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THE INFLUENCE OF ISLAM ON SCIENCE AND EDUCATION IN THE MIDDLE AGES

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Abstract. *The article is devoted to the study of the influence of Islam on the development of science and education in the Middle Ages, in particular during the Islamic Golden Age (8th–14th centuries). The work analyzes the establishment of the first Islamic educational institutions, such as madrasahs and universities, their role in preserving and disseminating knowledge, as well as in creating conditions for the development of scientific thought. Considerable attention is paid to the achievements of Muslim scientists in the fields of mathematics, medicine, pharmacology, engineering, and philosophy. In particular, the fundamental works of Al-Khwarizmi in mathematics, Ibn Sina and al-Razi in medicine, al-Jazari in engineering, and Ibn Rushd in philosophy are considered. The role of the translation of Arabic scientific and philosophical texts into Latin in forming the intellectual basis of the European Renaissance is emphasized. The article emphasizes the importance of cross-cultural dialogue, which ensured the transfer of knowledge between the East and the West, contributing to scientific progress and cultural development. The legacy of the Islamic Golden Age is seen as a key factor in the formation of a global scientific tradition that continues to influence modern research and education.*

Key words: *Islamic Golden Age, Middle Ages, science, education, madrasahs, universities, mathematics, medicine, engineering, philosophy, cultural exchange, translations, Renaissance.*

Introduction

During the Middle Ages, Islam played a key role in the development of science and education, leaving an indelible mark on the course of world history. This period, often called the Islamic Golden Age, spans from the 8th to the 14th centuries, when Muslim territories became centers of scholarship, research, and innovation. During this time, Muslim scholars and thinkers gathered, systematized, and significantly expanded the knowledge of the ancient world, making enormous contributions to fields such as mathematics, astronomy, medicine, chemistry, and philosophy.

Their works and discoveries had a profound impact not only on the Islamic world but also on Europe, fostering scientific progress and cultural exchange. The Islamic

Golden Age served as a bridge between the knowledge of the ancient East and West, ensuring the transmission and dissemination of scholarship that laid the foundation for the European Renaissance. An introduction to this era reveals not only the Islamic heritage in the development of science but also emphasizes its significance for world civilization as a whole.

Main text

Islamic educational institutions played an important role in preserving and spreading knowledge during the Middle Ages, becoming the foundation for the development of scientific and academic thought in the Islamic world.

The establishment of the first Islamic educational institutions dates back to the beginning of the Islamic Golden Age. Madrasas (religious schools) and universities began to appear throughout the Muslim world as centers of learning, where not only religious sciences were studied but also mathematics, astronomy, medicine, and philosophy. One of the first and most significant institutions was the University of al-Qarawiyyin in Fez, Morocco, founded in 859 by Fatima al-Fihri. It is considered one of the oldest continuously operating universities in the world. Following it were the University of Al-Azhar in Cairo, Egypt, and many others (Shamsutdynova, 2024b).

Islamic educational institutions influenced the development of science and education. They not only provided in-depth study of Islam but also promoted the development of sciences such as medicine, mathematics, astronomy, and philosophy. Scholars from madrasas and universities made significant contributions to scientific knowledge, creating fundamental works that were later translated into Latin and other languages, contributing to the development of European science during the Renaissance. Islamic educational institutions also played a key role in preserving scientific and philosophical works of the ancient world, including the works of Aristotle and Galen, which had been lost in Europe during the Dark Ages (Shamsutdynova, 2023).

Thus, Islamic educational institutions left an indelible mark on the map of world science and education, becoming a bridge between ancient knowledge and modern scientific progress.

Muslim scholars played a key role in the development of mathematics, introducing significant innovations that influenced all subsequent scientific thought. One of the most important contributions was the development of algebra and geometry, as well as the introduction of the concept of zero and Arabic numerals.

Al-Khwarizmi, who lived in the 9th century, is often called the father of algebra for his fundamental contribution to this field of mathematics. His work *Kitab al-Jabr wa-l-Muqabala* (The Book of Restoration and Balancing) laid the foundations of algebra, presenting methods for solving linear and quadratic equations. These ideas became the basis for the development of algebra as a separate scientific discipline. In geometry, scholars such as Ibn al-Haytham studied optics and perspective and contributed to the understanding of Euclidean geometry, promoting the development of this field of mathematics (Yasin, 2013).

The concept of zero, although introduced in India, was further developed in the Islamic world, where it was fully integrated into the mathematical system. Muslim scholars spread the use of zero, which greatly simplified mathematical calculations and record-keeping. Arabic numerals, also borrowed from India, were refined and adapted by Muslim mathematicians, leading to the creation of the numerical system we use today. This system played a key role in the development of mathematics, making calculations more accessible and understandable.

Thus, the achievements of Muslim scholars in mathematics are fundamental and continue to influence modern science. Their work not only advanced mathematical knowledge but also provided the tools necessary for the development of fields such as astronomy, engineering, and finance, thereby promoting scientific and cultural exchange between East and West.

Muslim physicians and pharmacologists made great contribution in the development of medical science, especially during the Islamic Golden Age. Their work had a significant impact on medicine, preserving and expanding the knowledge of ancient times and laying the foundation for future generations of doctors and scientists.

Muslim physicians such as Ibn Sina (Avicenna) and al-Razi (Rhazes) made significant contributions to medicine by creating major works that were used in Europe

and the Arab world for centuries. Ibn Sina, whose work *The Canon of Medicine* is considered one of the most important medical texts of all time, systematized knowledge about medicine, including descriptions of diseases, their treatment, and surgical methods. Al-Razi wrote the great encyclopedia *Al-Hawi* (The Comprehensive Book), also known as *The Great Canon of Medicine*, which contains detailed descriptions of medical conditions and their treatments (Muliadi, & Nasri, 2023).

Muslim scholars also played a key role in preserving and spreading ancient Greek medical knowledge. They translated, studied, and commented on the works of Hippocrates, Galen, and other ancient Greek physicians, thereby preserving this knowledge for future generations. These translations and commentaries contributed to the development of medical science in medieval Europe when many of these texts were translated from Arabic into Latin (Shamsutdynova, 2024a).

Muslim scholars also made significant contributions to the development of pharmacology, describing the properties and uses of numerous medicinal plants and minerals. Ibn al-Baytar, for example, compiled a large reference work on plants and medicines that remained an authoritative source for many centuries. These works expanded pharmacological knowledge and contributed to the development of more effective treatment methods (Aderibigbe, 2023).

Muslim physicians and pharmacologists of the Middle Ages created a legacy that continues to influence medical science to this day. Their efforts in preserving, expanding, and transmitting medical knowledge represent an invaluable contribution to the development of global medicine and pharmacology (Amini, 2022)..

During the Islamic Golden Age, Muslim scientists and engineers made significant discoveries and developments in engineering and technology. Their contributions cover many areas, including hydraulic engineering, mechanical engineering, agriculture, and water supply, significantly influencing the development of these sciences (Akbar, 2022).

Muslim engineers succeeded in creating complex hydraulic systems and mechanisms. They developed the first water pumps that allowed efficient use of water resources for irrigation and water supply. In addition, they invented various types of

water wheels and turbines used for mills and water lifting. The engineer al-Jazari created many innovative mechanical devices, including the first automatic clock and mechanical robots, which were highly advanced technologies of the time (Ismail, 2022).Innovations in agriculture and water supply also deserve special attention.

Muslim scholars made significant contributions to the development of irrigation systems, including qanats and underground channels, which made it possible to distribute water in arid regions. These technologies contributed to improved agricultural productivity and food security. Methods of soil cultivation, crop rotation, and yield improvement were also developed, influencing agricultural practices .

Muslim innovations in engineering and technology were motivated by the desire to improve people's lives and make maximum use of available resources (Pandia, & Drew, 2023).. Their achievements formed the basis of many modern technologies and continue to inspire scientists and engineers worldwide. The contribution of Muslim scholars to the development of engineering and technology is invaluable and emphasizes the importance of cross-cultural exchange and cooperation in advancing scientific progress.

Islamic philosophy had a significant influence on Western thought, especially in the Middle Ages when many Islamic texts were translated into Latin. This cultural and intellectual exchange contributed to the development of philosophy, science, and art in Europe.

Islamic philosophers such as al-Farabi, Ibn Sina (Avicenna), and Ibn Rushd (Averroes) made significant contributions to the development of logic and metaphysics, influencing the further development of these disciplines in Western Europe. Al-Farabi, known for his works on Aristotelian logic, strengthened the foundations of analytical thinking. Ibn Sina developed concepts of existence and essence, which later appeared in the works of Western philosophers. Ibn Rushd influenced medieval Christian philosophy by offering an interpretation of Aristotelian philosophy consistent with Islamic beliefs.

In the 12th–13th centuries, thanks to translators such as Gerard of Cremona, many Islamic philosophical and scientific works were translated from Arabic into Latin.

These translations deeply influenced European thought, especially the development of scholasticism and Renaissance philosophy. Islamic works on astronomy, mathematics, and medicine became important sources of knowledge for European scholars. Moreover, the ideas of Islamic philosophers about the unity of reason and faith paved the way for the development of Renaissance humanism.

The influence of Islamic philosophy on the West demonstrates the importance of cross-cultural dialogue and the exchange of ideas. Islamic scholars and philosophers not only preserved and developed the heritage of ancient civilizations but also enriched European culture, providing intellectual impetus for the development of science and philosophy in subsequent centuries.

Conclusion

The Islamic Golden Age left an indelible mark on the history of science and education, demonstrating the profound influence of Islam on the development of world civilization during the Middle Ages. Muslim scholars and philosophers not only preserved ancient knowledge but also significantly expanded it, contributing to fields such as mathematics, astronomy, medicine, engineering, and philosophy. The establishment of madrasas and universities promoted the dissemination of knowledge and the training of future generations of scholars.

Islamic innovations had a tremendous impact on the European Renaissance and subsequent scientific development, emphasizing the importance of cultural and intellectual exchange.

The legacy of the Islamic Golden Age continues to inspire modern scholars and researchers, reminding us that progress in science and culture is often the result of the joint efforts of many civilizations. Studying this period helps us understand how the interaction of different cultures enriched human knowledge and culture, highlighting the importance of tolerance and openness in scientific inquiry and education.

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Abstract. *Within the concept of communicative competence, pragmatic competence occupies an important place as one of its key components. This component is responsible for the speaker's ability to build an expression that is consistent with his intentions, the socio-communicative situation and the cultural expectations of the interlocutor. It ensures the semantic and functional relevance of speech acts, which is especially important in intercultural interaction, where the lack of pragmatic correspondence can lead to misunderstandings or communicative failures.*

Within the model of communicative language ability, pragmatic competence is singled out as an autonomous subcategory. It encompasses both knowledge of language tools for the implementation of certain communicative functions and awareness of social norms that regulate communication in a specific cultural environment. Thus, pragmatic competence encompasses both the functional and social dimensions of speech behavior, emphasizing their integration into the general system of language training of the individual. Both models demonstrate a consistent scientific tendency to interpret pragmatic competence as a necessary tool for effective and culturally grounded communication in a foreign language.

Particular attention is paid to the intercultural aspect of pragmatic competence and the importance of developing in students the ability to recognize and correctly interpret pragmatic norms inherent in different cultural environments. The discrepancy between the pragmatic expectations of the speaker and the addressee can cause communicative barriers or even conflicts. In this regard, the need for systematic teaching of pragmatic strategies in the context of intercultural competence, which ensures not only the grammatical correctness of the statement, but also its social acceptability and effectiveness in specific communication conditions should be emphasized. This approach corresponds to modern trends in the methodology of teaching foreign languages, where pragmatic competence is increasingly considered as a central condition for the successful integration of the individual into the global communicative space.

Modern Ukrainian and foreign studies confirm that pragmatic competence has a multidimensional nature: it integrates speech, sociocultural, cognitive and interpersonal factors, and its effective formation is impossible without taking into account the principles of intercultural communication, the development of critical thinking and flexible application of knowledge in

changing communication conditions. In this regard, the inclusion of a pragmatic component in the system of teaching foreign languages is not only a pressing requirement of the time, but also a necessary condition for achieving real sociolinguistic integration of students into the global communicative space.

Pragmatic competence in the process of teaching English occupies an extremely important place, since it is it that ensures the ability of students to interact effectively in real communicative situations. This component is not just a supplement to linguistic or lexical-grammatical training, but a fundamental component that forms in students the ability to consciously select language tools taking into account the social roles of communication participants, their intentions, expectations, as well as cultural contexts. The formation of pragmatic competence requires the creation of such learning conditions that would contribute not only to the assimilation of linguistic material, but also to the development of the ability to critically understand the situation, predict possible reactions of the interlocutor and choose appropriate strategies of speech behavior.

***Keywords**: communicative competence, pragmatic competence, intercultural interaction, socio-communicative situation, intercultural aspect of pragmatic competence.*

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