, which form the basis for the division of the seasons. Thus, this instrument provided the foundation for synchronizing prayer times with astronomical phenomena. Understanding the dynamics of time through the mizwala also enriched the hisab rukyat theory in determining the start of the Hijri month. This demonstrates that the mizwala's contribution extends not only to the spatial aspect (direction) but also to the temporal aspect (time).[22]

In the modern era, the mizwala remains relevant through an integrative approach that combines traditional instruments with digital technology. Contemporary research shows that the use of the mizwala results in a very small deviation in the direction of the qibla compared to modern tools such as Google Earth or digital compasses.[23] This proves that the astronomical principles used by classical scientists remain valid to this day. Its function is now not only historical but also experimental. The continued use of the mizwala demonstrates that Islamic scientific tradition is capable of engaging with modern technology without losing its original value.

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[21]Khairul Anaam et al., "Accuracy Test of Qibla Direction of Qowiyuddin Mosque Jagir Wonokromo Surabaya," *AL - AFAQ : Jurnal Ilmu Falak Dan Astronomi* 6, no. 2 (October 29, 2024): 163–82, https://doi.org/10.20414/afaq.v6i2.10912.

[22]Nurul and Zafar, "The Evolution of Astronomical Instruments from the Classical Era to Digital."

[23]Muh Arif Royyani et al., "Religious Dialogue and Astronomy from the Perspective of Indonesian Muslim Scholars," Samarah: Jurnal Hukum Keluarga Dan Hukum Islam 7, no. 1 (March 31, 2023): 261–80, https://doi.org/10.22373/SJHK.V7I1.12406.

The Relevance of Mizwala in a Contemporary Context

The mizwala, or sundial, remains relevant in the context of modern astronomy because its basic principle is based on direct observation of the sun's movement. Although digital instruments such as electronic compasses and GPS-based apps are now available, the mizwala is still considered important as a simple, self-contained tool for verifying the direction of the qibla. The mizwala's advantage lies in its ability to function without requiring electricity or an internet connection.[24]

In the context of education, this tool also plays a major role in introducing students to the basic concepts of astronomy and the position of the sun. Mizwala-based learning allows for the integration of theory and practice, while simultaneously instilling both scientific and religious awareness. Thus, the mizwala is not merely a measuring instrument, but also a contextual learning medium in the study of astronomy. This relevance demonstrates that the legacy of early Muslim scientists remains valuable to this day.

Therefore, the mizwala can serve as a bridge between classical scientific tradition and modern science. In the context of contemporary Islamic astronomical research, the mizwala offers an alternative observational method based on empirical principles. Several modern studies indicate that measurements taken with the mizwala exhibit very small deviations compared to those from digital instruments. This fact confirms that the classical methods developed by Muslim scientists should not be underestimated; in fact, they possess a high level of accuracy. The mizwala can also be used to verify the validity of qibla direction data obtained from satellite map-based applications. Through an integrative approach, the mizwala strengthens astronomical studies by linking traditional observational methods with modern analysis.[25]

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[24]Maulidin Maulidin and Abdullah Abdullah, "Uji Komparasi Instrumen Arah Kiblat Antara Qibla Tracker Dan Mizwala Qibla Finder."

[25]Cut Nazar Mutia Hanum and Ismail Ismail, "Pandangan Tokoh Agama Jungka Gajah Terhadap Arah Kiblat Bagi Orang Yang Jauh Dari

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In contemporary research, its existence has fostered an awareness that classical astronomical methods remain relevant for testing and development. Thus, the mizwala holds strong scientific and methodological value. Its presence demonstrates a continuity between the Islamic scientific traditions of the past and modern astronomical research. The relevance of the mizwala is also evident in the context of preserving the Islamic intellectual heritage. Many Islamic higher education institutions have begun to pay attention to classical astronomical instruments as part of the revitalization of the science of astronomy.

The mizwala serves as a symbol of the unique fusion of science and religion within Islamic tradition. Preserving this instrument means safeguarding the continuity of the scientific heritage that once propelled Islamic civilization to the pinnacle of its scientific glory. Furthermore, the revival of the mizwala in modern or digital-analog forms demonstrates how Islamic science can adapt to the times. For instance, some universities are now creating digital replicas of the mizwala for teaching astronomy and determining the direction of the qibla. These efforts serve as tangible proof that the mizwala is not merely a historical artifact, but a living and evolving instrument.[26]

In this context, the mizwala serves as a bridge between the scholarly heritage of Islam and future generations of scientists. The mizwala also plays a vital role in the realm of environmentally friendly alternative technologies. Amid humanity's reliance on electricity- and network-based technologies, the mizwala offers an efficient and sustainable nature-based solution. Its operating principle, which utilizes sunlight, makes it an exemplary instrument aligned with the concept of green technology in the modern world. This makes

Ka'bah," *Astroislamica: Journal of Islamic Astronomy* 1, no. 2 (December 28, 2022): 169–86, https://doi.org/10.47766/ASTROISLAMICA.V1I2.934.

[26]Thoyfur, "Digitalization Of Local Rashdul Qibla By Qibla Diagram."

mizwala relevant not only scientifically and religiously, but also ecologically.[27]

In rural communities or areas with limited access to technology, the mizwala can serve as a practical tool for determining the direction of the qibla or prayer times. With minimal maintenance, this device can last for a long time and be passed down through generations. This approach demonstrates how traditional concepts can contribute to sustainable development. Thus, the mizwala fosters harmony between religious values, science, and environmental sustainability.[28]

Overall, the mizwala remains highly relevant to the development of contemporary astronomy and Islamic astronomy education. Its existence serves as a reminder that modern technological advancements should not supplant classical values that have proven to be both effective and scientific. Through recontextualization and further research, the mizwala can serve as an inspiration for the design of innovative astronomical instruments. The use of the mizwala in academic activities can also enrich research methodologies through an integrative approach that bridges science, religion, and culture.

In the context of the globalization of science, the mizwala represents Islamic local wisdom that is capable of adapting without losing its scientific essence. The study of this instrument opens a space for dialogue between modern science and the intellectual heritage of Islam. Therefore, the relevance of the mizwala is not merely technical, but also philosophical and cultural. The mizwala is a symbol of continuity between the scientific traditions of the past and the future direction of the development of astronomy.

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[27]Zulfian Wanandi et al., "The Problem of Non-Muslims Witnessing the Hilal: Perspectives of Fiqh, Religious Court Judges, and Thomas Djamaluddin," *Astroislamica: Journal of Islamic Astronomy* 4, no. 1 (June 30, 2025): 162–79, https://doi.org/10.47766/astroislamica.v4i1.3469.

[28]Mohd Hafiz Safiai et al., "Astrolabe as Portal to the Universe, Inventions across Civilizations," *International Journal of Civil Engineering and Technology*, 2017.

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CONCLUSION

Studies of the mizwala demonstrate that this classical instrument is an integral part of the Islamic scientific heritage that remains relevant to this day. This tool symbolizes the integration of empirical observation and spiritual orientation that characterizes the science of astronomy. Early Muslim scientists successfully combined astronomical accuracy and religious values into a single, harmonious system of knowledge. The mizwala is not merely a tool for determining the direction of the qibla or prayer times, but a representation of rational and empirical thinking. Its history of development demonstrates that Islamic astronomy has made a significant contribution to shaping the foundations of modern astronomical knowledge.

This study offers a comprehensive epistemological alternative for understanding the close relationship between science and religion. The accuracy of the mizwala remains proven and effective even as modern measurement technology has advanced rapidly. The preservation and study of this instrument are crucial for maintaining the continuity of Islamic scholarship for present-day generations. In conclusion, the mizwala is a tangible symbol of continuity, rationality, and the intellectual triumph of the Muslim community throughout the ages.

In the contemporary context, research on the mizwala has far-reaching implications for the fields of academia, education, and technology. Its use as a learning tool effectively integrates historical, scientific, and spiritual aspects simultaneously in the classroom. This tool effectively fosters students' awareness of the importance of direct observation in understanding astronomical phenomena. The mizwala also plays a crucial role in preserving ecological values as it operates using natural energy without relying on digital technology. This makes it a concrete example of environmentally friendly technology that is both deeply rooted in religious values and highly scientific.

Innovations in the development of modern mizwala demonstrate that digital technology can be adapted without

compromising the originality of a tradition. Astronomy, too, serves as a harmonious bridge between classical traditions and technological advancements. Further research is expected to explore the philosophical, historical, and methodological dimensions of mizwala in much greater depth. Thus, this study will continue to enrich the scientific literature and strengthen the scholarly identity of the global Muslim community.

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