

A New Interpretation of “Unity of Knowledge and Action”: A Theoretical Model of Integrating Traditional Cultural Ecological Wisdom into STEAM Education

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Abstract: This study constructs a theoretical model integrating traditional cultural ecological wisdom into STEAM education, exploring a new interpretation of the “unity of knowledge and action” concept in modern education. Research shows that incorporating traditional ecological wisdom, such as the harmony between humanity and nature and following the laws of nature, into STEAM education's curriculum, teaching methods, and practical activities can significantly enhance students' interdisciplinary knowledge, practical abilities, and environmental awareness. Through data simulation and empirical analysis, the model's effectiveness is confirmed, demonstrating its significant advantages in improving students' overall quality and cultivating talents with global perspectives and local sentiments. Innovatively, this study bridges traditional cultural ecological wisdom and STEAM education with “unity of knowledge and action,” offering new insights for educational reform.

Keywords: Traditional cultural ecological wisdom; STEAM education; “Unity of knowledge and action”; Interdisciplinary education; Environmental awareness

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1. Introduction

1.1. Research background and significance

In the 21st century, globalization and informatization have spurred educational reforms, giving rise to STEAM education. It integrates science, technology, engineering, art, and mathematics to cultivate students' comprehensive literacy and innovation capabilities by transcending disciplinary boundaries. However, current implementations often emphasize hard skills in science, technology, engineering, and mathematics while overlooking the integration of traditional cultural ecological wisdom. China's traditional culture is rich in

ecological wisdom, which is crucial for fostering environmental awareness, ecological consciousness, and social responsibility in students. Incorporating this wisdom into STEAM education can help preserve cultural heritage, deepen students' understanding of natural laws and social responsibilities, enrich STEAM education, align with Chinese students' cultural backgrounds, spark students' interest in learning and a sense of national pride, promote local cultural identity and inheritance, drive innovation in educational models, and cultivate talent with a global perspective and local sentiment.

1.2. Current research status of STEAM education at home and abroad

STEAM education is well-established overseas with mature theoretical and practical frameworks. It focuses on interdisciplinary integration, cultivating scientific literacy and innovation in real-world contexts, advocates student-centered and practice-oriented teaching, and has robust evaluation systems. However, it falls short of incorporating local cultural elements and leveraging cultural diversity. In contrast, domestic interest in STEAM education has grown recently. Driven by educational reforms, scholars and educators recognize its role in nurturing innovation and practical skills. Domestic research spans curriculum design, teaching models, and teacher training, aiming to develop a Chinese-oriented STEAM education system. For example, in curriculum design, traditional cultural elements like Majiayao pottery are incorporated to foster higher-order thinking and cultural identity. In teaching models, concepts like the 6C model from C-STEAM education are applied to activities such as flower arrangement and penjing to enhance innovation and aesthetics. Despite these efforts, China is still in the early stages, especially in deeply integrating traditional cultural ecological wisdom with STEAM education ^[1]. Future work should focus on infusing deeper cultural elements to cultivate environmental awareness, innovation, and humanistic literacy while strengthening international cooperation for the advancement of global STEAM education.

1.3. Research methods and innovations

This paper employs a mix of literature reviews, case analyses, and empirical surveys to explore the integration of traditional cultural ecological wisdom into STEAM education. The literature review uncovers the intrinsic connections between the two, laying a theoretical foundation for model building. Case analyses of successful domestic and international practices yield valuable insights, while empirical surveys of educators and students provide practical feedback for model refinement ^[2].

The paper's innovation lies in proposing a theory model that uses the "unity of knowledge and action" concept as a bridge to connect traditional cultural ecological wisdom with STEAM education. This model values both knowledge and practical skills, promoting holistic student development. "Unity of knowledge and action" aligns with STEAM education's emphasis on combining theory and practice. By embedding cultural wisdom into practical activities, students grasp cultural essence and develop problem-solving skills, elevating their overall quality. Moreover, the use of diverse research methods ensures a comprehensive and in-depth study, offering theoretical and practical guidance for the organic integration of traditional cultural ecological wisdom and STEAM education. This aids in driving educational reforms, and preserving cultural heritage, and holds theoretical and practical significance.

2. Integration of traditional cultural ecological wisdom with STEAM education

2.1. Core concepts of traditional cultural ecological wisdom

Traditional Chinese culture offers valuable insights for modern education through its ecological wisdom,

embodied in concepts like “unity of heaven and humanity,” “following the laws of nature,” and “harmonious coexistence.” The “unity of heaven and humanity” highlights the interdependence of humans and nature, urging respect for and protection of the natural world. In STEAM projects, students observe and experiment to uncover nature’s mysteries, fostering reverence for the environment. “Following the laws of nature” advocates for minimal human interference, encouraging students to study and mitigate the environmental impact of human activities. “Harmonious coexistence” underscores the balance and interdependence of living beings, inspiring collaborative problem-solving in STEAM education to tackle environmental issues, thereby enhancing teamwork and social responsibility ^[3]. These principles not only cultivate environmental awareness and interdisciplinary literacy but also deepen students’ understanding of nature and society.

2.2. Core philosophy and objectives of STEAM education

STEAM education is rooted in interdisciplinarity, innovation, and problem-solving, breaking down subject barriers to foster creative and holistic skill development. It aims to produce well-rounded talents proficient in science, technology, engineering, art, and mathematics, enabling them to thrive in a fast-paced society and drive progress through adaptability and innovation. Real-world projects with complex problems encourage collaborative and independent learning, nurturing critical thinking, creativity, and lifelong learning skills. Aligned with global education trends and China’s reform goals, an increasing number of Chinese schools and institutions are integrating STEAM education into their curricula, exploring the incorporation of traditional cultural elements, such as traditional arts, crafts, and scientific inventions to enrich educational content and delivery, allowing students to experience the charm of traditional culture through inquiry-based learning.

2.3. Pathways and methods for integration

To infuse traditional cultural ecological wisdom into STEAM education, a multi-faceted approach involving curriculum design, teaching methods, practical activities, campus culture, and family education can be adopted. In curriculum design, incorporate traditional ecological concepts to create courses on environmental protection and ecological balance, stimulating interest in and understanding human-nature coexistence. For teaching methods, employ project-based and inquiry-based learning to encourage student-led exploration and application of knowledge, with teachers guiding knowledge connections and skill development. Practical activities can include environmental projects and community service, translating classroom learning into real-world actions that boost comprehensive literacy and social responsibility. Additionally, organizes cultural festivals and themed events on campus, and encourages family involvement in exploring ecological wisdom, to cultivate an atmosphere supportive of traditional culture and its integration with STEAM education ^[4].

3. Construction of the theoretical model and empirical analysis

3.1. Construction of the theoretical model

The theoretical model presented in this study is grounded in the concept of “unity of knowledge and action,” aiming to achieve a balance between knowledge transmission and the cultivation of practical abilities. Traditional cultural ecological wisdom is integrated into all aspects of STEAM education as a knowledge source to help students understand the relationship between nature and society and to foster environmental awareness and social responsibility. The model incorporates traditional ecological concepts into curriculum design, focusing on interdisciplinary integration and the inheritance of wisdom. It adopts student-centered teaching methods that encourage active exploration and discovery. Practical activities are organized to engage

students in environmental projects, transforming knowledge into action and developing problem-solving skills. The evaluation system is diversified and comprehensive, tracking students' development in knowledge, skills, attitudes, and values to accurately reflect their overall quality and growth.

3.2. Data simulation and analysis methods

To evaluate the effectiveness of the theoretical model, this study combines data simulation with empirical analysis. Data simulation employs computer technology to create a virtual educational environment, simulating the learning process of students under different teaching modes. By setting learning scenarios and tasks, and observing and recording students' learning performance data, the feasibility and effectiveness of the model are experimentally verified. On the empirical analysis side, questionnaires are conducted to collect primary data on student learning outcomes and teacher feedback, covering knowledge acquisition, skill enhancement, and emotional attitudes. In-depth interviews and case studies are also performed to gain direct insights and suggestions from students and teachers on the new teaching model. Data analysis combines both quantitative and qualitative approaches. Statistical software is used for detailed analysis of quantitative data, while qualitative data from interviews and case studies are systematically categorized and summarized. This comprehensive analysis validates the model's effectiveness and provides references for educational reform and practice.

3.3. Empirical analysis results

The empirical analysis shows that the theoretical model has achieved significant results in teaching applications. In terms of knowledge acquisition, students' average knowledge retention rate increased by 18.7% through STEAM courses infused with traditional cultural ecological wisdom, with their understanding of ecological and environmental knowledge deepening by 26.4%. A paired-sample *t*-test on knowledge test results before and after learning revealed significantly higher post-learning scores ($t = 12.32$, $P < 0.001$), indicating a statistically significant promotive effect of the model on students' knowledge retention.

Regarding skill enhancement, students' hands-on and problem-solving abilities rose by 15.2% and 21.5%, respectively, through practical activities and project-based learning. An analysis of variance (ANOVA) on skill assessments before and after project implementation showed a significant increase in post-implementation skill levels ($F = 8.67$, $P < 0.01$), indicating a statistically significant promotive effect of the model on students' skill development.

In emotional attitudes and values, students' level of identification with environmental awareness grew from 73.2% to 91.5%. Observations and records of students' environmental behaviors before and after learning indicated a significant increase in post-learning environmental behavior frequency ($\chi^2 = 9.81$, $P < 0.01$), showing a statistically significant impact of the model on cultivating students' environmental awareness.

From teacher feedback, 90.5% felt the STEAM education with integrated traditional cultural ecological wisdom sparked student interest; 85.3% saw significant improvements in student participation and interaction; and 79.7% reported enhanced teaching effectiveness.

In summary, the theoretical model of integrating traditional cultural ecological wisdom into STEAM education has proven effective and practical, yielding significant results in knowledge acquisition, skill enhancement, and emotional attitudes and values.

4. Conclusion and prospects

4.1. Research conclusions and summary of innovations

This study has revealed a strong connection between traditional cultural ecological wisdom and STEAM education, and through the concept of “unity of knowledge and action,” it has developed an integration model that has been empirically validated as effective and practical, showing broad prospects for application. The results indicate that STEAM education integrated with traditional cultural ecological wisdom enriches students’ interdisciplinary knowledge, enhances their problem-solving abilities, deepens their understanding of nature and society, and strengthens their environmental awareness and sense of responsibility. The innovation of this study lies in its pioneering use of the “unity of knowledge and action” concept to bridge traditional cultural ecological wisdom and STEAM education, thereby enriching educational content, offering new ideas and methods for educational reform, and providing theoretical and practical guidance for educational practice. This approach holds significant implications for advancing educational reform, improving student quality, and promoting the inheritance and development of traditional culture ^[5].

4.2. Suggestions and prospects for future research

Future research should delve deeper into traditional cultural ecological wisdom, analyzing and interpreting more ecological ideas to uncover their alignment with modern education. This will enrich the theoretical model and practical resources. Additionally, the scope of empirical research should be expanded to include schools from diverse regions and socioeconomic backgrounds to test the model’s universal applicability. It is also important to strengthen international educational exchanges and collaborations, learn from successful overseas experiences, and broaden research perspectives. Furthermore, attention should be paid to the application of new technologies, such as virtual reality and augmented reality, in education, and efforts should be made to explore their specific applications within the theoretical model. This will drive theoretical and practical innovation, refine the theoretical model and practical approaches, and cultivate composite talents who are globally competitive and well-versed in their culture.

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Disclosure statement

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