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SCIENTIFIC THEORETICAL FOUNDATIONS OF USING THE HERITAGE OF OUR SCIENTISTS IN THE FORMATION OF ENVIRONMENTAL EDUCATION IN PRIMARY GRADES

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Abstract: This article examines the scientific and theoretical foundations for integrating the legacy of prominent scientists into the development of environmental education for primary school students. It explores the pedagogical value of national scientific heritage, particularly the contributions of historical scholars such as Al-Biruni, Ibn Sina, and others whose ecological insights and nature-based philosophies can serve as a foundation for shaping environmental consciousness from an early age. The article also discusses strategies for curriculum integration, developmentally appropriate pedagogical methods, and the role of cultural identity in fostering responsible environmental behavior in young learners.

Keywords: Environmental education, primary education, scientific heritage, Al-Biruni, Ibn Sina, ecological thinking, national scientists, pedagogy, sustainable development, cultural identity.

INTRODUCTION

Environmental education has become a pressing necessity in the modern world due to escalating ecological crises, climate change, and the deterioration of natural ecosystems. Instilling ecological awareness and responsibility from a young age is critical in forming environmentally literate citizens. In this context, the legacy of our historical scientists offers a rich pedagogical resource that can make environmental education more meaningful, culturally rooted, and intellectually stimulating.

The great thinkers of the East — such as Abu Rayhan Al-Biruni, Abu Ali Ibn Sina, Mahmud Zamakhshariy, and others — explored natural phenomena with scientific rigor and philosophical depth centuries before ecological science emerged as a formal discipline [1, 2]. Their works reflect an integrated view of humanity and nature, responsibility toward natural resources, and a harmonious worldview that aligns closely with the objectives of modern environmental education.

This article aims to present the theoretical foundations for using this heritage in teaching environmental concepts to primary school students, highlighting how the values, insights, and intellectual contributions of our scholars can enhance both the effectiveness and relevance of ecological education.

MATERIALS AND METHODS

The legacy of scientists such as Al-Biruni and Ibn Sina presents a unique opportunity to merge cultural education with environmental instruction. For example:

Al-Biruni wrote extensively on geography, the behavior of water, the properties of minerals, and the interdependence of natural systems. His descriptions of tides, the water cycle, and soil structures align with modern environmental science [1].

Ibn Sina emphasized the balance of natural elements and discussed the interconnection between human health and the environment in his work Canon of Medicine [2].

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By studying these contributions, students not only gain scientific knowledge but also develop a sense of respect for their intellectual heritage. This cultural connection fosters identity, belonging, and responsibility toward the natural world.

RESULTS AND DISCUSSION

Environmental education in primary school is grounded in several key pedagogical theories:

Constructivist theory (Piaget, Vygotsky): Children learn best through interaction with their environment. Using local examples, historical figures, and real-life observations helps construct meaningful knowledge.

Holistic education: Education must address the intellectual, emotional, and ethical dimensions of the child. Teaching about nature from the perspective of cultural values nurtures not only knowledge but also care and empathy.

Moral development theory (Kohlberg): Exposure to the ethical teachings of historical scientists reinforces the importance of ethical behavior toward the environment.

These theories support the integration of scientific heritage as a bridge between cultural learning and environmental responsibility.

The practical implementation of our scientists' legacy into the primary curriculum involves multiple pedagogical strategies [5]:

Approach	Example Activity
Storytelling and biographies	Narrating the life of Al-Biruni and his exploration of rivers and mountains
Project-based learning	Creating a nature observation journal inspired by Ibn Sina's writings on plants
Experiential learning	Outdoor activities reflecting the harmony of nature as seen in medieval science
Arts-integrated learning	Drawing or modeling environmental concepts based on historical diagrams and maps
Inquiry-based learning	Students ask and investigate questions about the Earth, as Al-Biruni once did

These approaches ensure that heritage is not merely historical content but a living, dynamic element of students' learning experience.

Teaching environmental education through the lens of scientific heritage allows for the transmission of several core values:

Respect for nature: Seen in the writings of early scholars who viewed the natural world as a divine trust.

Sustainability and moderation: Lessons from scholars emphasizing balance and ethical use of resources.

Cultural continuity: Using historical figures fosters pride and continuity between generations.

These values align with global educational goals such as UNESCO's Education for Sustainable Development (ESD), which emphasizes the role of local cultures in global sustainability efforts.

While the benefits of integrating scientific heritage into environmental education are numerous, several challenges must be addressed:

Lack of curriculum materials that effectively blend heritage and modern ecology;

Insufficient teacher training on historical-scientific content and methods;

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Limited awareness of the ecological contributions of national scholars among educators.

Recommendations include:

Developing teaching aids and textbooks that include stories, quotes, and scientific insights from historical scholars;

Organizing professional development workshops for primary teachers;

Including heritage-based environmental modules in teacher training institutions;

Promoting interdisciplinary collaboration between historians, ecologists, and educators.

Eco-pedagogy, an emerging educational paradigm, emphasizes ecological consciousness, ethical interaction with the environment, and sustainable living as key pillars of education. While largely shaped by contemporary environmental movements, many of its principles can be traced back to the wisdom of early scientists and philosophers from the Islamic Golden Age and Central Asian heritage.

Historical scholars like Al-Farabi, Al-Biruni, and Ibn Sina approached nature not merely as an object of study but as a living system interconnected with human existence. Their reflections on balance in ecosystems, ethical responsibility, and the beauty of the natural world provide a moral-philosophical basis for eco-pedagogy.

In post-colonial and culturally diverse societies, environmental education must also serve as a medium for cultural identity formation. Using the heritage of native scientists empowers students by:

Connecting ecological knowledge to their own historical and cultural context, making learning more relevant and relatable.

Encouraging pride in national contributions to global science, reducing the Western-centric narrative of environmentalism.

Reinforcing a worldview in which nature is not dominated but respected — a perspective deeply embedded in many traditional philosophies.

By presenting science through the lens of indigenous knowledge systems, educators can foster both environmental awareness and cultural confidence among learners.

Early childhood is the ideal time to form foundational views about the world. Teaching children to see themselves as part of — not separate from — the natural environment is essential. Classical scholars offer timeless lessons in this regard:

The unity of nature and spirit in many medieval scientific texts mirrors current ecological philosophy.

The idea that human well-being is inseparable from environmental health was already emphasized by thinkers like Ibn Sina and Al-Ghazali.

Educating through the beauty of creation, as celebrated in historical poetry and science, fosters awe and gratitude — emotional keys to lifelong environmental responsibility.

Teachers can use these humanistic elements to enrich environmental education with values, imagination, and a sense of ethical duty toward nature.

One of the most effective ways to apply historical scientific heritage in environmental education is through interdisciplinary learning. Instead of treating science, history, ethics, and literature as separate domains, primary school educators can connect these areas around a central ecological theme.

CONCLUSION

The heritage of our great scientists is not merely a historical record — it is a living source of knowledge, wisdom, and cultural identity. When integrated into environmental education in

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primary grades, this heritage enriches both content and context, nurturing environmentally responsible, culturally grounded, and intellectually curious students.

Educators have a powerful opportunity to shape young minds not only to understand nature but to respect and protect it — with the guidance and inspiration of the scholars who once saw the Earth as a sacred trust. Embracing this approach can ensure that the environmental education of the future is both scientifically sound and deeply rooted in the values of the past.

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