

THE ROLE OF ISLAMIC EDUCATION IN SCIENCE AND TECHNOLOGY

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Abstract

The whole universe is a source of appreciation as it is created by Almighty Allah. How it functions has been an important issue for Muslims and that is the more reason why they are encouraged to reflect, study and explore the universe in order to prove the Qur'an scriptural prophesy on scientific theories and discoveries. This article delves into the historical contributions of Islamic education to science and technology, the integration of faith and reason in Islamic educational philosophy, and the contemporary impact of this education on scientific research and innovation. By exploring these aspects, we aim to underscore the enduring relevance and potential of Islamic education in contributing to global scientific progress. In the course of discussing the role of Islamic education in science and technology, the contributions of Islamic scholars to various scientific fields, the integration of faith and reason within Islamic educational frameworks, and the contemporary impact of Islamic education on scientific research and innovation were explored. By examining both historical and modern contexts, the paper highlights the continuing influence of Islamic education on the global scientific community and the potential for future advancements. While delving into the conceptual framework, it shows the contributions of the early Muslims to the field of science and technology.

Keywords: Role, Islamic Education, Science and Technology

Introduction

Education is a term that is derived from the word 'educate' which means to raise, educate, and enlighten (Siti & Sinta, 2020). In the dictionary of education, the meaning of education encompasses all processes that enable a person to develop his abilities, attitudes, and forms positive behavior in the society where he or she lives.

Education in Islam is linked with an Arabic word 'ilm' which means knowledge. The first revelation of the Qur'anic verses revealed to Prophet Muhamad (S.A.W.) commanded him repeatedly to read and praise the owner of education and knowledge. It runs thus: *"Read! In the name of your Lord Who creates, Creates man from a clot (of Blood). Read! And thy Lord is the most Bounteous. Who Teaches by the pen. Taught man what he knew not. (Qur'an 96:1-5)*

The above verses declared that the source of all knowledge is God (Allah) Who is the Creator of the universe. Islam stressed the importance of knowledge and education at a period when the

entire world was lost in ignorance and darkness. It prescribes knowledge for mankind not as a special privilege of a particular class but as an essential need for all the created. In this regards, the Qur'an contain numerous references to knowledge and its importance. For instance, Almighty Allah encourages Muslims to pray thus: "And say. My Lord, increase me in knowledge" (Qur'an 20:114). In another verse, the Qur'an praises the learned and their elevation thus: "Say: Are those who know and those who know not alike?" (Qur'an 39:9). In one of the Ahadith of Prophet Muhammad (S.A.W), he said: "The seeking of knowledge is an obligation upon every Muslim male or female" (Narrated by Ibn Majah). He also stressed that there is no age limit for the seeking of knowledge as he further emphasized that: "The seeking of knowledge is from the cradle to graveyard. These evidences from the Qur'an and Hadith become part and parcel of the philosophy of Islam on education irrespective of sex, age, tribe and social status.

The Concept of Islamic Education

According to Siti & Sinta, (2020), Islamic education is a scientific discipline which involve the collection of ideas and intellectual concepts structured and needed through experience and knowledge. Ogunsola (2006) views Islamic Education as process of development of the body and soul in an individual to create the awareness of the existence of the Creator (Almighty Allah) in the individual. It is an all- round development of man (biologically) to enable him know his relationship with and duties towards his Creator, himself and to all other creatures whereby he would be able to carry out those duties accordingly. Saidu (1995) sees Islamic education as a type of education that inculcates in the learners both spiritual and mundane values based on the teaching of the Holy Qur'an and the exemplary life of Prophet Muhammad (S.A.W). Islamic education is not limited to the study of Islamic religion but also, extends to the study of other sciences that are beneficial to man as observed by Nasiru (1980). He asserts that without scientific investigations, religion would have little meaning. Kareem (2002) in his own view sees Islamic education as a body of knowledge given according to the injunctions of Islam. Ogunsola (2006) identified two kinds of Islamic education as: the spiritual and the mundane. The spiritual aspect of Islamic education involves the moral and spiritual development of man to regulate his relationship with his creator, himself and his fellow creatures. In this sense, Islamic education addresses people's mind: Hearts and souls and trying to convince them from within. The mundane or material aspect of Islamic education deals with the development of scientific and technological materials in order to benefit from the World round.

Al-Ghazali (1982) attributed the purpose and goals of acquiring knowledge and its teachings to seeking the good of this world and that of the hereafter in order to enjoy nearness to God, keep company with the Angels and the pious. Sheriff and Asheikh (2005) stated the main objectives of Islamic education to be the attainment of piety and faith, which should be well developed so that it brings the learner nearer to God. This was clearly specified at the first World Conference on Muslim education held in Makkan in 1977 as quoted by Sahadat (1997) thus:

"Islamic Education should aim at the balanced growth of the total personality of man through the training of man's spirit, intellect, his rational self, feeling and bodily senses. Education in Islam should therefore cater for the growth of man in all its aspect; spiritual, intellectual, imaginative, physical, scientific, linguistic; both individually and collectively and motivates all aspects towards goodness and the attainment of perfection. The ultimate aim of Muslim education lies in the realization of complete submission to Allah on the level of the individual, community and humanity at large".

The goal of education for Muslim is therefore to become an obedient and righteous servant of God. There is no difference to the type of education that is obtained through revelation and the type that is acquired through empirical means that is experience and experimentation.

The Concept of Science and Technology

Oxford Dictionary (2003) defines Science as a branch of knowledge involving the systematized observation of and experiment with phenomena. It is also a systematic and formulated knowledge especially of a specified type or on a specified subject. According to Ibn Khaldun (1967), the sciences with which people concern themselves in cities, and which they acquire and pass on through instruction are of two kinds: one that is natural to man and to which he is guided, by his own ability to think, and a traditional kind that he learns from those who invented it. The first kind comprises the philosophical sciences. They are the ones with which man can become acquainted through the very nature of his ability to think and to whose object, problems, arguments and methods of instruction he is guided by his human perceptions, so that he is made aware of the distinction between what is correct and what is wrong in them by his own speculation and research, in as much as he is a thinking human being.

The second kind comprises the traditional, conventional sciences. All of them depend upon information based on the authority of the given law (Religious e.t.c.). Therefore, science is the pursuit of knowledge and understanding of the natural and social World following a systematic methodology based on evidence. It is a system of acquiring knowledge based on empiricism, experimentation, and methodological naturalism as well as to organized body of knowledge that human beings have gained by such research. Science can also be described as comprehending what things and events tell us, what the Divine laws reveal to us, and striving to understand the creator's purpose of creation. Following the above definitions of science, it becomes necessary to observe, read, discern and learn about our surroundings by the decree of, the Exalted Creator to control and have influence over other creatures in order to submit to the will of the Creator (Allah).

The word technology comes from Greek texvorayia (technologies, from texvn (techne), meaning "art, skill, craft and-loyia, (logia), meaning "study of (Merriam 2007). Technology is the making, usage and knowledge of tools, machine, techniques, crafts, systems or order to solve a problem or perform a specific function. According to Merriam, (2007) the term can either be applied

generally or to specific areas which for example include construction technology, medical technology. He attributed the origin of the human species use of technology to the conversion of natural resources into simple tools. The prehistorical discovery of the ability to control fire, increased the available sources of food and the invention of the wheel helped humans in traveling in and controlling their environment. The recent technological developments, including the printing press, the telephone, lap tops and internet, have lessened physical barriers to communication and allowed humans to interact freely on a global scale. However, not all technology has been used for peaceful purposes, the development of weapons of ever-increasing destructive power has progressed throughout history from clubs to nuclear weapons. Many technological products known as pollution and deplete natural resources, to the detriment of the Earth and its environment.

The Role of Islamic Education in Science and Technology

Science, the study of nature is considered to be linked with the concept of Tawheed (oneness of God- faith), as are all branches of knowledge (Muzaffah 2007). In Islam, nature is not seen as a separate entity but rather an integral part of Islam's holistic outlook on God, humanity and the World. This link implies a sacred aspect to the pursuit of scientific knowledge by Muslims as nature itself is viewed in the Qur'an as a compilation of signs pointing to Divine. (Toshiniko 1964). Qur'anic verses encourage thinking, study and contemplation of the universe that surrounds us and is particularly concerned with those sciences that give human beings the ability to benefit from the World around them. Through Islamic education one discovered that God distinguished man from all other animals by an ability to think which He made the beginning of human perfection and the end of man's noble superiority over existing things. This, according to Ibn Khaldun (1967), comes about as follows.

Perception that is, consciousness on the part of the person who perceives is something peculiar to living beings to the exclusion of all other possible and existent things. Living beings may obtain consciousness of things that are outside their essence through the external senses, God has given them, that is, the senses of hearing, vision, smell, taste and touch. Man has this advantage over other beings: he can perceive things outside his essence through his ability to think, which is something beyond his senses. It is the result of (special) powers placed in the cavities of his brain. With the help of these powers, man takes the pictures of the sensibility, applies his mind to them, and thus abstracts from them. (other pictures). The ability to think is the occupation with pictures that are beyond sense perception, and the application of the mind to them for analysis and synthesis.

While encouraging investigation, the Qur'an contains references to a variety of subjects which have been shown to be scientifically accurate. For instance, God statement over 14 centuries ago relates thus: "We will show them our signs in the horizons and within themselves until it becomes clear to them that it is the truth" (Qur'an 41:53). In another, Allah says: "O man! What has made you careless about your Lord, the Most Generous? Who created you, fashioned you

perfectly and gave you due proportion, in whatever form He willed, He put you together (Qur'an 82:6-8)

The above verses indicate that the human body is composed of a number of specialized systems: the skeleton, the muscular system, the digestive system the lymphatic system, the nervous system, the skin, the urinal system and the tasting, smelling, hearing and seeing. Also, God speaks about the stages of man's embryonic development 1,400 years before modern day scientists discovered important information on creation of man and his development thus:

"And indeed We created man (Adam) out of an extract of clay (water and earth) Thereafter We made him (the offspring of Adam) as a Nutfall (mixed drops of the male and female sexual discharge and lodged it) in a safe lodging (womb) of the woman). Then We made the Nutfall into a clot (a piece of thick coagulated blood), then We made out of that little lump of flesh bones, then We cloth the bones with flesh, and then We brought it forth as another creation So Blessed is Allah, the Best of Creators" (Qur'an 23: 12-14).

In line with the above information on human development in the womb. Prophet Muhammad said:

"Every one of you is collected in the womb of his mother for the first forty days, and then he becomes a clot for another forty days, and then a piece of flesh for another forty days. Then Allah sends an angel to write four words: He writes his deeds, time of his death, means of his livelihood, and whether he will be wretched or blessed. Then the soul is breathed into his body.

The Holy Qur'an contains many verses describing creation of the universe; God created heavens and earth in six heavenly days (Qur'an 7:54), God furnished the creation of the earth with mountains, rivers and fruit gardens (Qur'an 41:10). The heavens and earth formed from one mass which had to split (Qur'an 21:30), the seven heavens were created from smoke (Qur'an 41:11) forming layers, one above the other (Qur'an 67:3). The angels inhabit the seventh heavens. The lowest heaven is adorned with lights (Qur'an 41:12), the sun and the moon (which follow a regular path) (Qur'an 71:16, 14:33), the stars and the constellations of the Zodiac (Qur'an 37:6, 15:16 e.t.c.). However, it was with this understanding that the pursuit of science was tolerated in Islam. There has never been an established, scientific fact that contradicted the teachings of all these. Whatever modern science discovers increases the Muslim knowledge of God's magnificent creation. Thus, Islam actively encourages scientific endeavours and the study of God's signs in nature. It also welcomes beneficial technological advances and allows people to enjoy the fruits of human ingenuity. That is why, conflict between science and Islam as a religion is an impossibility for Islam comes from God and so does His system of creation and development.

The modern purely materialistic approach to scientific and technological advancement has indeed granted man a measure of physical comfort, but not mental or spiritual comfort. Islam advocates the incorporation of knowledge within a just and balanced value system where anything beneficial worldly improvement is encouraged and advocated. The essence of Islamic education is to have positive effect on his faith, for knowledge reinforces textual evidence for the

existence of the Almighty creator and assists in appreciation of the many scientific allusions found in the Qur'an. Therefore, Islam strongly urges mankind to study and explore the universe. This invitation to explore and search made Muslims interested in astronomy, mathematics, chemistry, and other sciences.

The Contribution of Early Muslims to Science and Technology

Islamic education has historically played a significant role in the development of science and technology, particularly during the Islamic Golden Age. Islamic education, deeply rooted in the teachings of the Qur'an and Hadith, has always emphasized the pursuit of knowledge as a fundamental aspect of faith. This quest for understanding has historically driven significant advancements in various scientific and technological fields. According to Siti & Sintia, (2020), the period of the history of Islamic education development is classified into four:

- Early education era which is the formation period
- The Golden Age which is the period of the Abbasid empire
- The Decline Era is attributed to the Ottoman Empire where the development of science and reason was neglected for the establishment of military strength. The period was identified with the decline of Islamic era of Science and Technology (Kola-Aderoju,2023)
- The New Era is the twentieth century until now which has shown development in science and technology-based knowledge

During the Islamic Golden Age, from the 8th to the 14th centuries, scholars in the Islamic world made groundbreaking contributions to mathematics, medicine, astronomy, chemistry, and more. These contributions not only advanced their contemporary knowledge but also laid the groundwork for the European Renaissance and modern scientific thought. Their contributions role in science and technology is profound and multifaceted. From historical contributions that laid the foundation for many modern scientific principles to contemporary efforts in research and innovation, Islamic education continues to inspire and drive progress. Emphasizing the harmony between faith and reason, it offers a unique and valuable perspective on the pursuit of knowledge and technological advancement. Today, the legacy of this intellectual tradition continues to influence the educational systems in many Muslim-majority countries.

In the Islamic Golden Age, scholars in the Islamic world made significant contributions to various fields of science and technology. Institutions like the House of Wisdom in Baghdad became centers of learning, where scholars translated and built upon the knowledge of ancient civilizations such as the Greeks, Persians, and Indians. Notable figures like Al-Khwarizmi, Ibn Sina (Avicenna), and Al-Razi made groundbreaking advancements in mathematics, medicine, chemistry, and astronomy. Their contributions are notable with the following:

- **Integration of Science and Faith:** Islamic education emphasizes the harmony between science and faith. The Quran encourages the pursuit of knowledge and understanding of the natural world as a way to appreciate the Creator's work. This holistic approach has led to a culture where scientific inquiry and religious devotion are not seen as mutually exclusive but rather as complementary pursuits.
- **Contemplation and Reasoning:** The Qur'an and Hadith ask Muslims to travel and study the history of nations and their civilization so as to increase in knowledge; it asks further to reason and reflect. All these activities will result in additional facts or information as well as increase in experience. These references and injunctions to think, reflect, explore and learn inspired the early, Muslim scholars to study the heavens. They integrated the earlier works of the Indians, Persians and Greeks into a new synthesis. Some of them are here under discussion with their contributions to science and technology.
- **Mathematics and Astronomy: Al-Khwarizmi (ca. 8th-9th Century):** He was a Persian mathematician (Toomer 1990), geographer and astronomer. He was regarded as the greater mathematician of Islamic civilization. He was instrumental in the adoption of the Indian numbering system, later known as Arabic numerals. He developed algebra, which also had Indian antecedents, by introducing methods of simplifying the equations. According to Lawal (2006), Alkhwarizmi's Algebra contained solutions to linear and quadratic equations. He systematized the treatment of quadratics reducing them to the following basic types: $x^2 = ax$; $x^2 - a$; $ax = b$; $x^2 + ax = b$; $x^2 = ax + b$; $x^2 + b = ax$. Al-Khwarizmi, often referred to as the "father of algebra," introduced the concept of algorithms, which are foundational to modern computer science. Islamic astronomers like Al-Battani and Ibn Al-Haytham made significant strides in understanding the movements of celestial bodies, which later influenced the European Renaissance.
- **Medicine and Chemistry: Ibn Sina (Avicenna) (908-946)** was a Persian physician, astronomer, physicist and mathematician from Bukhara Uzbekistan. He made important astronomical observations, and discussed a variety of topics including the different forms energy can take and the properties of light. He contributed to the development of mathematical techniques such as casting out nine. (Masood 2009). Ibn Sina's comprehensive medical encyclopedia, "The Canon of Medicine," served as a standard reference in Europe for centuries. Al-Razi's work in chemistry and the classification of substances laid the groundwork for modern chemistry and pharmacology.
- **Result Oriented Experiments: Jabir Ibn Hayyan (ca. 8th- 9th Centuries)** who was an alchemist conducted extensive experimentation and produced many works on science and alchemist which have survived to the present day. Jabir described the laboratory techniques and experimental methods of chemistry. He identified many substances including sulfuric and nitric acid. He described processes including sublimation, reduction and distillation. He utilized equipment such as the alembic and the retort.

There is considerable uncertainty as to the actual provenance of many works that are ascribed to him (Masood 2009, Lageikvist 2005).

- **Creations of Automated Devices: The Banu Musa Brothers (Jafar-Muhammad, Ahemad and al-hassan (ca early 9 Century) -** They were three Persian sons of a colorful astronomer and astrologer. They were scholars close to the court of caliph al-Mamum and contributed greatly to the translation of ancient works into Arabic. They elaborated the mathematics of cones and ellipses, and performed astronomic calculations. Mostly notably, they contributed to the field of automation with the creations of automated devices such as the ones described in their *Book of Ingenious Devices* (Lindberg 1978, Serlin 1997).
- **Ibn Ishaq al-Kindi (801-873):** He was a philosopher and polymath scientist heavily involved in the translation of Greek classics into Arabic. He worked to reconcile the conflicts between his Islamic faith and his affinity for reason; a conflict that would eventually lead to problems with his rulers. He criticized the basis of alchemy and astrology, and contributed to a wide range of scientific subjects in his writings. He worked on cryptography for the caliphate and even wrote a piece on the subject of time, space and relative movement (Masood 2009).
- **al-Battani (850-922);** He was an astronomer who accurately determined the length of the solar year. He contributed to numeric tables such as the *Tables of Toledo*, used by astronomers to predict the movements of the sun, moon and planets across the sky. Battani also developed numeric tables which could be used to find the directions of Macca from different locations. Knowing that, the direction of Macca is important for Muslims as this is the direction faced during prayer (Masood 2009).
- **al-Farabi (ca. 879-950):** He was a rationalist philosopher and mathematician who attempted to describe, geometrically, the repeating patterns popular in Islamic decorative motifs. His, book on the subject is title *Spiritual Crafts and Natural Secrets in the Details of Geometrical figures*. (Masood 2009),

al-Zahrawi (936-1013): He was an Andalusian surgeon who is known as the greatest surgeon of Medieval Islam. His most important surviving work is referred to as *al-Tasrif* (Medical knowledge). It is a 30 volume set discussing medical symptoms, treatments and mostly pharmacology. The last volume is a surgical manual describing surgical instruments supplies and procedures. (Masood 2009).

- **Abubakar Zakariyya al-Razi (ca. 854-925):** He is one of the most famous doctors and writers of Islamic History. He was a Persian born in Rey, Iran. He was a polymath who wrote on a variety of topics, but his most important works were in the field of medicine. He discovered the origin of small pox and showed that one could only acquire it once in

one's life, thus showing the existence of the immune system and how it worked. (Macksood 1995). He identified measles and recognized fever was part of the body's defenses.

Modern Implications

In contemporary times, Islamic education continues to play a vital role in science and technology. Universities and research institutions in Muslim-majority countries are investing heavily in STEM (Science, Technology, Engineering, and Mathematics) fields. Countries like Malaysia, Turkey, and the United Arab Emirates are emerging as hubs for scientific research and technological innovation. Modern Islamic educational institutions often integrate religious studies with contemporary scientific curricula. This dual approach equips students with a balanced education, fostering critical thinking and ethical considerations alongside technical skills. Innovation and Research: Islamic educational institutions are also becoming prominent in global scientific research. For instance, King Abdullah University of Science and Technology (KAUST) in Saudi Arabia is at the forefront of research in areas such as sustainable energy, biotechnology, and environmental science.

Challenges and Opportunities

While the contributions of Islamic education to science and technology are notable, there are challenges to be addressed. These include overcoming political and economic instability in certain regions, improving access to quality education, and fostering a culture that encourages scientific inquiry and innovation. However, the potential for growth and development is immense. By continuing to integrate religious values with scientific education, the Islamic world can contribute significantly to global advancements in technology and science.

Conclusion

The role of Islamic education in science and technology is profound and multifaceted. From historical contributions that laid the foundation for many modern scientific principles to contemporary efforts in research and innovation, Islamic education continues to inspire and drive progress. The main sources of Islamic science, the Qur'an and Sunnah strongly urge mankind to study and explore the universe since this is the best way for people to know Allah (God), appreciate His wondrous creations and be thankful for them. Those early Muslims understood the teachings of Islam that useful knowledge is necessary for the benefits of the self and of humanity. Hence, they pursued it to such a degree that they surpassed other nations, in development and productivity and carried the torch of civilization for many centuries. In essence, the goal of education for Muslim is to become an obedient and righteous servant of God. Thus, harmony between faith and reason offers a unique and valuable perspective on the pursuit of knowledge and technological advancement.

Recommendations

Based on the above findings on the role of Islamic education in Science and Technology, Muslims are required to go into all fields of study since Islam covers all branches of knowledge. They need to reflect and thereby travel in search of knowledge as the Holy Prophet Muhammad recommends thus: "Seek knowledge even if it is in China". The above hadith gives credence to the fact that, no place is too far for seeking of knowledge.

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