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A COMPARATIVE-EPISTEMOLOGICAL ANALYSIS OF ENVIRONMENTAL EDUCATION AND UPBRINGING PROCESSES IN THE USA, FRANCE, AND UZBEKISTAN: PARADIGMS, INSTITUTIONAL MECHANISMS, AND INTERSECTORAL INTEGRATION

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Abstract
This comparative study analyzes the epistemological foundations, institutional governance, and didactic mechanisms of environmental education and upbringing in the USA, France, and the Republic of Uzbekistan amid the global ecological crises of the Anthropocene. The paper contrasts three distinct models: the decentralized, pragmatist "Place-Based Education" (PBE) approach in the USA aligned with NAAEE and EPA standards; France's centralized, secular, and interdisciplinary "Éducation à l'environnement et au développement durable" (EEDD) framework alongside the "E3D" eco-school certification system; and Uzbekistan's continuous environmental education system rooted in Article 49 of the revised Constitution, environmental legislation, and the intellectual-moral heritage of Eastern thinkers. Drawing on comparative, systemic-functional, and hermeneutic methods alongside foundational works by Smith & Williams (1999), Zverev (1980), and Nigmatov (2004), the study offers scientific conclusions and practical recommendations for advancing active environmental citizenship and project-based learning in Uzbekistan.

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Keywords: environmental education, environmental upbringing, comparative pedagogy, epistemological paradigm, Sustainable Development Goals, Place-Based Education, EEDD, environmental law, continuous education, ecological culture, biosphere, institutional mechanisms.

Introduction

In the opening decades of the twenty-first century, human civilization has entered a decisive, highly contradictory, and perilous phase in the evolution of the Earth's biosphere—the Anthropocene era. The unprecedented acceleration of anthropogenic pressure is disrupting planetary geochemical and biological equilibrium. Global climate change driven by the accumulation of greenhouse gases in the atmosphere, the threatened extinction of millions of biological species, the sharp depletion of freshwater resources, soil degradation, desertification, and the contamination of the world's oceans with microplastics and toxic waste are no longer merely localized sanitation issues; rather, they signal the potential collapse of the biosphere, which serves as the very foundation of our civilization's existence. This global ecological crisis demonstrates that the utilitarian-consumerist and technocratic development paradigm established during the era of traditional industrialization has reached its natural limits.

According to the doctrine of the biosphere and noosphere substantiated by V. I. Vernadsky, humanity—through its intellectual and material power—has become a major geological force. The noosphere represents a new evolutionary stage in which human reason and responsible activity are fully harmonized with the laws of the biosphere. Reaching this stage cannot be achieved solely through technological modernization; it requires, first and foremost, a fundamental transformation of human worldview, axiological values, and ecological culture. The principle of the "ecological imperative" advanced by N. N. Moiseev demands that all social, economic, and engineering activities be strictly aligned with the carrying capacity of the biosphere. Consequently, the education system must evolve beyond being a mere institution for transmitting ready-made knowledge and become a strategic intellectual foundation that restores the individual's ontological connection with nature and fosters a culture of sustainable development in society.

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However, across different regions of the world today, the philosophical, socio-political, and institutional foundations of environmental education and upbringing vary considerably. Specifically, because governance traditions, cultural heritage, and economic conditions differ across North America, Western Europe, and Central Asia, distinct models of environmental pedagogy have emerged. Guided by its unique federalist structure, deep-rooted tradition of pragmatism, and decentralized school system, the United States has championed an approach that directly links education to the local living environment. Relying on its republican secularism, strong centralized state apparatus, and analytical philosophical traditions, France has institutionalized ecological knowledge as an integrated, cross-curricular discipline. Meanwhile, the Republic of Uzbekistan is building a national system of continuous environmental education grounded in the complex ecological realities of Central Asia (most notably the Aral Sea tragedy), a millennia-old Eastern philosophy of reverence for nature, and constitutional and legal reforms enacted during the period of independence.

The process of environmental education and upbringing is not confined to the rote memorization of elementary facts about nature. It encompasses three organically interconnected components: the cognitive-epistemological component (understanding ecological laws, matter-energy cycles, and the complex interdependencies of the biosphere), the axiological-value component (recognizing the intrinsic value of nature, biocentric ethics, personal responsibility, and empathy toward the natural world), and the praxeological-behavioral component (reducing waste, conserving energy and water, complying with environmental laws, and participating actively as citizens in green initiatives). The balanced development of this triad defines an individual's ecological culture. A pressing challenge facing pedagogical science is that, in many educational institutions, environmental issues are still taught merely as isolated topics within biology or geography, without comprehensive integration with economics, law, technology, literature, and philosophy. As a result, young people fail to grasp the deep socio-political and economic roots of ecological problems. In this regard, comparing the experiences of states with diverse civilizational and governance systems and analyzing their achievements and shortcomings to identify universal patterns and best practices constitutes one of the most urgent tasks of comparative pedagogy.

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An examination of international practice reveals that countries such as the USA, France, and the Republic of Uzbekistan have developed distinct historical-philosophical, socio-political, and cultural foundations for environmental education and upbringing. These three models differ markedly in their governance architecture, curriculum structure, and pedagogical strategies:

In the U.S. experience, environmental education is grounded in pragmatism (John Dewey's concept of "learning by doing") and social constructivism. Education is not forced into a uniform mold by the federal center; instead, each state and school district implements the "Place-Based Education" (PBE) concept tailored to its local ecosystem and community needs (Smith & Williams, 1999, pp. 42–115). Students step outside the classroom to investigate the environmental challenges of their own city, river, or forest through hands-on scientific inquiry and practical community projects.

In the French Republic, an entirely different—highly centralized, normative-regulatory, and philosophical-theoretical—approach prevails. In French education, ecology is not separated out as an isolated subject; rather, it is rigorously integrated across all academic disciplines under the "Éducation à l'environnement et au développement durable" (EEDD) program (Zverev, 1980, pp. 54–112). This model places strong emphasis on cultivating critical analysis, civic-legal responsibility, and a scientific-philosophical worldview in students, while transforming schools into ecologically sustainable communities under the "E3D" certification label.

In the Republic of Uzbekistan, the process of environmental education and upbringing is advancing as a continuous educational chain imbued with the principles of independent statehood, robust constitutional guarantees, and the rich spiritual and moral heritage of the nation (Nigmatov, 2004, pp. 88–142). The supreme constitutional enshrinement of citizens' right to a favorable environment in Article 49 of the revised Constitution of the Republic of Uzbekistan has endowed environmental education with a new legal-epistemological dimension. At the same time, the works of great encyclopedic scholars such as Abu Rayhan al-Biruni, Ibn Sina (Avicenna), and al-Khwarizmi on harmony with nature, alongside the values of the "Avesta," form the spiritual bedrock of national environmental upbringing.

The primary scientific objective of this study is to conduct a comparative-pedagogical analysis of the philosophical-epistemological foundations,

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institutional governance mechanisms, and intersectoral curricular integration of environmental education and upbringing in the USA, France, and Uzbekistan; to identify the strengths and weaknesses of each system; and to formulate scientific-theoretical and methodological recommendations for systematically incorporating international best practices into Uzbekistan's continuous education system.

LITERATURE REVIEW AND METHODOLOGY

This study relies on a synthesis of modern comparative pedagogy, philosophical epistemology, systemic-structural analysis, axiological and hermeneutic approaches, and pedagogical modeling. Comparative methodology enables an objective evaluation of education systems established under diverse socio-economic, geopolitical, and cultural conditions—not merely at the level of superficial similarities, but in terms of their deep epistemological roots, governance architecture, and didactic effectiveness. During the research, educational legislation, state educational standards, subject curricula and syllabi, school textbooks of the USA, France, and Uzbekistan, as well as reports by international organizations (UNESCO, UNEP), were subjected to comparative legal and content analysis. Through the method of pedagogical hermeneutics, the implicit axiological content of educational texts, competency definitions in standards, and ecological narratives in textbooks were examined. Meanwhile, the systemic-functional approach served to model the multi-level horizontal and vertical linkages among state governance, educational institutions, and civil society in environmental education.

The theoretical-epistemological foundation and comparative analytical criteria of this research are anchored in three seminal monographic sources that illuminate the core essence of the selected countries and their pedagogical traditions:

On the U.S. Epistemological and Practical Approach: Smith, G. A., & Williams, D. R. (1999). Ecological Education in Action: On Weaving Education, Culture, and the Environment. State University of New York Press (pp. 42–115). In this work, the authors critique the negative consequences of the traditional modernist educational model, such as alienation from nature, excessive fragmentation of knowledge, and the promotion of utilitarian consumerism. As an alternative, they establish the philosophical and didactic foundations of "Place-Based Education" (PBE). Across pages 42–115, the authors illustrate practical

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mechanisms for connecting the learning process to the student's local bioregion and community culture. Rather than merely memorizing textbook formulas, students engage in real-world socio-ecological investigations concerning soil degradation, river pollution, and biodiversity conservation in their own localities, fostering deep knowledge retention, stewardship, and active civic behavior.

On the European Integrative Didactic Approach: Zverev, I. D. (1980). Ekologiya v shkol'nom obuchenii: Novyy aspekt obrazovaniya [Ecology in School Education: A New Aspect of Education]. Moscow: Pedagogika (pp. 54–112). This monograph serves as the theoretical and methodological cornerstone for the interdisciplinary integration of ecological knowledge in secondary and higher education. Zverev demonstrates that ecology cannot be confined to a single natural science; rather, comprehending the integrity of the biosphere requires biology, geography, chemistry, and physics to reveal natural laws, while history, economics, law, and literature illuminate the socio-moral dimensions of ecological issues. On pages 54–112, the personal structure of ecological culture (ecological knowledge, ecological thinking, emotional-value attitudes, and practical activity) is analyzed in detail, and didactic models for designing integrated lessons are developed. Today, this model forms the conceptual core of education in France and continental Europe.

On Uzbekistan's National-Legal and Continuous Pedagogy Model:
Nigmatov, A. N. (2004). Ekologiya huquqi va ta'limi: Nazariya va amaliyot [Environmental Law and Education: Theory and Practice]. Tashkent: Fan va texnologiya (pp. 88–142). This foundational monograph provides a comprehensive investigation of the legal, conceptual, and pedagogical bases for establishing a continuous system of environmental education in Uzbekistan. The scholar (pp. 88–142) outlines mechanisms for instilling environmental legal norms into students' consciousness and ensuring continuity across all stages from preschool to postgraduate education. Most importantly, the work synthesizes national mentality, Eastern philosophical heritage, and folk traditions (reverence for nature, keeping irrigation ditches clean, preserving greenery) with modern environmental legislation, systematizing a national theory of environmental upbringing tailored to Uzbekistan.

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RESULTS

The U.S. Environmental Education Model: Pragmatism, Decentralization, and Place-Based Education. The genesis of environmental education in the United States unfolded in close connection with the country's federalist state structure, liberal-democratic values, and robust pragmatic philosophical tradition. Under the U.S. Constitution, authority over education rests not with the federal government, but directly with the 50 state governments and more than 13,000 independent local school districts. Consequently, the United States has no single mandatory national environmental curriculum. While this decentralization fosters regional adaptability and innovation, it also produces significant disparities in the quality and resources of environmental education across states and districts.

The coordinating regulatory framework of the system is established by the National Environmental Education Act of 1990, which created the Office of Environmental Education within the U.S. Environmental Protection Agency (EPA). In partnership with the non-governmental North American Association for Environmental Education (NAAEE), the EPA develops scientific benchmarks and standards for schools nationwide. The NAAEE's "Guidelines for Excellence in Environmental Education" serve as a cognitive and practical reference point across states, encompassing four core strands: (1) questioning, analysis, and interpretation skills for ecological systems; (2) knowledge of environmental processes and systems; (3) skills for understanding and addressing environmental issues and decision-making; and (4) personal and civic responsibility.

The most significant epistemological and practical achievement of U.S. environmental education is the widespread adoption of "Place-Based Education" (PBE) (Smith & Williams, 1999, pp. 42–115). Aimed at restoring students' living connection with the natural world, PBE moves instruction beyond the four walls of the classroom directly into open nature, city streets, local farms, and watersheds. Grounded in John Dewey's pragmatic philosophy of experience, students acquire theoretical knowledge not as passive listeners, but as active researchers investigating pressing ecological challenges in their own communities. For instance, students conduct field analyses of the chemical composition of local lake or stream water, monitor urban air pollutant dynamics using sensors, map the biodiversity of local woodlands, and propose environmental solutions to local municipalities based on their findings. STEM (Science, Technology, Engineering, Mathematics) integration is actively utilized

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in this process: natural sciences explain the ecological problem, while technology and engineering model solutions such as rainwater filtration systems or solar installations. As a result, young people develop rigorous scientific intellect, teamwork skills, and active environmental citizenship.

The French Environmental Education Model: The EEDD Concept, State-Centrism, and Interdisciplinary Integration. True to its historical traditions, the education model of the French Republic is characterized by high centralization, strong state oversight, republican secularism, and a rigorous rational-philosophical orientation. France's education system is governed by the Ministry of National Education (Ministère de l'Éducation nationale) through strict normative standards. A turning point in environmental education occurred with the adoption of the constitutional Charter for the Environment (Charte de l'environnement) in 2004 and accompanying ministerial circulars, which introduced the mandatory nationwide framework "Éducation à l'environnement et au développement durable" (EEDD — Education for the Environment and Sustainable Development).

The most fundamental feature of French didactics is that ecology is not included in the curriculum as a standalone, independent subject. French educational strategists contend that isolating ecology into a separate subject would narrow its global and complex essence. Therefore, in full alignment with the principle of interdisciplinary integration substantiated by Zverev (1980, pp. 54–112), ecological knowledge is deeply embedded across the curricula of all existing subjects from preschool through lycée and university. Within the French interdisciplinary model, environmental issues are systematically addressed across all subject blocks: natural sciences (SVT — Sciences de la vie et de la Terre, physics, and chemistry) explain the biological and geological mechanisms of ecosystems as well as matter and energy cycles; geography and economics analyze territorial resources, anthropogenic load, and urban planning; history and civic education (Éducation civique) examine environmental policy, the rule of law, and human rights; while philosophy and French language and literature bring humanity's place in nature, the limits of rationality, and environmental ethics into critical debate.

The primary instrument for operationalizing the EEDD concept in French schools is the national "E3D" (École/Établissement en Démarche de Développement

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Durable — School/Institution Committed to Sustainable Development) certification system. Under this framework, each school is evaluated across three dimensions: (1) the integration of interdisciplinary environmental projects into the curriculum; (2) the ecological sustainability of school infrastructure (energy efficiency, composting food waste, water conservation, and waste separation); and (3) strong partnerships with local communities, municipalities (mairies), and environmental organizations. Furthermore, students elect "eco-delegates" (éco-délégués) who champion environmental initiatives on school councils and participate as equal stakeholders in institutional decision-making.

The Environmental Education Model of the Republic of Uzbekistan: Constitutional-Legal Foundations, Continuity, and Integration of National Values. In the Republic of Uzbekistan, the process of environmental education and upbringing has evolved in organic connection with independent national statehood, comprehensive legal reforms, and the centuries-old spiritual and moral heritage of Central Asian civilization. The revised Constitution of the Republic of Uzbekistan, adopted by nationwide referendum in 2023, elevated the legal-epistemological status of environmental education to an entirely new level. Article 49 of the Constitution firmly establishes everyone's right to a favorable environment and reliable information about its condition, alongside the state's obligations to improve, restore, and protect the environment and preserve the ecological system of the Aral Sea region. Concurrently, the "Concept for the Development of Environmental Education in the Republic of Uzbekistan" and the "Concept for Environmental Protection" approved in 2019 defined the elevation of ecological culture at all stages of education as a priority of state policy. These legal mechanisms elevated environmental education from a voluntary initiative to a constitutional and legal duty.

As Professor A. N. Nigmatov scientifically demonstrated in his foundational works (Nigmatov, 2004, pp. 88–142), the core of Uzbekistan's educational model is the "system of continuous environmental education." This continuity constitutes a holistic didactic system spanning every stage of human life: (1) at the preschool stage (within the "Ilk Qadam" [First Step] curriculum), initial emotional and moral perceptions such as love for nature and care for animals and plants are cultivated; (2) at the general secondary education stage, environmental concepts are integrated across subjects beginning with "The World Around Us"

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and "Natural Science" in primary grades and extending into "Biology," "Geography," "Chemistry," "Physics," and "Upbringing" (Tarbiya) in upper grades; (3) at the vocational and higher education stages, general ecology modules are taught across all academic tracks, while specialized fields offer in-depth instruction in green engineering, environmental auditing, and environmental law; and (4) through postgraduate education and professional retraining systems, the ecological literacy of specialists and administrative personnel is continuously upgraded.

A unique epistemological feature of Uzbekistan's model—unparalleled in global practice—is its deep synthesis with national, spiritual, and cultural values. In the "Avesta," the ancient monument of Central Asian peoples, keeping the four sacred elements—earth, water, air, and fire—pure is prescribed as a strict rule, serving today as a powerful educational factor in awakening a sense of ecological duty among students. The legacies of great scholars of the Eastern Renaissance—Abu Rayhan al-Biruni's observations on geological strata and natural processes, Abu Ali ibn Sina's teachings on the link between environmental cleanliness and human health, and the contributions of al-Khwarizmi and Ahmad al-Farghani to hydrometry and irrigation science—form the spiritual foundation of modern textbooks. Moreover, the centuries-old Uzbek tradition of "hashar" (community voluntary labor), cleaning irrigation ditches (ariqs) and drainage canals, planting trees (viewed as a virtuous deed), and folk taboos such as "do not spit into water" and "do not pluck greenery needlessly" constitute an informal yet highly impactful medium of folk pedagogy in environmental upbringing.

DISCUSSION

A comparative-pedagogical analysis of the environmental education systems of the USA, France, and Uzbekistan clearly reveals the distinctive strengths and weaknesses of each model, as well as their institutional architectures and epistemological orientations. The differences among these models are not accidental; rather, they stem directly from each country's state structure, level of economic development, and cultural-philosophical foundations.

Institutional Governance Architecture and Degree of Standardization: While the U.S. model is highly flexible, community-driven, free from excessive bureaucracy, and aligned with market mechanisms, the absence of mandatory

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nationwide standards creates quality disparities across states and school districts. The French model guarantees strong state oversight, rigorous standardization, and uniform quality across the entire republic, yet its centralized structure can encounter bureaucratic hurdles when attempting to rapidly support localized initiatives. Uzbekistan's model possesses a robust constitutional-legal foundation and demonstrates high effectiveness in implementing systematic policy across the entire educational chain through state governance and vertical coordination.

Epistemological and Methodological Instruments: The U.S. practice of Place-Based Education (Smith & Williams, 1999) leads in cultivating practical research skills and active civic engagement among students. France's EEDD and E3D system (Zverev, 1980) serves as a benchmark for deep intellectual-philosophical analysis, interdisciplinary coherence, and transforming school life into a sustainable ecological space. Meanwhile, Uzbekistan's model (Nigmatov, 2004) provides a solid foundation for shaping environmental responsibility on the basis of national ethics, Eastern values, and the rule of law.

Transformative Prospects and Practical Directions for Uzbekistan's Education System: Enriching Uzbekistan's continuous environmental education system with international experience calls for three transformative directions: (1) Transitioning from theoretical knowledge to practical action—broadly introducing U.S. PBE methodology to connect textbook content with real ecological challenges in the student's own region, city, and neighborhood (the consequences of the Aral Sea crisis, water scarcity, air pollution, and municipal waste); (2) Modernizing school governance—establishing a national "Green School" certification system modeled on France's "E3D" framework and expanding student eco-committees in schools; and (3) Enhancing teachers' professional competence—incorporating dedicated modules on interdisciplinary environmental didactics into pedagogical universities for all prospective subject teachers.

CONCLUSION AND RECOMMENDATIONS

Based on the comparative-epistemological analysis of environmental education and upbringing processes in the USA, France, and Uzbekistan, the following fundamental conclusions have been formulated:

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Amid the global ecological crises of the Anthropocene, environmental education and upbringing represent the most vital strategic instrument for ensuring humanity's harmonious coexistence with the biosphere. Shifting from a traditional anthropocentric mindset to a biocentric worldview and noospheric responsibility must be the overarching goal of modern pedagogy. The experiences of the USA, France, and Uzbekistan demonstrate that an effective environmental education system must rest on three core pillars: scientific-practical project-based learning (the U.S. experience), deep interdisciplinary integration and eco-infrastructure (the French experience), and a synthesis of a strong constitutional-legal framework with national-cultural values (Uzbekistan's experience). These three dimensions are not mutually exclusive; rather, they complement one another to form a comprehensive model of environmental pedagogy.

To modernize the continuous education system of the Republic of Uzbekistan in alignment with international standards, the following systemic recommendations are proposed: (a) integrate the U.S. "Place-Based Education" approach into general secondary education standards and textbooks by incorporating field and laboratory projects in which students directly study their local ecosystems, water bodies, and flora and fauna; (b) introduce a nationwide "Green Educational Institution" state accreditation system modeled on France's E3D framework, promoting solar panel installation, water conservation, waste sorting, and student eco-patrols in schools; (c) incorporate interdisciplinary environmental teaching methodology based on Zverev's concept into the mandatory curricula of teacher training and professional development institutes; and (d) elevate young people's legal-ecological culture by integrating character-building lessons grounded in national values, the heritage of Eastern scholars, and folk traditions with modern environmental legislation (Article 49 of the Constitution).

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