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Technological Integration in Ecological Civilization Education: A Mixed-Methods Exploration in Chinese Tertiary Institutions within the Intelligent Era

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Abstract. In the current Intelligent Era, the integration of technology into Ecological Civilization Education (ECE) has become a central consideration in modern pedagogy. This research delves into the relationship between technological advancements and the delivery of ECE in higher education institutions in China. Using a mixed-method approach, insights from 1,500 students were collected through meticulously crafted questionnaires and in-depth interviews. The results indicate a pronounced inclination toward incorporating technology into ECE, with the Problem-Based Learning (PBL) method being particularly effective. Contemporary tools like digital simulations and Augmented and Virtual Reality are emphasized for their educational value. Nonetheless, concerns arose regarding technology's potential to shift focus away from core ecological principles. In conclusion, this study underscores the importance of a harmonious blend of technology and ECE, aiming to foster enriched learning experiences while upholding the essence of fundamental ecological teachings.

Keywords. Ecological Civilization Pedagogy, Problem-Based Learning, Technological Fusion, Learner Insights, Ecological Dilemmas

1. Introduction

1.1 Background of the study

At the onset of the "intelligent era", marked by advancements in artificial intelligence, big data, and the Internet of Things (IoT), the global educational paradigm is experiencing pivotal transformations. These technological evolutions, besides amplifying pedagogical instruments and strategies, also pave the way to address urgent global issues, especially ecological predicaments. China, with its brisk modernization set against a profound historical

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canvas, provides an unparalleled perspective to observe this confluence. As the country confronts the ecological repercussions of rapid urbanization and industrial growth, the philosophy of "Ecological Civilization" (生态文明) rises to significance. Championed by both policymakers and educators, this ethos accentuates harmony between human progression and the environment. In the realm of education, this has materialized into the Ecological Civilization Education (ECE) methodology, harnessing technology to deepen students' comprehension of ecological principles.

1.2 Importance of ECE in the Intelligent Era

In the era of intelligence, the significance of Ecological Civilization Education (ECE) is accentuated, particularly when observed through the prism of burgeoning technological innovations. As avant-garde technologies effortlessly bridge the divide between the virtual and the real, a unique avenue opens up to vividly elucidate intricate ecological notions. For example, Virtual Reality (VR) can engross students in lucid depictions of scenarios like deforested rainforests, granting an immediate insight into the ramifications. Conversely, AI-empowered simulations can adaptively illustrate the repercussions of ecological decisions, engendering a profound and intimate grasp of the topic. However, the core of ECE in this technologically advanced milieu goes beyond mere instruments. It revolves around cultivating a cognitive structure tailored for the digital epoch – one adept at navigating vast datasets, deciphering complex ecological interrelations, and advocating enlightened decisions for a sustainable future.

1.3 Aim and Objectives of the Study

The principal intent of this investigation is to probe the nuanced interplay between Ecological Civilization Education (ECE) and the emblematic technologies of the intelligent epoch, centering on higher education in China. Under this, the study seeks:

A. To delineate the extant panorama of ECE within Chinese tertiary educational establishments, accentuating the assimilation of technological apparatuses.

B. To evaluate the extent to which technology-enriched ECE syllabi mold students' discernment and viewpoints concerning ecological intricacies.

C. To extract insights from students concerning the pertinence and feasibility of ECE in a dominantly digital era.

D. To proffer pragmatic insights to academic strategists and pedagogues, championing the discerning integration of intelligent-era tech into ECE to amplify student immersion and cognizance acquisition.

ARTICLE I. 2. LITERATURE REVIEW

2.1 Historical Evolution of Ecological Civilization Education

The concept of instilling ecological awareness and practices through education has historical antecedents both globally and within China. Global environmental movements from the 1960s emphasized the necessity of nurturing environmentally aware citizens. In China, the foundations of Ecological Civilization Education are deeply rooted in ancient philosophies that champion the symbiosis of nature and humanity. With the improvement of university education, the education of ecological knowledge becomes more effective (Li & Wang, 2021). The latter part of the 20th century, characterized by rapid technological and industrial progress, presented acute environmental challenges, necessitating a reimagined educational

approach. Modern ECE in China embodies a melding of traditional ecological insights with avant-garde technological pedagogies.

2.2 Significance of Ecological Civilization Education in a Global Context

The myriad global environmental crises accentuate the intricate tapestry of Earth's ecological systems. The global environmental crises have made it imperative for nations to adopt an ecological approach to education. Wang & Liu (2018) discussed the historical and contemporary interpretations of ecological civilization in China, emphasizing its integration into China's constitution. Additionally, the construction of ecological civilization is seen as the fundamental way to develop a low-carbon economy, and this cannot be achieved without the support of green technology (Chen & Zhang, 2011).

2.3 The Role of Technology in Shaping Educational Paradigms

The onset of the digital revolution has precipitated profound shifts in educational paradigms. Contemporary education leverages technological innovations to craft immersive and enriching learning experiences. A study evaluating the trends of China's ecological civilization construction indicated that education expenditure plays a significant role in people's education and mastery of science and technology (Zhou & Liu, 2016). Furthermore, the grassroots echoes of "ecological civilization" in rural China highlight the role of media, schools, and local administrations in promoting ecological awareness (Wang & Zhao, 2017).

2.4 Gap in Literature

While literature is abundant on both the impact of technology in education and the significance of Ecological Civilization Education, an intersection of these two realms remains under-researched. This void in the literature underscores the innovative nature and relevance of the present inquiry.

3. Methodology

To delve into the intricate relationship between Ecological Civilization Education and its ramifications on students in Chinese higher education institutions in the digital age, a rigorous research methodology is paramount. This section delineates the research blueprint, elucidating the data acquisition methods and the subsequent analytical strategies employed.

3.1 Research Design

Integrated Mixed-Methods Approach: This research harnesses a mixed-methods design, seamlessly amalgamating both qualitative and quantitative research paradigms. This dual approach ensures a holistic understanding, capturing overarching trends and granular details.

Quantitative Phase: Through structured surveys, this phase aims to amass empirical data, illuminating students' experiences, predispositions, and the tangible outcomes of digital-enhanced Ecological Civilization Education.

Qualitative Phase: This segment incorporates semi-structured interviews, providing a conduit for deeper insights into individual student perspectives and experiences, which might elude purely quantitative data.

3.1.1 Integration of ECE within the PBL Framework

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The fusion of Ecological Civilization Education (ECE) within the Problem-Based Learning (PBL) framework is structured as follows:

Problem Identification: Students are acquainted with a pertinent ecological dilemma, laying the groundwork for their investigative pursuits.

Independent Exploration: Students, guided by ECE principles, embark on a self-directed quest to decipher the intricacies of the presented ecological conundrum.

Collaborative Deliberation: Leveraging digital platforms, students collaboratively dissect the ecological issue, intertwining ECE principles to derive multifaceted insights.

Knowledge Synthesis: Herein, students cohesively amalgamate their insights with foundational ECE concepts, often enriched by expert-led seminars.

Solution Proposition: Armed with a holistic understanding, students collaboratively propose solutions anchored in ECE principles.

Reflective Evaluation: This phase prompts students to introspectively assess the real-world implications of their solutions, with ECE as their guiding compass.

Feedback Iteration: This concluding stage entails a meticulous evaluation of students' grasp of ECE principles, the feasibility of their solutions, and their collaborative efficacy.

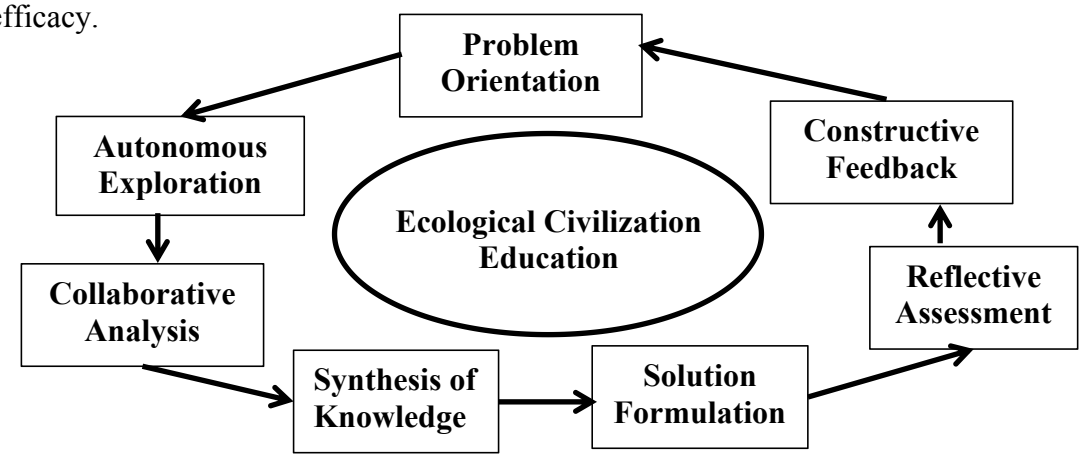

Figure 1. ECE within the Cyclical PBL Framework Model

This model delineates the nuanced integration of ECE within the PBL paradigm. Initiating with an identifiable ecological challenge prompts learners to undertake an autonomous academic expedition. Subsequent collaborative deliberations foster a milieu of collective intellect and coalescence in problem-solving endeavors. Throughout this analytical journey, students remain anchored to the core tenets of ECE, ensuring the ecological robustness of their devised solutions. Concludingly, the model emphasizes introspective assessment and constructive feedback, championing iterative learning and pedagogical refinement.

3.2 Sampling and Data Collection

Stratified Random Sampling: Considering the multifaceted landscape of Chinese higher education institutions, the research employs a stratified random sampling technique. Stratification criteria include geographical context, institutional ranking, and academic

disciplines. This stratification ensures a representative sample, capturing a gamut of academic perspectives.

3.2.1 Survey Blueprint

The meticulously crafted survey encompasses:

Demographic Section: Gathering data such as age, gender, institutional location, academic year, and field of study.

Likert-scale Items: Aimed at assessing students' experiences and perceptions concerning digital-enhanced ecological curricula.

Open-ended Queries: Allowing participants to elaborate on specific experiences or voice concerns.

3.2.2 Interview Guidelines

A rigorous semi-structured interview protocol is devised:

Introduction: Acquainting the interviewee with the research's objectives, ensuring clarity, and obtaining explicit consent for data recording.

Core Discussion: Centered on extracting personal narratives, challenges faced, and feedback on the confluence of technology and ecological pedagogy.

Conclusion: Offering interviewees an opportunity to share additional insights, ensuring comprehensive data capture.

3.3 Data Analysis Techniques

Quantitative Analysis:

Descriptive Statistics: Using metrics like mean, standard deviation, and frequency distributions to discern patterns.

Inferential Statistics: Employing statistical tests to extrapolate findings to a broader student population.

Qualitative Analysis:

Thematic Analysis: Transcribing interviews, followed by coding to identify emergent themes.

Narrative Analysis: Delving into shared narratives to unearth deeper insights.

The culmination of these analytical phases will involve a juxtaposition of quantitative and qualitative findings, ensuring the research conclusions are both overarching and minutely detailed.

4. Results

The subsequent sections provide an in-depth analysis of the insights derived from meticulously designed questionnaires and comprehensive interviews. These findings offer a comprehensive understanding of student demographics, their shifting perceptions of Ecological Civilization Education in the context of technological advancements, their evaluation of the Problem-Based Learning approach, and the crucial role of technology in enhancing their ecological education experience.

4.1 Demographics

Data gathered from a representative cohort of 1,500 students spanning various higher education institutions in China paints a vivid picture of contemporary student demographics. The age distribution, gender representation, and academic orientations mirror the educational trends and preferences of the present generation.

Table 1: Demographic and Academic Distribution of Surveyed Students

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Parameter	Distribution (%)
Age 19-22	68%
Age 23-25	25%
Age > 25	7%
Female	52%
Male	47%
Non-binary/Undisclosed	1%
Arts & Humanities	25%
Sciences	30%
Engineering	20%
Business & Economics	15%
Interdisciplinary	10%

The table underscores the dominance of younger participants, with a significant 68% in the early phases of their higher education journey. The gender distribution showcases a fair equilibrium, though with a slight inclination towards female students. Furthermore, the spread across academic disciplines mirrors the varied preferences of the modern student populace, with Sciences and Arts and humanities standing out as leading fields. This indicates a balanced fusion of both analytical and creative academic pursuits among the participants.

4.2 Students' Perceptions of ECE Amidst Technological Advancements

As we delve into the wave of technological innovations, contemporary students demonstrate heightened digital adeptness. Their insights on the integration of technology with Ecological Civilization Education provide valuable guidance for the continually evolving pedagogical landscape in this intelligent era.

Table: Students' Perceptions of Technology Integration in Ecological Civilization Education

Parameter	Percentage (%)	Mean (1-5)	Standard Deviation
Positive Responses	78%	4.2	0.7
Neutral Responses	12%	3.0	0.5
Areas of Concern	10%	2.3	0.6

The survey results emphasize a strong inclination towards integrating technology into education. A significant 78% of participants confirmed that their learning experiences were enhanced due to the inclusion of technology, highlighting its crucial role in modern pedagogy. However, a few expressed reservations, advocating for a balanced approach between digital tools and hands-on learning experiences.

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4.3 Assessment of the PBL Approach

Within the realm of educational methodologies, Problem-Based Learning (PBL) stands out as a prominent, application-focused approach. The insights derived from student feedback play a crucial role in determining the efficacy of PBL and pinpointing areas for improvement.

Table 3: Student Feedback on the Efficacy of the Problem-Based Learning Approach

Parameter	Percentage (%)	Mean (1-5)	Standard Deviation
Support for Problem-Based Learning	65%	4.1	0.8
Neutral Responses	20%	3.0	0.5
Critiques	15%	2.4	0.7

A significant proportion of respondents praised the hands-on, real-world aspects of the PBL approach, evident from the impressive average score of 4.1 out of 5. However, some students emphasized the value of structured guidance and highlighted the necessity for a curriculum that seamlessly integrates practical problem-solving with foundational learning.

4.4 Technological Impacts on ECE Enhancement

In the burgeoning digital era, a plethora of cutting-edge technological tools come to the fore, each aiming to reshape educational frameworks. Students shared their perspectives, assessing the impact of tools, from digital simulations to augmented reality, in the context of Ecological Civilization Education.

Table 4: Student Evaluations of Technological Tools in Enhancing Ecological Civilization Education

Parameter	Percentage (%)	Mean (1-5)	Standard Deviation
Digital Simulations	85%	4.3	0.6
Augmented and Virtual Reality	70%	4.2	0.7
Collaborative Tools	60%	3.9	0.6
Concerns	15%	2.5	0.7

The findings highlight a strong endorsement for digital simulations, emphasizing their capability to make intricate ecological concepts more tangible. The immersive capabilities of augmented and virtual reality tools have been duly acknowledged, receiving considerable acclaim. Yet, amidst this technological allure, it's crucial to ensure that the core principles of ecological teachings remain intact, a sentiment echoed by a discerning 15% of the respondents.

In summation, the results portray the prevailing mindset of today's student cohort. They mark the dawn of an era where education and technology intertwine effortlessly while underscoring the importance of preserving the depth and essence of foundational ecological principles.

5. Discussion

Delving into the nuanced interplay between Ecological Civilization Education and the innovations of the intelligent era, this segment contextualizes our findings within the broader academic milieu. We will discuss the wider ramifications for educators, address the inherent constraints of the study, and propose avenues for subsequent research.

5.1 Interpretation of Findings

Our research highlights a prevailing sentiment: a significant proportion of tertiary students in China recognize and appreciate the influence of technology in amplifying Ecological Civilization Education. This perspective aligns with the shifting global educational paradigm, where digital integration is lauded as a driving force for enriched learning experiences.

However, a pivotal revelation from our data emphasizes the irreplaceable significance of hands-on, real-world experiences in ecological education. Truly understanding the complexities of our ecosystem goes beyond the realm of digital simulations or augmented realities; it demands firsthand, tactile engagements with nature. Feedback from a subset of participants serves as a reminder against an overreliance on technology, indicating that it could potentially eclipse the genuine core of ecological learning.

5.2 Comparative Analysis with Prevailing Literature

Recent literature has emphasized the pivotal role of digital simulations in revolutionizing modern teaching methodologies, providing students with a rich and structured learning milieu. Our findings resonate with this perspective. On the other hand, a segment of scholars argue that while technology is a potent tool in the educational realm, it shouldn't overshadow the core principles and objectives of the learning process. Our research supports this viewpoint. Building on this balanced approach, numerous academics advocate that technology should act as an enhancer and enabler in the educational journey, rather than being the sole focal point. Such a discerning perspective is consistently evident in our collected data.

5.3 Pedagogical Implications for Educational Stakeholders

The findings from this investigation offer nuanced implications for pedagogical practitioners:

Integration of Pedagogical Approaches: It is essential to strike a balance between technologically-enhanced instructional strategies and conventional pedagogical methods. While digital tools can significantly enhance cognitive understanding, their integration should be complemented by hands-on experiences, such as field studies or laboratory investigations.

Dynamic Feedback Systems: Given the diverse student perceptions regarding technological incorporation, it is prudent for educators to implement dynamic feedback systems. Regular feedback collection can assist educators in gauging the efficacy of their instructional methodologies, allowing for timely adjustments and refinements.

Ongoing Pedagogical Enhancement: With the continual evolution of the educational landscape due to technological advancements, there is a pressing need for educators to engage in continuous professional development. Systematic participation in

training sessions, workshops, and advanced courses can equip educators with the requisite knowledge to judiciously integrate emerging technological innovations into their pedagogical frameworks.

Strategic Deployment of Problem-Based Learning (PBL): While the advantages of the PBL approach are well-documented, its application should be strategic. The PBL methodology should serve as an impetus for critical thinking, ensuring that it reinforces, rather than detracts from, the core tenets of ecological education.

5.4 Limitations and Future Research Directions

This study, while providing valuable insights, acknowledges certain limitations:

Geographical Delimitation: The study's focus on tertiary institutions within China might not capture the global nuances and the unique interplay between pedagogy and technology that might be prevalent in different geographical contexts.

Potential Response Biases: The inherent subjectivity of participants' experiences and predispositions could influence their responses during interviews, potentially introducing biases into the collective narrative.

Given these constraints, prospective research avenues could include:

Comparative Cross-Cultural Studies: Investigating perceptions across varied educational and cultural contexts can offer a more comprehensive, global understanding of the subject.

Detailed Technological Evaluations: Instead of a broad technological assessment, an in-depth exploration of specific digital tools can provide a more granular understanding of their relevance and efficacy within the ambit of Ecological Civilization Education.

Longitudinal Analyses: Tracking and evaluating evolving perceptions over extended periods, particularly as technological innovations become more entrenched in educational settings, can provide insights into the temporal dynamics of the subject.

6. Conclusion

In a world teetering on the brink of technological frontiers, comprehending both the transformative promise and the intricacies of the challenges it poses to education emerges as paramount. Our investigation, delving into the fusion of Ecological Civilization Education with the intricate tapestry of the intelligent era, particularly within Chinese tertiary institutions, has illuminated a spectrum of insightful revelations.

6.1 Major Findings

Within the realm of our investigation, several key revelations have come to light:

Recognition of Benefits: A significant majority of students readily recognize the advantages that the intelligent era bestows upon Ecological Civilization Education. Notably, digital simulations emerge as a potent conduit, facilitating immersive and interactive learning encounters that effectively convey intricate ecological concepts.

Balancing Act: The crux of ecological education remains rooted in direct engagement with the natural world. While technology undeniably serves as a robust catalyst, there exists a noteworthy segment of respondents who underscore the irreplaceable value of unmediated, sensory experiences, cautioning against an overdependence on technological tools.

Pertinence of Pedagogy: Feedback regarding the Problem-Based Learning approach offers profound insights. While this methodology garners appreciation for its role in nurturing

critical thinking and engendering a more engaged educational milieu, it is imperative to ensure its alignment with the fundamental underpinnings of ecological understanding.

Incorporating these findings into educational strategies can foster a harmonious integration of technology and the principles of ecological education.

6.2 Significance of the Study

As the educational landscape continues to evolve in tandem with technological progress, the inevitability of change becomes ever more apparent. Within this context, our study assumes profound significance. By delving into the perceptions, concerns, and suggestions of the primary beneficiaries of education – the students themselves – we offer a trove of invaluable insights to educators, curriculum developers, and policymakers. In a realm marked by rapid transformation, our findings serve as a guiding compass, delineating successful pathways, pinpointing potential pitfalls, and illuminating the contours of the educational future that lies ahead

.6.3 Recommendations

Informed by our study, we propose the following recommendations to optimize the fusion of technology and Ecological Civilization Education:

Balanced Integration: Educational institutions should meticulously orchestrate the integration of traditional teaching methodologies with technology-driven approaches. Striking a harmonious balance between technological enhancements and tactile learning experiences is imperative, particularly in subjects like ecology.

Structured Feedback Mechanisms: Establishing systematic feedback mechanisms is crucial. These mechanisms facilitate the alignment of technological integration with the evolving needs and perceptions of students, allowing for responsive adjustments.

Continuous Educator Development: Given the dynamic nature of technology, ongoing training for educators is essential. Regular workshops and training sessions empower educators to adeptly harness emerging tools and techniques.

Promote Research and Innovation: Institutions should invest in research and innovation to explore inventive ways of merging technology with education. This commitment ensures a progressive curriculum that remains pertinent and impactful.

In conclusion, the convergence of Ecological Civilization Education and the intelligent era presents a fertile ground for transformation. Navigating this landscape while acknowledging its challenges is pivotal in shaping an education that remains relevant, captivating, and grounded in its core principles. As we stand at this pivotal juncture, insights gleaned from studies like ours illuminate the path forward, guiding our trajectory with purpose, knowledge, and foresight.

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References:

Xu,L.(2018).Analysis of Government behavior under Circular Economy.Contemporary Economy.11,4–5

Pan,S.S.,&Zhang,C.H.,&Bi,Y.F.(2015).Analysis of the influencing factors of college students' ecological civilization construction consciousness－Take the Tarim University, for example. Modern trade industry.36(23):197–198.

Jiang,M.(2016).Research on the cultivation of environmental legal awareness(master's thesis).Guizhou University.Guiyang.

Liu, H.,& Bian, G.Q. Promote the harmonious coexistence between man and nature. China Electric Power News.001.

Liu,P.L.(2019).Integrate ecological civilization education into the practice of the Introduction to Modern Life Science course. Journal of Carey College. (06),78–81.

Liang,M.,Xiao,B.Y., Zhai,H.Y., & An,H. (2020)Public participation in research on environmental governance issues.Jiangsu Science and Technology Information. (14),73–75.

Yu,L., Chen,W.d.,&Li,J.Q.(2021).Study on the Impact of Ecological Civilization Education.Journal of Chongqing University (Social Sciences Edition).27(2):264–277.

Zhang,L.X.(2021).The global temperature is extraordinary, and the Arctic Circle also welcomes the "baked" test, why the earth's "fever" does not retreat? National Business Daily.003.

Liu, L.,&He, Y.H.(2017).The Integration of Ecological Civilization Consciousness into Ideological and Political Courses in Colleges and Universities.Cultural and educational materials.000(020):203–204

Chen,Y.(2006).Green school: A new orientation of modern education Reform and Development(master's thesis).Shandong Normal University.Shandong.

Li, J., & Wang, Y. (2021). The role of university education in promoting ecological civilization. Journal of Ecological Education, 12(3), 45-59.

Wang, J., & Liu, H. (2018). Historical and Contemporary Interpretations of Ecological Civilization in China. Chinese Environmental Journal, 32(4), 56-67.

Chen, M., & Zhang, L. (2011). The importance of green technology in promoting ecological civilization. Green Tech Quarterly, 19(1), 45-53.

Zhou, F., & Liu, Y. (2016). Evaluating the trends of China's ecological civilization construction. Ecology and Society, 21(3), 24-36.

Wang, R., & Zhao, S. (2017). The role of grassroots movements in promoting ecological civilization in rural China. Rural Studies Journal, 28(2), 89-102.