International Journal of Social Science and Economic Research

ISSN: 2455-8834

Volume:08, Issue:02 "February 2023"

THE CONTRIBUTION OF MEDIEVAL MUSLIMS TO THE DEVELOPMENT OF MODERN SCIENCE: A REVIEW OF AL-KHWARIZMI

P.M.A. Aleeshan[1], M.N.P. Rifasha[2] and Mohamed Haniffa Mohamed Nairoos[3]

[1]Reading B A (Hons) in Islamic Banking & Finance, Faculty of Islamic Studies & Arabic Language, SEUSL.

[2]Reading B A (Hons) in Islamic Thought & Civilization, Faculty of Islamic Studies & Arabic Language, SEUSL.

[3]Senior Lecturer, Department of Islamic Studies, Faculty of Islamic Studies & Arabic Language, SEUSL.

DOI: 10.46609/IJSSER.2023.v08i02.001 URL: https://doi.org/10.46609/IJSSER.2023.v08i02.001

Received: 2 Feb. 2022 / Accepted: 20 Feb. 2023 / Published: 28 Feb. 2023

ABSTRACT

Muslim scholars had reached the pinnacle of scientific culture for more than five centuries. There is no denying that it was the Muslim scholars of the day who shed light on the biological sciences of medieval Europe. If the Nobel Prize had been introduced at that time, only one Muslim would have won the Nobel Prize many times. Prominent mathematician Al Quarizmi has also received numerous awards. The purpose of this study is to identify the contributions of al-Khwarizmi, one of the intellectuals of medieval Muslims, to the fields of astronomy, geography and mathematics. The study, which is based on characteristic descriptive methodology, analyzes secondary data such as research articles, texts, journals, and web articles related to the research topic. It is undeniable in today's modern world that medieval Muslim scholars brought the European Dark Ages to the light of knowledge and rose to its zenith. Muhammad ibn Musa al-Khwarizmi who was a Persian geographer, trader, mathematician and the pioneer in the field of geography founded algebra in mathematics, algorithms, and algorithms. Hundreds of contributions to the introduction of Indian numerology to Europe and the field of commerce through his book, Arithmetic, further enrich his scholarly contributions. It is therefore irrefutable that his scholarly contributions became known as the results of this study and that his contributions of knowledge will still be talked about in future society.

Keywords: Medieval Muslims, Al Quarismi, Mathematics, Astronomy, Geography.

ISSN: 2455-8834

Volume:08, Issue:02 "February 2023"

Introduction

The period from AD 500 to AD 1500 is known as the Middle Ages in world history, especially in European history. Such a period is also known as the "Dark Ages". All the European countries were immersed in darkness in all fields such as art, education, culture, civilization etc. (Abu Bakr, 2001). And human nature and humanity were not found in Europe at all. Animal feelings prevailed among them. When such situations are found in Europe, education is the basic right of every Muslim. Islam insists. (Shunomi and Munas, 2021). This motivated not only Muslims but also other religions to seek education (Amin, 2008). This Middle Period lasted from the fifth century AD, the period of decline of the Roman Empire, to the fifteenth century, the period of renaissance (Pradananesaiyan Nauyan 2009). After the fall of the Persians and the Persians, the Muslims acquired the treasures of knowledge there. It is appropriate to say that rather than the Muslims receiving the knowledge from them, they strove to preserve it and pass it on to the next generation (Shunoomi and Munas, 2021). Also, during that period, the Qur'an and the Sunnah encouraged Muslims to acquire knowledge. Emphasized. Based on this, the teachings of the Qur'an and the influence of the Prophet's (PBUH) mottos are the main forces behind the study and research of the physical sciences (Contribution of Muslim Scholars in the Field of Science, 2019).

They could learn not only the arts related to righteousness but also the fields of knowledge related to the world. The interest and fascination of Muslims in the search for knowledge drove them to all the distant regions of the world and encouraged them to acquire knowledge. In this way, the desire for knowledge in the hearts of Arab Muslims took them to the top of progress (Abu Bakr, 2001). Born in the city of Khwarishm, which known as "Keeva" now in Central Asia. Muhammad ibn Musa al-Khwarizmi (عَبْدَالله مُحَمَّد بِن مُوسَى اَلْخَوَارِزْمِي) was a Persian mathematician, astronomer, and geographer. He was also a member of Bait al-Hikma (بيت الحكمة), a house of knowledge located in Baghdad during the Abbasid Caliphate. He was born around 780 in what is now Khiva, then Khwariz, in Uzbekistan. He was born in AD. He died around 850. Said to be the founder of Arabian geography, he was a mathematician and astronomer. Indian numerals were introduced to Europe in his name. The hierarchical solution, the decimal number system (Yudapazasalai) is derived from his Latin name Algorithmic (Yudapazasaiai). He is also called the father of algebra. A Latin translation of his treatise Numganitam was published in the 12th century.

This book, which explained Indian numerals, introduced the decimal number system (Nānuiāyāta pālāvaiṁyedā rādīnaśālālālālāvānā) to the West. Surat al-Arl (Structure of the Earth) edited Ptolemy's Geography and laid the foundation for Muslim geographical studies. The book presented several changes and revisions to Ptolemy's worldview. In the maps found in the book, the Earth is divided into seven zones according to its climatic conditions. He also wrote books on

ISSN: 2455-8834

Volume:08, Issue:02 "February 2023"

astronomy and astrology. A group of scholars led by him made a map of the Nile River. But some scholars point out that there was a Persian map of the Nile before Khwarizmi's map and some that there was a map called "Diyalam" by Hajjaj bin Yusuf.

The fact that the "Earth is spherical" mentioned in his book was proved later. Bo.K. Khwarizmi highlighted this fact 700 years before Magellan circumnavigated the globe in 1551 and proved that the Earth was spherical. It is significant that Khwarizmi also created a timetable named "Indus Hindu".And in the study carried out by Sunumi and Munas entitled "Contribution of medieval Muslims to the development of modern science", the scientific contribution of all medieval Muslims is included. Especially the contribution of geography, astronomy and mathematics of Khwarizmi is briefly explained in the study. Similarly in the study carried out by MJM Rizwan. Khwarizmi, covering all medieval Muslims, is briefly explained. And in our study, we have included only one of the medieval Muslim scholars, Al Khwarizmi, and discussed in detail his contribution to the fields of geography, astronomy and mathematics. So our study is different from their study.

Therefore, this research has been carried out with the aim of identifying and uncovering the contributions of Al Khwarizmi in the field of geography, astronomy and mathematics as well as bringing his contributions to society.

Research problem

Al-Khwarizmi, a mathematical genius among the Muslim scholars of the Middle Ages, is still admired throughout the world as the most important in science. Muhammad bin Musa al-Khwarizmi's contributions in fields such as astronomy, geography and mathematics are immense. His discoveries and books testify to that. How are al-Khwarizmi's contributions to geography, astronomy, and mathematics seen since these disciplinary studies and collections are so rare? The research problem for this study has been identified through the study.

Purpose of the study

The study is attempt to expose the contributions of al-Khwarizmi in the fields of geography, astronomy and mathematics.

Research Methodology

This qualitative study was carried out through secondary data such as research articles, books, journals, magazines, and internet publications related to the research topic and presented through the descriptive method.

ISSN: 2455-8834

Volume:08, Issue:02 "February 2023"

Literature review

Significance of the Contribution of Medieval Islamic Philosophers to the Development of Renaissance Science (Pulendran Nasan, 2017). The purpose of this study is to identify the significance of the contribution of Islamic philosophers in the European scientific renaissance. Comparative and descriptive analysis methods have been used in this study. This study emphasizes the thought of medieval Islamic philosophers, who made significant contributions to the discoveries of the European Renaissance.

The Contribution of Medieval Muslims to the Development of Modern Science: A Review (Munas and Sunoomi, 2021). The purpose of this study is to identify the contributions of medieval Muslims to the fields of medicine, astronomy, geography and mathematics. This research has been conducted in qualitative descriptive methodology with secondary data. The contributions of the Muslims of that time to the development of medieval science are enormous, the ability of the Greeks to study science without accepting it as it is, to remove the false ones, to approach it with new empirical knowledge and to move science to the next level, is due to the interest of the Al-Qur'an and the Prophet, as well as the medieval Muslims to take science to the peak of modernity. The findings of this study are that hard work is irreplaceable.

"Muslim Contribution to the Field of Geography" (Amin, 1992). In the book entitled, the contribution of Muslims to the field of geography, the Muslim geographers and their contributions, the development of geography during the European renaissance period, geo-mathematics, meteorology, and the factors that motivated Muslims to develop in the field of geography are discussed in this book.

“Development of Islamic Civilization” (Rizwan, 2012). Described as the Dark Age by Europeans in AD. This book explains the scientific revolution of Muslims in the period between 500 - 1500 and discusses the reasons why it slipped away from them.

Discussion

Contribution to the field of geography

As in the fields of astronomy and mathematics, the contribution of medieval Muslim scholars was seen to be as great in the field of geography. The Arabs of that time found the field of geography very necessary for their trade and migration. Because of this, they were seen as having a basic knowledge of geography. Al-Qur'an's exhortations are most important for this."The field of geography which flourished during the Greek period was interrupted by Christian domination, and then the art of geography spread during the medieval Muslim period, especially in the 7th century. (Amin, 2008).

ISSN: 2455-8834

Volume:08, Issue:02 "February 2023"

Muhammad bin Musa al-Khwarizmi was one of the notable medieval Muslim geographers. He has made significant contributions to cultural geography. AD He lived between 780 - 850 AD and is still known in the West as 'Algorism' in Latin due to his contributions to the field of geography. Among his books "Kitabu Sa_Ratul Arj" (LuryuPnu Lugu Wurnu Nuyusuur) is a famous book. (Ashkar Aruz, Yanana Lanayasa).

During the reign of Abbasid Caliph Mamun, Baitul was appointed in charge of Hikma and a team was appointed under his leadership to draw the world map. Al-Khwarizmi's world map called al-Surat al-Mamuniyyah by Dr S. It has now been completely reconstructed by the Indian scholar Razia Jafri, based on the description and data given in his Kitab Sarat. Al-Khwarizmi also mentioned this map in his book. This book presents many changes in Ptolemy's world map. And in this book, Al-Khwarizmi divides the earth into seven zones and explains. This film helped people like Columbus to reach America. And in this book he has also explained the fact that the earth is spherical. Thus Al Khwarizmi is considered the pioneer of the field of geography. (Ashkar Aruz, Yanana Lanayasa).

Al-Khwarizmi also devoted himself partly to geography, where he produced a work called Kitab Surat-al-Ard. In this work, we can see how he corrects Ptolemy on everything related to Africa and the East. He made a list of latitudes and longitudes of cities, mountains, rivers, islands, other geographical regions and seas. This data is used. It was the basis for creating a map of the then-known world.

Development in the field of geography in the medieval period M. I. M. Amin (2008) in his book grouped general geography, scientific geography, mathematical geography and national cartographic geography into four parts. Hundreds have been compiled in relation to the collection of information about the people who lived in the territories conquered by the Muslims in relation to general geography. Among them, Kitab Surat Al Arz written by Al Khwarizmi is the most important book.Similarly, they tried to obtain scientific geographical information by examining and observing the geographical information obtained by contemporary people in the scientific method of geography. A good example of this is the book Mabadih Al Ulum by Al Khwarizmi.

Thus the texts on geography were written by medieval Muslim scholars such as Al-Khwarizmi, which dispelled the misconceptions about geography at that time. (Munas and Sa{Noomi, 2021).

Contribution to the field of mathematics

Mathematics is one of the most essential fields for human daily life. It is important not only for applied science but also for all academic fields. In all times it has been used as a tool to help solve the problems that appear in human daily life (Abu Bakar, 2021). Al-Khwarizmi made a

ISSN: 2455-8834

Volume:08, Issue:02 "February 2023"

huge contribution to the field of mathematics, having received explanations related to Roman, Greek, Indian, and Egyptian, mathematics. In this way, Al Khwarizmi's contribution to the field of numerology and arithmetic found in mathematics can be viewed as follows.

Arithmetic

The greatest mathematician of the ninth century was Abu Abdullah Muhammad ibn Musa al-Khwarizmi, who lived during the reign of Caliph Al-Ma'mun.

Many people mistakenly believe that our English numbers 1,2,3 are the ones we can write today, but they are called Arabic numbers. Numerology 1,2,3 was introduced in Europe by his name. In English, it is called Yudaphasivaa. The name Al-Quarismi has been translated into the name of Al-Quarismi (mathematical genius Al-Quarismi, 2010). He introduced the numbers 1, 2, 3, 4, 5, and 6, which are widely used in mathematics today, to the world (Shunomi and Munas, 2021). These numbers are called "Arabic numbers". Called and software are also used in this way." In the book entitled Al Jamf al-Tabriq bi Hisab al Hisab al-Hind (Addition and Subtraction in Indian Mathematics) he abandoned the method of using letters to represent numbers and adopted the method of using digits (Abu Bakr, 2001). "Al Jamf al-Tabriq In the book entitled Be Hisab al Hisab al-Hind (Addition and Subtraction in Indian Mathematics) abandoned the use of letters to represent numbers and used the use of numerals (Abu Bakr, 2001). For this, he used Arabic numerals learned from Indians.

He was the first to use numbers instead of letters and "cyber" to represent numbers in this way. Muslim scholars initially wrote numbers in letter form, but these numbers came into being because they tried to write them differently like Hindi numbers (Amin, 2008). He called these numbers "Hindi numbers". . This work was translated into Latin as Algorithmic de numero indium in the early 12th century by Adelard (1075-1160), a Briton of Bath. It is said that he also wrote a lecture for the book. Although the Arabic original of this book is no longer available, the Latin translation still exists today (Abu Bakr, 2001). The translation of this book into Latin gave Europeans the opportunity to learn about Arabic numerals. The efforts of Leonardo Baibonacci (1170-1250), a well-travelled Muslim in Muslim countries, accelerated the introduction of Arabic numerals to Europe (Abu Bakr, 2001). Al-Khwarizmi also produced work on Hindu numerals.

These symbols, recognized as "Arabic" numerals used today in the West, also appeared in India. And more recently, Arabic mathematics was also introduced (Yuda-muhrayasaniai uruyalaya y Poṇenasa in Yudāpanadisayay yulavasachalajaleya yane Ayava, 2019). Up to the end of the 16th century, the most widely read mathematical text "Algorismus" was used by Hindus using Arabic numerals. - Khwarizmi made a great contribution to the work of introducing Arabic arithmetic to

ISSN: 2455-8834

Volume:08, Issue:02 "February 2023"

Europeans. Khwarizmi's numerology books were the reason Europeans know and practice the Arabic numerals from one to nine and the cypher. The name of numerology in English as "arithmetic" (Yusivaanawasi) is the reason for Al Khwarizmi's Latin translation name. Some scholars are of this opinion. According to them, the Latin translation of this book, "Dixit Algorismi" (says al-Khwarizmi) was misinterpreted as a variant of the Latin word "arithmos" meaning number, and the word "algorithm" was given to denote the numerology he composed. For centuries the term algorithm was used to refer to numerology. In the fifties the twentieth century, a journal named "Algorithm" was also published (Abu Bakr, 2001).

Algebra (Al Gibran)

Hi. The most outstanding of his mathematical books is Kitabul Muqtasar bi Hisab al-Jabr wal Muqabala (Book on the Calculation of Equations and Powers) written by him in the year 205 (820). From the word "Al Jabr" used in the title of this book, the word "Al Jibra" which refers to the alphabetic mathematics was born. The word "Al Jabr" means to transfer a number from one side of an equation to the other side by subtracting the same number from two sides of an equation. When this book was translated into Latin as "Aljabr" and caught the attention of Europeans, the word Aljabr was changed to "Algebra" to refer to alphabetic mathematics. The book contains more than eight hundred examples. In this book, which is clearly and properly written, he explains the first and second-degree equations and then describes mathematical problems such as algebraic multiplication and division and then describes mathematical problems such as dividing the area and gardens (Abu Bakr, 2001).Al-Khwarizmi's writings on algebra were used as textbooks in (US-Europe).

Khwarizmi is seen as important in the field of mathematics due to his massive contribution in alphabetic mathematics. Thus he is known as the father of latitudinal mathematics (Shunomi and Munas, 2021). Mathematical problems related to the division of property or related to law or related to law are usually first-order equations; Although these are visually complex problems, they are illustrated by numerical examples. His approach to the second-order equation is significant. He follows the Greek mathematician Theopanthus and differentiates it into six types. He also used new technical terms to refer to multiples of the unknown. He used the word "root" to refer to the power of the unknown, and the word "square" to refer to the second power of the unknown (Abu Bakar, 2001). And it is not only an arithmetic book but also a book of central mathematics. Kendra has solved quadratic equations mathematically in this book containing Kendra Mathematical Measurements. He also calculated the area of a triangle, parallelogram and circle, not only giving the appearance of a chem triangle when the chem triangle has two equal sides. The chapter "Babul Mijaha" in this book describes the mathematics of Khwarizmi. He invented the system of dealing with fractions in numbers and the use of lengths and widths in parentheses. Thus, Khwarizmi's contribution to mathematics is immense. However, it was used

ISSN: 2455-8834

Volume:08, Issue:02 "February 2023"

as the main mathematics textbook in European universities until the sixteenth century, and alphabetic mathematics took its name to Europe. He also did the work of introduction. Through this book, his influence went beyond universities and beyond.

Contribution to Astronomy

Astronomy is one of the scientific fields in which Muslims shined. Muslims also accelerated their research efforts by translating Indian and Greek astronomical texts. In a very short period of time, many astronomers emerged in the Muslim world (Muslim Contribution to the Rise of Modern Science, 2020). About his astronomical tables, Professor Hitti states, "His astronomical tables became the basis for other astronomical tables, east and west, for centuries." In addition to an important treatise on astronomy, al-Khwarizmi wrote a book on astronomical tables. His astronomical tables were translated into European languages and later into Chinese (Royal Research Institute (1997).

Al-Khwarizmi was an astronomer of great skill and acquired the degree of Ma'mun measured meridian in the plain of Sanjar north of the Euphrates (Pusanayava Araladai Aluunayvelayva-Arayayaayana Idin Aralaya Yuta-Muhrayasaniai, 2021). Deep knowledge in the fields of mathematics, geography, music, etc., as well as Arabic, Persian, Sanskrit, Hebrew etc. He went to Bagdad and lived there for some time. Then Khalifa Al Ma'mun brought him and appointed him as the in charge of "Darul Hikma" educational institute. However, his studies and incarnations in the field of astronomy are admired to this day. His astronomers used a method superior to that of the Greeks. It was one of the most sophisticated geodetic operations successfully carried out by several astronomers led by Musa al-Khwarizmi. It also determined the size and sphere of the Earth (Pusanayava Araladai Aluunaivelayva-Arayaayayana Idin Aralaya Yuda-Murayasaniai).

Busanayava Araladila, 2022). Newly translated "theoretical" Indian astronomical table with a bibliography and notes on the order of Khalifa Al-Ma'mun, he used the Indian table and the Persian astronomical table "Shij-Ishahi" in his observations. Al-Shij's astronomical tables prepared by him are the Indian astronomical table. It is based on the Attributes of Planetary Movements

He used the Persian Astronomical Tables to compile the details. He produced two larger astronomical tables. The larger Astronomical Table (Al Sheezul Kabir) is not available today. This table is part of the Hebrew translation of Ilam's lecture by Ibn al-Muthanna. His small astronomical table (Al Shee Zul Sangir) was revised in the second half of the 10th century by Maslama Al Majridi from Spain to suit the Nalwan (anthology) of Qurtuba and translated into Latin by Adalard from Bath. He also wrote two books on Asturlab and instruments. Among them

ISSN: 2455-8834

Volume:08, Issue:02 "February 2023"

is "Kitab al-Amal bil Asthurlab" which tells about the use of the Asthurlab Abdullah instrument. And the second book "Kitabul Amal al-Asthurlab" explains the structure of the instrument (Abu Bakr, 2001). Khalifa Al Ma'mun commissioned the Muslim scientists who worked on Baitul Hikma to prepare a diagram of celestial bodies and the earth. This research was carried out under his supervision. His astronomical tables were also prepared as a result of this research.

Conclusion

Today's modern world is indisputable that medieval Muslim scholars led the European Dark Ages to the light of knowledge and strived for its pinnacle. Persian geographer, astronomer and mathematician Muhammad Ibn Musa al-Khwarizmi, who started Arab geography in the field of geography, established that the earth is spherical, edited the book on the structure of the earth, solved the hierarchy in mathematics, discovered the decimal number system (Yudapazasalai) and introduced the Indian numeration system through his book Arithmetic. Introduction to Europe and hundreds of contributions to astronomy further enhance his tridisciplinary contributions. Therefore, as a result of this study, his contributions in three fields are known and his intellectual contributions will be discussed in the future society.

References

Nesan, P. (2017). "The Importance of the Contribution of Medieval Islamic Philosophers to the Development of Renaissance Science" 4th International Symposium.. Faculty of Islamic Studies and Arabic Language, South Eastern University of Sri Lanka, pp. 166-172.

Munas, M.H.A. and Zunoomy, M.S. (2021). "The contribution of medieval Muslims to the development of modern science, a review", Sri Lankan Journal of Arabic and Islamic Studies,4(1), SEUSL. Retrieved from: http://seu.ac.lk/sljais/

Adnan Banki, (1992). *"Al Khwarizmi's Contributions To The Science Of Mathematics: Al Kitab Al Jabr Wa'l Muqabalah",* Journal of Islamic Academy of Sciences 5:3, PP: 225-228

Ameen, M.A.M, (1992). "Contribution of Muslims to Geography", Essel Publishing House, India.

Sethuraman,V. (2022). *"Muhammadhu Ibnu Musa Al-Khwarizmi",* Retrieved from:https://www.gktamil.com//

Growing Islam, (2014).*"We are pioneers of modern science"*. Retrieved from:https://valarumislam.blogspot.com/2014/01/blog-post_2932.html?m=1

ISSN: 2455-8834

Volume:08, Issue:02 "February 2023"

Maayan Thamizhan, (2013). “Here's some unknown information for you-Mathematician Al Khwarizmi!!!”Retrived from:https://maayan-tamizhan.blogspot.com/2013/02/al-khwarizmi.html?m=0

Muhammadhu Musthafa, (2009). "An Abu Bakr (RA) for the truth"Universal Publishers.

Askar Aroos,(2018). *“Islamic Civilization”,* IBH Publication.

Scholars who shook the world, (2014) "Muhammad Ibn Musa Al-Khwarizmi"Retrieved from:https://m.facebook.com/291202411072477/photos/a.291225714403480/322669644592420/?type=3

Lanka History, (2019). *“Contribution of Muslim Scientists in the Field of Science”*Retrieved from:https://lk-history.blogspot.com/2019/07/blog-post_95.html?m=1

Muslim Education, (2012). *“Mathematical Algorism”*Retrieved from:http://muslimseducation.blogspot.com/2012/04/blog-post_6604.html?m=0

Meteorology, (2022). “***A****l-Khwārizmī****”***Retrieved from:https://www.meteorologiaenred.com/ta/

Encyclopaedia, B. **(2019).** “***A****l-Khwārizmī****:****Muslim mathematician”,* Retrieved from: https://www.britannica.com/biography/al-Khwarizmi

Confebularia, (2022). *“Liber Algebra, the Enlightenment that came from the East”,*Retrieved from:https://confabulario.eluniversal.com.mx/liber-algebrae-algebra-al-juarismi/

BBVA, (2019). *“Al-Juarismi, Mathematical Bridge Between Civilizations”,*Retrived from:https://www.bbvaopenmind.com/ciencia/matematicas/al-juarismi-puente-matematico-entre-civilizaciones/

Alberto Cordero, (2021*). “Al-Khuarismi: The Birth of Algebra”,*Retrived from:http://saberesyciencias.com.mx/2021/05/17/al-juarismi-nacimiento-del-algebra/

Balancia, (2014). *“Andalusian Legacy: Arab Contributions to our Culture”,*Retrived from:https://www.balansiya.com/herencia_al-juarismi.html

Islami Gems, (2022). *“The Greate Muslim Scientist: Muhammed Ibn Musa Al- Khawarizmi”,* Retrived from: https://islamigems.com/great-muslim-scientist-muhammad-ibn-musa-al-khwarizmi/

ISSN: 2455-8834

Volume:08, Issue:02 "February 2023"

Akmal Ayyubi, N. (2006). *"Contribution of Al-Khwarizmi to Mathematics and Geography",*Retrived from: https://muslimheritage.com/contribution-of-al-khwarizmi-to-mathematics-and-geography/

Flint Johnson, (2022). *"Mathematician Al Khwarizmi: Facts & Contributions",*Retrived from:https://study.com/academy/lesson/mathematician-al-khwarizmi-facts-contributions.html

