

The Pedagogical Legacy of Mirzo Ulugh Beg: Its Relevance to Contemporary Primary Education

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Article Info

Received: 24 June 2026

Revised: 20 July 2026

Accepted: 21 July 2026

Online Version: 10 August 2026

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Abstract. This study aims to analyze the pedagogical aspects of Mirzo Ulugh Beg's scientific activities and examine their relevance to contemporary primary education. The study employs a qualitative descriptive approach through literature review and analysis of historical and educational sources related to Ulugh Beg's scientific and educational legacy. The findings indicate that Ulugh Beg made significant contributions to the development of a scientific school through the establishment of educational institutions, the development of mentorship traditions, and the promotion of research-based learning. His educational practices emphasized scientific inquiry, systematic observation, critical thinking, and the transmission of knowledge through direct academic guidance. These principles remain relevant to contemporary primary education, particularly in fostering students' curiosity, critical thinking, scientific attitudes, and independent learning. Thus, Ulugh Beg's educational legacy provides valuable pedagogical insights for the development of research-oriented and student-centered learning in modern primary education.

Keywords: *Mirzo Ulugh Beg, education, scientific school, mentorship, research-based learning, primary education.*



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Journal Homepage

<https://ejournal.aripendis.com/edulogia>

How to cite:

Dilnoza, A. (2026). The Pedagogical Legacy of Mirzo Ulugh Beg: Its Relevance to Contemporary Primary Education. *Edulogia: Jurnal Pendidikan dan Keislaman*, 1(5), 255-261.

Published by:

Yayasan Pendidikan Islam Bintang Nusantara

INTRODUCTION

Education plays an essential role in developing intellectually capable, responsible, and morally mature generations. In this context, the scientific and educational legacies of historical figures can serve as important sources for understanding the development of knowledge, learning traditions, and educational values. One of the prominent figures whose legacy remains relevant to the history of science and education in Central Asia is Mirzo Ulugh Beg (Muhammad Tarag'ay ibn Shahrukh), a Timurid ruler, astronomer, mathematician, and scholar who lived during the fifteenth century. He is widely

recognized as one of the major intellectual figures of the Eastern Renaissance and made significant contributions to the development of astronomy, mathematics, and scientific education.

The significance of Mirzo Ulugh Beg extends beyond his achievements in astronomy and mathematics. His contribution can also be viewed from a pedagogical perspective, particularly through his efforts to establish a scientific learning environment, develop scholarly communities, support talented young people, and promote relationships between teachers and students. Although Ulugh Beg did not formulate his pedagogical ideas in a separate educational treatise, his scientific activities and organizational practices demonstrate several principles of education and intellectual development. His legacy therefore provides an important historical perspective for understanding education based on scientific inquiry, systematic observation, intellectual interaction, and practical experience.

A significant manifestation of this educational vision was the establishment of the Ulugh Beg Madrasa in Samarkand. Constructed during 1417–1420, the madrasa became an important center of higher learning in its period, where mathematics, astronomy, logic, and philosophy were taught extensively. Ulugh Beg personally supervised the educational process and emphasized the creation of an academic environment, the development of talented students, and the continuation of the teacher–student tradition. These characteristics indicate that education in his scientific environment was not limited to the transmission of theoretical knowledge but also involved intellectual interaction, observation, practice, and scholarly collaboration.

The educational principles reflected in Ulugh Beg's activities are relevant to contemporary education. His emphasis on scientific observation, systematic learning, support for talented students, and the integration of theory and practice corresponds with several approaches applied in modern education, including research-based learning and STEM education. In particular, scientific observation and accuracy can help develop responsibility, discipline, logical thinking, and intellectual precision among learners.

Therefore, this study aims to analyze the pedagogical dimensions of Mirzo Ulugh Beg's scientific activities and to examine the relevance of his educational legacy to contemporary primary education. The discussion focuses on four interconnected dimensions: the development of a scientific school and academic environment, scientific observation and accuracy, the teacher–student tradition, and the integration of scientific principles into contemporary learning. Through this analysis, Ulugh Beg's historical legacy can be understood not merely as a contribution to astronomy but also as an educational model emphasizing scientific thinking, intellectual collaboration, discipline, and a culture of inquiry.

RESEARCH METHOD

This study employed a qualitative descriptive approach based on literature review and analysis of historical and educational sources related to Mirzo Ulugh Beg's scientific and educational activities. A qualitative approach was considered appropriate because the study focuses on interpreting educational values and pedagogical principles reflected in historical practices rather than measuring variables quantitatively.

The analysis focused on information concerning Ulugh Beg's scientific activities, the establishment and development of the Ulugh Beg Madrasa in Samarkand, his scientific community, teacher–student relationships, research practices, and the educational principles that can be derived from these activities. The source material indicates that Ulugh Beg developed a scientific environment in Samarkand by bringing together

prominent scholars, including Qazi Zada al-Rumi, Jamshid al-Kashi, and Ali Qushji. Their collaborative activities included astronomical observations and mathematical calculations, providing an important basis for examining the relationship between scientific practice and education.

The data were analyzed descriptively by identifying recurring pedagogical themes in the available historical material. These themes included scientific inquiry, systematic observation, accuracy, theory–practice integration, mentorship, individual development, intellectual communication, and academic collaboration. The identified themes were subsequently interpreted in relation to contemporary primary education, particularly learning activities that encourage students to work collaboratively, investigate problems, ask questions, conduct projects, and connect theoretical knowledge with practical experience.

The analysis also considered the historical sources cited in the original material, including works associated with E. S. Kennedy, S. F. Starr, and G. Saliba, as well as the references to Karimov, Ahmedov, and the *O'zbekiston Milliy Ensiklopediyasi*. The study does not claim to conduct empirical classroom research; rather, it interprets the pedagogical implications of Ulugh Beg's scientific and educational legacy based on the available literature.

RESULTS AND DISCUSSION

Ulugh Beg's Scientific School as an Educational Model

The analysis shows that one of Mirzo Ulugh Beg's most important educational contributions was the establishment of a scientific school and academic environment in Samarkand. The establishment of the Ulugh Beg Madrasa in the early fifteenth century provided an institutional setting in which mathematics, astronomy, logic, and philosophy could be studied systematically. The madrasa was not merely a place for transmitting knowledge but also functioned as part of a broader intellectual environment in which scholars and students could engage in scientific and philosophical discussions.

Ulugh Beg's role in supervising the educational process and supporting talented young people demonstrates the importance of academic leadership in developing a sustainable scientific culture. His scientific school was strengthened through collaboration with prominent scholars such as Qazi Zada al-Rumi, Jamshid al-Kashi, and Ali Qushji. Their collective work illustrates that scientific advancement can be supported by an academic environment based on dialogue, collaboration, observation, and mathematical reasoning.

From a contemporary educational perspective, this model highlights the importance of creating learning environments in which students are not passive recipients of information. Primary education can incorporate this principle through collaborative learning, group activities, project-based learning, problem-solving tasks, and opportunities for students to communicate their ideas. Such approaches can encourage learners to become active participants in the learning process.

Scientific Inquiry, Observation, and Accuracy

Another important finding concerns Ulugh Beg's emphasis on observation and accuracy. His scientific achievements were closely associated with systematic astronomical observations and mathematical calculations. The *Zij-i Sultani*, identified in the source as his major scientific work, contains astronomical tables, trigonometric calculations, and a catalogue of stars. The work was produced through long-term scientific observation and became an important astronomical reference.

The emphasis on systematic observation demonstrates an educational principle that remains important today: knowledge should be developed through evidence, careful investigation, and intellectual discipline. Scientific observation requires patience, consistency, precision, and responsibility. These characteristics are not only relevant to advanced scientific research but can also be introduced at an appropriate level in primary education.

In primary classrooms, this principle can be implemented through simple observation activities, experiments, classification tasks, measurement exercises, and inquiry-based questions. Students can be encouraged to observe phenomena, record findings, compare results, and formulate conclusions. Such activities can gradually develop logical thinking and intellectual accuracy. The source emphasizes that scientific accuracy, patience, systematic observation, responsibility, discipline, intellectual precision, and logical thinking are valuable qualities for contemporary education.

Integration of Theory and Practice

Uluh Beg's scientific activities also demonstrate the importance of connecting theoretical knowledge with practical investigation. His interest in mathematics and astronomy was accompanied by direct observation and scientific calculation. Consequently, learning within his scientific environment involved more than the acquisition of abstract concepts; knowledge was strengthened through practical scientific activity.

This principle is particularly relevant to contemporary educational approaches that emphasize experiential and inquiry-based learning. Students are more likely to understand concepts meaningfully when theoretical explanations are connected with concrete experiences. At the primary-school level, teachers can therefore design activities that allow learners to apply mathematical concepts, observe natural phenomena, conduct simple investigations, and solve problems based on real situations.

The integration of theory and practice also corresponds with the development of STEM-oriented education. The source specifically identifies scientific learning, systematic thinking, and the relationship between theoretical knowledge and practical experience as principles that are consistent with contemporary STEM education.

The Teacher–Student Tradition and Individual Development

The teacher–student tradition represents another central pedagogical dimension of Uluh Beg's scientific legacy. Knowledge in his academic environment was developed through interaction between scholars and students, while scientific activities were supported by practical learning and intellectual communication. The source identifies three important pedagogical principles within this tradition: student-centered education, development of individual abilities, and the formation of a culture of scientific communication.

These principles have clear relevance to contemporary primary education. Students have different abilities, interests, learning speeds, and ways of responding to educational activities. Therefore, teachers need to provide opportunities for individual development while maintaining collaborative learning experiences. The teacher's role is not limited to delivering content but also includes mentoring, facilitating inquiry, encouraging students to ask questions, and supporting their intellectual development.

In practical classroom settings, these principles can be implemented through small-group activities, project-based learning, problem-based situations, and question-and-answer activities. The source explicitly identifies these strategies as contemporary

forms through which the teacher–student principles reflected in Ulugh Beg's educational legacy can be applied.

Scientific Culture, Global Thinking, and Contemporary Education

Ulugh Beg's legacy also demonstrates the broader cultural significance of scientific education. His scientific school brought together scholars who contributed to a collaborative intellectual environment, while his astronomical works influenced scientific traditions beyond Central Asia. The source notes that his astronomical tables were used in European scientific contexts and associates his legacy with global thinking, scientific collaboration, and intercultural communication.

This dimension is particularly significant in contemporary education because scientific knowledge increasingly develops through international cooperation and intercultural exchange. Introducing students to historical scientific figures such as Ulugh Beg can therefore serve not only to develop scientific knowledge but also to cultivate respect for intellectual diversity and the contributions of different civilizations.

For primary education, the historical narrative of Ulugh Beg can be presented through age-appropriate interdisciplinary learning. For example, mathematics, science, history, and character education can be connected through activities concerning astronomy, measurement, observation, scientific perseverance, and the history of knowledge. Such integration can help students recognize that scientific development is a collective human achievement.

Relevance to Contemporary Primary Education

Overall, the analysis indicates that Ulugh Beg's scientific and educational legacy contains several principles that remain applicable to contemporary primary education. These include scientific inquiry, systematic observation, accuracy, theory–practice integration, mentorship, collaborative learning, individual development, and respect for knowledge. Although Ulugh Beg did not directly formulate a methodology for modern primary education, his scientific activities provide conceptual foundations that can be adapted to contemporary pedagogical practices.

The relevance of his legacy should therefore not be understood as a direct transfer of a fifteenth-century educational system into modern classrooms. Instead, his principles can be reconstructed and adapted according to contemporary educational needs. Scientific inquiry, for instance, can be translated into simple classroom investigations; mentorship can be reflected in supportive teacher–student relationships; and scientific collaboration can be implemented through group projects and cooperative learning.

The central educational value of Ulugh Beg's legacy lies in the cultivation of a learning culture that respects knowledge and encourages students to investigate, question, observe, and think systematically. Such a culture can contribute to the development of students' scientific thinking, responsibility, discipline, and intellectual curiosity. In this respect, Ulugh Beg's legacy remains relevant as a historical and pedagogical resource for strengthening contemporary primary education.

CONCLUSION

The analysis demonstrates that Mirzo Ulugh Beg's contribution to education extends beyond his achievements in astronomy and mathematics. Through the establishment of the Ulugh Beg Madrasa, the development of a scientific school, the support of scholarly collaboration, and the cultivation of teacher–student relationships, he contributed to the formation of an academic environment based on scientific inquiry

and intellectual development. His scientific practices emphasized systematic observation, accuracy, discipline, mathematical reasoning, and the integration of theoretical knowledge with practical investigation.

These principles remain relevant to contemporary primary education. Scientific inquiry can encourage students to observe, investigate, question, and draw conclusions; the integration of theory and practice can strengthen meaningful learning; and the teacher–student tradition can support individual abilities and collaborative learning. Likewise, the development of an academic culture based on knowledge, communication, and scientific cooperation can foster responsibility, logical thinking, intellectual curiosity, and respect for learning.

Therefore, Mirzo Ulugh Beg's legacy can be regarded as a valuable historical and pedagogical resource for contemporary education. Its relevance does not lie in reproducing the educational system of the fifteenth century, but in adapting its fundamental principles to modern learning contexts. Scientific thinking, mentorship, systematic observation, collaboration, and the connection between theory and practice can provide meaningful foundations for developing primary education that encourages students to love knowledge, engage in inquiry, and develop intellectual and moral responsibility.

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