The Practical Drivers, Implementation Pathways, and Key Characteristics of Ecological Civilization Education in the United States

——A Case Study of Michigan

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Abstract: Ecological civilization has become a global consensus, and ecological civilization education is recognized as an effective approach to enhancing public environmental knowledge and practical capacity. Driven by pressing environmental challenges, the need to develop individuals with strong ecological literacy, and strategic and regulatory requirements for ecological practices, the U.S. state of Michigan has implemented a series of ecological education initiatives. These initiatives are characterized by the development of a comprehensive, whole-of-stage ecological curriculum with schools at the core, the establishment of a multidimensional network of ecological practices through community platforms, and the integration of green lifestyles into everyday family life as a key vehicle. Michigan's three-dimensional implementation pathway demonstrates several prominent features, including government-led multi-stakeholder participation, the mutual reinforcement of theory and practice, and an integrated "experience–cognition–practice" mechanism. Drawing on Michigan's experience in ecological education, valuable insights and references can be provided to advance ecological civilization education in China.

Key Words：United States; ecological civilization education; ecological literacy; Michigan; education for sustainable development; ecological curriculum

In July 2023, President Xi Jinping stated at the National Conference on Ecological and Environmental Protection that the next five years will be crucial for creating a "Beautiful China." He stressed the need to keep promoting the idea of ecological civilization, positioning the construction of a Beautiful China as a priority in national development. This involves modernizing while ensuring harmony between people and nature. Currently, ecological civilization has become a common goal for global development, and education on ecological civilization is an important way for countries to support eco-friendly growth and raise citizens' awareness of sustainable practices. Basic education plays a key role in teaching this and helps cultivate "ecological citizens." In 2019, the Ministry of Education, along with four other departments, issued a notice calling for the incorporation of Xi Jinping Thought on Ecological Civilization into primary and secondary schools. The document asked schools to promote values such as thrift, green living, and

low-carbon habits through lessons, school activities, and management practices, which aim to strengthen students' awareness of environmental issues and improve their ability to protect the environment. In 2021, the Ministry of Ecology and Environment, together with six other departments, published the Action Plan on Enhancing Public Awareness of Ecological Civilization (2021–2025). This plan aimed to integrate ecological education into the national education system and include related topics in school curricula to help young people develop good habits for caring for the environment. It also called for better legal and institutional support for ecological education and encouraged public involvement. Currently, ecological civilization education is gradually being added to China's basic education curriculum. It is included in subjects like geography, biology, and moral and political education[1]. Local governments have also promoted eco-friendly campuses, starting to develop a network of ecological education bases and green schools. Some schools have created systematic ecological education programs and engaging campus environments[2]. However, ecological civilization education in China still faces challenges, such as developing curricula, innovating teaching methods, training professional teachers, and establishing coordination among different systems[3][4]. Thus, to improve ecological civilization education in Chinese schools, it may help to learn from the experiences of other countries.

Since the 1960s, environmental issues have become urgent challenges in the U.S. Industrialization and urbanization have caused problems such as air and water pollution, biodiversity loss, and the overuse of natural resources. To address these issues effectively, the U.S. state and federal governments have enacted a series of environmental protection laws. Environmental problems have also become a key topic in academic research, helping to build a solid scientific understanding of how to tackle them. In addition, environmental organizations and public movements have raised awareness of these issues, leading more people to engage in environmental practices[5]. Michigan, known for its rich ecosystems, underscores the importance of conservation in U.S. states. However, population growth, urbanization, and economic development created serious threats to the state's ecosystems in the 1970s. In response, Michigan developed an education system focused on ecology and sustainable development to improve public understanding of these topics: Schools help spread ecological awareness, communities provide platforms and opportunities for ecological practices, and families encourage sustainable habits. This study examines the key features, drivers, and methods of ecological education in Michigan to offer helpful insights for developing similar initiatives in China.

I. Practical Drivers of Ecological Civilization Education in Michigan

(1) Environmental Challenges and the Need for Ecological Development

Since the Industrial Revolution, human society has entered an era of rapid development. However, Earth's ecosystems have been subjected to severe strain due to developmental problems, such as population explosions, mounting socioeconomic pressures, social inequality, and domestic

and international conflicts, which are making environmental problems increasingly acute. As noted by Anders Wijkman, former President of the Club of Rome, “the present era is the Anthropocene, in which human beings dominate everything, even to the extent of altering the biogeochemical composition of the Earth.”[6] . In North America, the U.S. state of Michigan is renowned for its rich and diverse ecosystems. It is home to vast forests and wetlands, as well as the North American Great Lakes—Lake Superior, Lake Michigan, Lake Huron, and Lake Erie—which together constitute one of the largest freshwater systems in the world. As a result, ecological conservation in Michigan is particularly significant to the United States. However, at the beginning of the twenty-first century, the state’s ecosystems were facing unprecedented challenges[7].

First, Michigan has faced environmental pollution stemming from past pollution. As a central industrial hub in the United States, the state experienced extensive long-term industrial development, resulting in frequent nutrient pollution of its rivers and lakes. Excessive phosphorus inputs have triggered large-scale harmful algal blooms, posing serious threats to aquatic life and to the health of residents[8]. Meanwhile, past manufacturing and mining activities have left behind numerous toxic waste sites. According to statistics, Michigan had identified 2,662 severely contaminated waste sites, posing serious threats to groundwater and soil safety by 1990[9]. Second, environmental degradation has led to biodiversity loss. Species crises in Michigan, arising from the invasion of non-native species and the overexploitation of natural habitats, caused an ecological imbalance that not only threatens the survival of native species and the stability of ecosystems but also disrupts the provision of natural resources, indirectly jeopardizing human health and safety[10]. Third, climate change has intensified environmental crises. Over the past century, average temperatures across much of Michigan have risen by approximately 2–3 degrees Fahrenheit. The increasing frequency of extreme precipitation events has led to urban waterlogging and flooding in some areas. At the same time, the ice-cover period of the Great Lakes has shortened, and water levels have become more variable. Rising lake temperatures have threatened cold-water fish habitats and further exacerbated the severity of harmful algal blooms[11].

Overall, it is evident that historical pollution, biodiversity loss, and climate change are deeply intertwined, collectively exacerbating the vulnerability of Michigan’s ecosystems. In the face of

these challenges, the Michigan state government and various social sectors have come to recognize that reliance on technological solutions alone is insufficient to address environmental problems fundamentally. Instead, strengthening public ecological education has been identified as a crucial means of advancing environmental protection efforts.

(2) The Demand for Development with Ecological Literacy

Cultivating individuals with strong ecological literacy has become an inevitable choice for environmental governance and an important foundation for the sustainable development of future societies. While science and technology continue to advance, they also place higher demands on human ecological literacy, bringing unprecedented challenges and transformation pressures to educational systems. However, in reality, the education systems of many countries or regions still pay insufficient attention to content related to ecological protection. In response, scholars have offered critical reflections on this issue. As Wijkman pointed out in *Flip the System*, an education system that focuses only on intellectual development is no longer sufficient. What needs reconsideration is the content and pedagogy of education. Education should not only transmit knowledge based on experience but also place greater emphasis on developing diverse knowledge, skills, and abilities, enabling students to adapt to and respond to an uncertain future creatively[10].". The ecological crisis urgently requires education to promote a profound transformation in values and ways of thinking. At the international level, related policy initiatives have continuously echoed this direction of transformation. UNESCO has proposed the Education for Sustainable Development initiative, which suggests that education should enhance individuals' and societies' capacity to address global challenges, particularly in environmental protection and sustainable development[12]. The Organisation for Economic Co-operation and Development (OECD), in its 2019 Learning Compass 2030 framework, noted that future citizens should be equipped to address complex environmental and sustainable development challenges. The U.S.-based Ecological Civilization Institute defines ecological civilization as "a cooperative relationship between humanity and the biosphere" and argues that ecological values should serve as the foundation for driving profound transformations in the broader civilizational system and social structures.[13]. These shared understandings underscore the central position of ecological civilization literacy within contemporary education systems. They have also encouraged countries to recalibrate existing educational models and to cultivate ecological awareness as an essential component of

schooling.

In Western contexts, the objectives of ecological civilization education primarily focus on three dimensions: disseminating knowledge, transforming values, and implementing actions. In the United States, ecological civilization education is framed as an integrated educational paradigm. It takes ecological knowledge as a foundational support, integrates content from the natural sciences, social science theories, and ethics education, and ultimately aims to cultivate individuals' ecological values while promoting pro-environmental practices to address ecological challenges. Thus, ecological knowledge, ecological ethics, ecological skills, and ecological responsibility are its core components. With ecological literacy positioned at the heart of ecological civilization education, its meaning goes far beyond simple environmental protection. As global efforts to advance ecological civilization have deepened, expectations for ecological literacy have continued to rise, emphasizing the cultivation of individuals who possess professional competencies, think critically, and are capable of addressing real-world problems actively[14]. For individuals, the environmental awareness, ecological knowledge, and practical experiences developed during adolescence can shape how they understand and respond to environmental issues throughout their lives[15]. Ecological education not only enables the public to acquire knowledge about environmental protection but also builds their practical capacity, thereby allowing individual efforts to converge into collective action and contribute to global environmental protection[16].

(3) Strategic and Regulatory Requirements for Ecological Practices

Strategic and regulatory frameworks served as the starting point of departure for the development of ecological education in the United States. After the adoption of the *Declaration of the Human Environment* at the first United Nations Conference on the Human Environment in 1972, the United States began to strengthen ecological civilization–oriented initiatives from a national, strategic perspective[17]. Notably, Michigan's environmental legislation predates federal-level initiatives. As early as 1970, amid rising public demand for environmental protection, the Michigan legislature enacted the landmark *Michigan Environmental Protection Act of 1970* (MEPA), a pioneering innovation in U.S. environmental law that granted citizens the right to sue for polluting activities. With firm commitment from the state government, schools, and communities, Michigan invested substantial effort in advancing both environmental protection and

education. At the K–12 level, curriculum reforms in the early 1970s began incorporating ecology and environmental science, while schools implemented experiential learning activities, such as nature camp programs and pollution observation projects. In addition, universities and local school districts served as hubs for experimentation, developing a range of practices with national demonstrative value[18]. In 1990, the U.S. Congress enacted the *National Environmental Education Act,* providing states with financial support and policy guidance. Subsequently, the Environmental Education Grants Program of the U.S. Environmental Protection Agency (EPA) began funding schools and non-profit organizations in Michigan to support curriculum development and teacher training[19]. Meanwhile, the Michigan state government incorporated environmental concepts into state curriculum standards, and the Department of Natural Resources, in collaboration with environmental organizations, promoted a range of national environmental education programs for schools to adopt.

Entering the twenty-first century, with the global rise of sustainable development agendas, the Michigan state government adopted more proactive measures to embed environmental education within mainstream schooling. One landmark initiative was the *Green Schools Program*, launched in 2006. This program established an environmental performance rating system for primary and secondary schools. Through tiered certifications, such as “Green School” and “Emerald Level” recognition, it incentivized schools to undertake practical activities in energy conservation and environmental protection[20]. By 2013, Michigan adopted the *Next Generation Science Standards* (NGSS), which placed greater emphasis on ecosystem protection and climate change, thereby incorporating ecological civilization education into the regular curriculum. Entering the 2020s, the growing urgency of the climate crisis has further elevated environmental education on the policy agenda. The current state administration’s *MI Healthy Climate Plan* underscores the role of public participation and education in achieving carbon-neutrality goals and has established a Climate Solutions Council to raise climate-change awareness in communities and schools[21]. These policy adjustments reflect the state government’s high priority for ecological civilization education and, at the institutional level, provide safeguards that enable schools to sustain and further develop related teaching and learning activities.

II. Implementation Pathways of Ecological Civilization Education in Michigan

(1) Building a Whole-Stage Ecological Curriculum System with Schools as the Core

The U.S. Partnership for Education for Sustainable Development developed a K–12 education framework that spans the entire basic education continuum from kindergarten to high school. Building on this foundation, the Michigan Department of Environment, Great Lakes, and Energy (EGLE) launched the *Michigan Environmental Education Curriculum Support* (MEECS) initiative. Designed in alignment with state education standards, MEECS offers a series of modular units covering key themes such as air quality, climate change, ecosystems and biodiversity, energy resources, land use, and water quality. Through concrete, place-based cases, these courses help students construct a systematic understanding of ecological issues, encouraging independent inquiry and deeper learning by measuring local environmental characteristics and engaging with real-world data to strengthen their grasp of ecological concepts[22]. By 2023, teaching teams from more than 200 schools had participated in the MEECS program, with approximately 8,000 teachers receiving training and the initiative reaching around 400,000 students. Beyond K–12 education, Michigan has also implemented systematic initiatives in higher education. Taking the University of Michigan as an example, the university has, in recent years, introduced innovative programs such as the Sustainable Living Experience, which organically connects classroom learning with campus-based sustainability practices. For instance, students may grow vegetables on campus farms or compost waste, enabling them to understand better how ecological civilization principles can be translated into concrete action[23]. This suggests that the concept of ecological education has been systematically embedded across Michigan's curriculum system, spanning from basic education to higher education.

Meanwhile, in accordance with the requirements of the *National Environmental Education Act*, Michigan has developed environmental education standards and curriculum guidelines applicable across educational stages, ensuring that students receive ecological civilization education that is systematic, coherent, and progressively deepened over time. More specifically, at the kindergarten level, learning primarily takes the form of nature-based observation activities and games. For example, children may identify leaves of different shapes in a botanical garden or use magnifying glasses to observe insects, thereby fostering an initial understanding of the natural environment. In primary school, the curriculum begins to introduce basic ecological knowledge related to the Great Lakes watershed. Teachers often organize hands-on projects in which students

test the pH of lake water, observe nearby trees and birds to strengthen their understanding of local ecosystems, and develop everyday pro-environmental habits such as not littering and turning off taps properly. At the middle school level, course content becomes more analytical and inquiry-oriented. Students may use mapping software to examine imagery showing how industrial discharges affect nearby wetlands, or work with local water-monitoring datasets to produce pollution trend charts. In high school, the curriculum engages with broader issues such as global warming and species extinction. For instance, teachers may conduct in-class debates on the allocation of carbon emission rights, and students may be required to use computer-based modeling to predict the outcomes of different environmental policy scenarios. Overall, this staged instructional design moves from knowledge acquisition and habit formation to practical competence, gradually cultivating students' comprehensive capacities for ecological protection.

(2) Establishing a Multi-Dimensional Network of Ecological Practices with Communities as Platforms

For learners beyond the compulsory education stage, communities serve as a crucial vehicle for ecological civilization education. Like many states in the U.S., community-based environmental education programs are typically government-funded and developed in collaboration with higher education institutions or research organizations. They are offered to schools and residents at no or low cost, facilitating the effective dissemination of ecological concepts and providing accessible platforms for a wide range of ecological practice activities.

To start, Michigan's school–community linkage ecological education programs have two types in general: administrative certification–driven initiatives and problem-solving–driven initiatives. First, the *Michigan Green Schools Program*, as a representative certification-driven initiative, is rooted in community support and focuses on cultivating individual ecological literacy and strengthening ecological civilization education within schools. Through a government-led certification system, schools that join those programs must implement practical sustainability actions, such as campus tree-planting, rain garden construction, and school-wide recycling schemes. Students in Michigan can enhance their ability to apply ecological knowledge and develop a stronger sense of responsibility by participating in ecological actions through community platforms. In the 2023–2024 year, 343 schools received Green School certification, with more than 150 achieving the highest "Evergreen" level, indicating both large-scale expansion

and improvements in the quality of ecological education. Secondly, A leading example of problem-solving–driven programming is the Great Lakes Stewardship Initiative (GLSI). Through regional network hubs, GLSI organizes schools to engage in community-based practices such as river cleanups, wetland restoration, and water-quality monitoring. Since its launch, the initiative has involved 263 schools, 1,562 teachers, and over 115,000 students statewide by 2024[24]. To summarize, through community-as-classroom projects, students directly participate in environmental governance practices , thereby strengthening their sense of responsibility and developing problem-solving competencies. In addition, local non-profit organizations help organize a wide range of community-based environmental education activities. The environmental monitoring data collected by students are also submitted to relevant government agencies, providing valuable evidence for ecological management and enabling an effective transfer of knowledge to real-world problem solving.

Second, locally grounded ecological education programs led by non-profit organizations are typically capacity-oriented, focusing on specific environmental domains. For instance, the West Michigan Environmental Action Council (WMEAC) runs the Teach for the Watershed program, which provides primary and secondary students with water-quality monitoring tools and volunteer mentoring, forming an action chain of "testing–analysis–advocacy." In Detroit, the organization *Green Living Science* has expanded recycling education into a comprehensive ecological curriculum system. Its waste-sorting simulation game has been incorporated into science curriculum modules in local public schools and has served more than 300,000 students cumulatively[25].

Third, interdisciplinary practice-oriented initiatives implemented by universities and communities focus on developing ecological education resources, designing programs, and supporting teacher professional development. The *Great Lakes Education Program* (GLEP), launched through collaboration between Michigan State University and Michigan Sea Grant, has attracted hundreds of thousands of teachers, students, parents, and community volunteers since 1989. It has been widely regarded as an important bridge linking education with practice, and schools with their surrounding communities[26]. The program has three phases: pre-voyage classroom instruction, an experiential voyage on a fishing boat, and post-voyage reflection and feedback activities. In the pre-voyage phase, teachers and students will learn interdisciplinary

knowledge by collaboratively studying activity handbooks that include key concepts in the local water environment, such as the water cycle, water quality, geography, and food chains. The voyage phase is conducted primarily on the Clinton River and Lake St. Clair, where students rotate through eight hands-on stations on board, including water-sample collection, seamanship, knot-tying, meteorological observation, and so on. Through these activities, they gain experiential learning opportunities and first-hand engagement with environmental governance and ecological conservation. In addition, concerning teacher professional development, the EGLE collaborates with ecological experts from institutions such as Western Michigan University, Michigan Technological University, and Grand Valley State University to provide educators with training, supporting the statewide dissemination and implementation of updated ecological civilization curricula[27]. In terms of teacher professional development, the EGLE collaborates with ecological experts from institutions such as Western Michigan University, Michigan Technological University, and Grand Valley State University to deliver teacher training, thereby supporting the statewide dissemination and implementation of updated ecological civilization curricula.

(3) Embedding Green Lifestyles Through Family-Based Engagement

The Michigan Department of Education has introduced *MiFamily: Michigan's Family Engagement Framework*, which underscores the importance of family engagement in improving children's academic achievement, cognitive development, and social-emotional skills[28]. In the context of ecological civilization education, it mainly reflects in two dimensions: home–school collaborative initiatives and the cultivation of everyday pro-environmental habits.

In family-based educational practice, cultivating ecological literacy is often advanced through concrete pro-environmental activities. Through "green campus" initiatives implemented by K–12 institutions in Michigan, schools engage families by parent meetings, "eco-themed parent–child weeks," and STEAM-oriented environmental innovation competitions. These activities extend practices such as waste sorting and energy-saving optimization into the home, embedding environmental values into students' everyday routines[29]. Communities across Michigan also play an active role in environmental education by offering diverse practice-based platforms that provide parents and children with opportunities for ecological engagement. For example, a recycling initiative launched in the Detroit area operates through a tripartite arrangement: schools are responsible for teaching ecological knowledge, communities provide

venues and resources for hands-on practice, and families serve as a crucial setting for reinforcing and sustaining environmental awareness[30]. Such initiatives establish an integrated school–community–family platform for ecological civilization education and provide comprehensive support for minors to grow into future green citizens.

Within the family, home education exerts a profound influence on children's pro-environmental habits. Through concrete behavioral role modeling in everyday life, parents can help children and adolescents develop ecological understanding and a sense of ecological responsibility. Children would gradually internalize green lifestyles as their parents, friends, and peers repeated these behavioral patterns. First, regarding soil protection, Michigan encourages households to convert food scraps and yard waste into compost. This practice helps improve soil quality, reduces reliance on chemical fertilizers, and contributes to environmental protection[33]. Second, regarding green consumption, the state government advises households to sort and recycle electronic waste properly and encourages residents to fully consider product sustainability when purchasing electronic devices, thereby avoiding impulsive or unnecessary consumption[31]. These measures not only encourage adult citizens to pay closer attention to everyday ecological practices but also help foster the development of ecological habits among minors.

III. Major Characteristics of Ecological Civilization Education in Michigan

(1) Collaborative Engagement: Multi-Stakeholder Participation under Government Leadership

A multi-departmental collaborative model is the foundational framework through which Michigan advances ecological education. In essence, it is coordinated and integrated by government agencies. The state's judicial and legislative bodies primarily address the legal dimension by enacting regulations related to environmental education and education for sustainable development, thereby clarifying concrete issues such as curriculum content and implementation standards. Environmental agencies, in turn, are responsible for formulating operational ecological development plans, including setting phased environmental protection targets and providing schools and communities with practical support materials such as illustrated guidelines.

As the primary arena for ecological civilization education for minors, schools also regularly invite leading scholars and industry experts in ecology and sustainability to deliver training sessions and lectures, enhancing both teachers' and students' environmental awareness and practical competence. Communities function not only as key settings for ecological education but also as critical links in the state's ecological governance. By establishing long-term partnerships, residents can participate in concrete initiatives that both strengthen policy implementation and facilitate the timely collection of public feedback. Ultimately, this approach forms a collaborative governance mechanism in which government agencies, educational institutions, community organizations, and ordinary families jointly participate in ecological stewardship.

(2) A Balancing Strategy: Mutual Reinforcement between Theory and Practice

Integrating theoretical guidance with practical action is a key implementation principle of ecological education in Michigan. Ecological civilization theory offers a systematic direction for environmental governance practices; conversely, practical ecological activities can feed back into theory, refining and enriching its content.

At the basic education level, primary and secondary schools translate these ideas into teaching through science classes and ecology-themed experiential activities. This approach helps students build a structured ecological knowledge framework and strengthens their capacity to address real-world problems. At the higher education level, local universities not only conduct theoretical research in areas such as ecological ethics but also explore practical ways to translate theory into instructional design and educational programming. Moreover, university researchers actively collaborate with K–12 schools and environmental agencies by organizing ecology-themed summer camps, wetland conservation volunteer programs, and other initiatives. Through these channels, theoretical knowledge learned in classrooms is applied to authentic contexts, forming a virtuous cycle in which theory guides practice and practice, in turn, informs and improves theory.

(3) Deep Continuity: An Integrated Experience–Cognition–Practice Mechanism

Ecological civilization education in Michigan demonstrates a strong longitudinal and vertically integrated character. Built upon a three-dimensional framework, it enables a coherent progression from individual ecological cognitive development to broader societal ecological transformation. This progress begins with introductory ecological experiences that highly stimulate children's interest, then advances to the systematic development of students' ecological

knowledge and skills, and extends to deeper learning on environmental ethics, sustainable development, and complex ecosystems, thereby cultivating practical competencies and leadership in environmental governance. For example, at the basic education level, animal identification, such as bird identification, is often used as an entry point for ecological learning. Combining classroom instruction with field observation can foster interest-driven activities and family-based interactive learning. This approach not only strengthens students' understanding of local biodiversity but also extends the surroundings of learning beyond school[32]. In higher education, Michigan Technological University has incorporated *adaptive forest management* into its curriculum, which sets long-term ecological objectives for students and enhances their systems thinking and adaptive capacity through interdisciplinary collaboration[33]. To summarize, these practices, ranging from knowledge initiation and competence building to the cultivation of social responsibility, illustrate a stepwise progression and deep integration within ecological civilization education. At the same time, school-based ecological education extends into communities, encouraging broader public participation in ecological civilization actions. In this way, the educational chain expands from individuals to society as a whole, forming a distinctive model for developing ecological literacy.

IV. Future Prospects

Michigan's reform of ecological civilization education is an ongoing and deepening process. As the state has moved from policy advocacy toward multi-stakeholder collaboration, it has gradually responded to contemporary environmental challenges and the long-term demands of sustainable development. Several educational practices have begun to exhibit new trends characterized by authentic problem orientation and interdisciplinary integration. Nevertheless, ecological civilization education in Michigan still faces several structural constraints. First, overall ecological knowledge levels remain relatively low, and, paradoxically, identification accuracy tends to decline as grade levels increase. This pattern suggests that ecological learning becomes increasingly marginalized in upper grades. In addition, the uneven distribution of educational resources between urban and rural areas persists: suburban and urban schools generally have greater access to ecological sites and learning opportunities, whereas rural areas often become cold spots for ecological education. As a result, students in these contexts lack field-based learning

experiences, further intensifying inequalities in educational opportunity[36]. Second, the instructional content of ecological education is highly fragmented. Teachers often select teaching materials based largely on personal interest, in the absence of unified standards and systematic evaluation mechanisms[34]. Third, public and Indigenous participation remains limited in some higher education–based ecological projects. For example, in initiatives such as forest management, the perspectives of Indigenous communities have not yet been fully incorporated into formal consultation mechanisms[37]. In addition, the organizational legitimacy of some education providers delivering ecological civilization practices is not always stable, and their funding often depends heavily on foundation-based projects, making it difficult to sustain long-term, systematic reform[37]. Going forward, Michigan should keep pace with emerging trends in ecological civilization education and, in light of its urban–rural disparities, resource distribution, and existing policy foundations, further advance reform across multiple dimensions, including curriculum standards, teacher capacity building, and cross-sector collaboration. In particular, it is necessary to clarify the boundary between school-based ecological education and broader social practice, strengthen interdisciplinary and inter-institutional integration of resources, and promote a universal, inclusive ecological education mechanism to improve ecological literacy across the entire population. Such efforts would help address new challenges, such as unequal resource allocation and insufficient participation, and ultimately realize the goals of equity, sustainable development, and the sustainability of ecological education statewide.

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