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An Empirical Study on the Application of OBE in the Course Design and Teaching of Ideological and Moral Education and Rule of Law in Vocational Undergraduate Universities: Based on the Cultivation of Ecological Civilization Literacy

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Abstract: In recent years, the improvement of China's ecological environment has attracted the attention of the Chinese government, leading to the formulation of systematic environmental protection strategies and policies, the design of environmental education programs, and the encouragement of ecological conservation behaviors among college students. This study takes first-year accounting students from a vocational undergraduate university in China as the research subjects, employing a quasi-experimental design method. Through course design and teaching empirical research, the effectiveness of the teaching is verified. The study finds that under the concept of outcome-based education (OBE), college students' knowledge, awareness, emotional engagement, and behavioral literacy in ecological civilization have all shown significant improvement. Additionally, empirical research reveals that under the new teaching model, college students' learning outcomes are superior to those of traditional course instruction. The study provides an empirical foundation and practical reference for higher education institutions to explore how to achieve outcome-based education through OBE course design.

Keywords: Ecological Civilization; OBE; Ideological and Moral Education; Curriculum Design

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1. Introduction

In China, with the steady economic growth, the strategic position and importance of ecological civilization have become increasingly prominent, serving as a crucial pillar for national development and a key factor in people's pursuit of a better life. Existing research has found that students who have participated in the Chinese government's ecological civilization theory courses exhibit more ecological civilization behaviors, primarily through ideological and political theory courses. However, there is currently no dedicated course in China's higher education system to provide ecological civilization education to college students. Integrating ecological civilization education into ideological and political courses and closely aligning it with the strategic layout of ecological civilization construction is a practical need to serve ecological

civilization development. Ideological and Moral Education and Rule of Law are courses that emphasize practice and focus on student learning outcomes. They require OBE (Outcomes-Based Education) as a guide, reflecting on the teaching process and learning outcomes, clarifying what to learn, why to learn, and how to learn, thereby refining teaching methods and strategies[1].

2. Research methods

2.1. Research procedure

The research methodology of this study comprises curriculum design and pedagogical validation. Phase I involves developing an OBE-based curriculum for Ecological Civilization Construction in Ideological and Moral Education. First, through literature analysis, we selected OBE teaching models proven effective in other disciplines for student competency development. Second, we drafted a preliminary case study for the OBE-based Ideological and Moral Education curriculum. Five experts reviewed the draft, and revisions were made based on their feedback. Finally, the revised case study was implemented as a formal course for empirical research. Phase II evaluates the effectiveness of the revised curriculum in cultivating ecological civilization knowledge, awareness, emotional engagement, and behavioral practices among college students. A quasi-experimental design was implemented, where experimental group students received OBE-based case study instruction while control group students followed traditional teaching methods. The teaching effectiveness was assessed by comparing the learning outcomes and performance of both groups in ecological civilization literacy development[2].

2.2. Study subjects

This study took 104 students from two administrative classes of the accounting major in a vocational undergraduate university in China as the research sample. The two classes were randomly assigned to an experimental group and a control group, with each group having a sample size of 52. Among them, the experimental group consisted of 34 male students and 18 female students, while the control group had 31 male students and 21 female students.

2.3. Research tools

2.3.1. Questionnaire

This study employed the College Students 'Ecological Civilization Literacy Questionnaire developed by Fang Bijie et al. as the measurement tool. The scale consists of 26 items across 4 subscales. The ecological civilization knowledge subscale contains 8 items with a Cronbach's Alpha of 0.853, while the ecological civilization emotion subscale includes 4 items with a Cronbach's Alpha of 0.839. The questionnaire uses a 5-point Likert scale, where 1 indicates "strongly disagree" and 5 indicates "strongly agree." The total subscale demonstrates a Cronbach's Alpha of 0.921, indicating high internal consistency reliability for both the four dimensions and the overall scale, all exceeding 0.7, which meets the research requirements[3].

2.3.2 Test

Prior to the experiment, students underwent a pre-test to accurately assess their knowledge level of the course content. After the learning process, a post-test was administered, with scores reflecting their comprehension of the curriculum. This study utilized the ecological civilization content from the textbook "Ideological and Moral Education and Rule of Law" as the test scope. The test questions were designed by the researcher and another experienced teacher of this course, covering dimensions such as ecological civilization knowledge, attitudes, and behaviors. A total of 50 multiple-choice questions were created, each scored 2 points out of 100. Higher scores indicate better learning performance, while lower scores suggest poorer performance. The test was conducted online via the Zhihuishu platform.

2.4. Course design

2.4.1. Course content

The Ideological, Moral, and Legal Education course is designed to cultivate well-rounded college students, focusing on shaping their outlook on life, values, ethics, professional ethics, and legal awareness. Through theoretical learning and practical experience, it integrates knowledge from related disciplines to enhance students' moral cultivation and legal consciousness. This study adopts the course as a research framework, refining its design and teaching arrangements to incorporate ecological civilization construction into the curriculum. The key themes of the course are as follows:

(1) Practical Activities

During the teaching practice period, we experienced China's National Day, and for this purpose, we arranged a practical activity titled "Protecting Ecological Civilization and Building Beautiful Rural Areas." The activities were carried out in groups, with methods such as questionnaire surveys and field research on rural "waste sorting" projects, and completed research reports. After returning to school, we conducted research presentations. The goal was to enable students to learn knowledge through the activities, enhance their awareness of ecological civilization, and improve their emotional and behavioral capabilities in ecological civilization[4].

(2) The rich connotation of the spirit of China

This study implements a teaching initiative themed "Lucid waters and lush mountains are invaluable assets" based on the curriculum. Using the Outcome-Based Education (OBE) framework, it builds upon students' individual preparatory work by incorporating pre-class group exploration and in-class discussions to enhance ecological literacy. Furthermore, the program integrates ecological civilization concepts into national security education, delivering lectures on "energy security" and "ecological security" through OBE-designed modules. These thematic sessions are specifically designed to cultivate ecological awareness and civic responsibility among university students.

(3) The Core Values of Socialism

Civilization and harmony constitute fundamental national dimensions within the core socialist values. Aligned with textbook content characteristics, this study employs Outcome-Based Education (OBE) to integrate ecological civilization development. The curriculum centers on the theme "Harmonious Coexistence Between Humanity and Nature," utilizing ecological conservation cases (e.g., the illegal Tibetan antelope poaching in Hoh Xil) and invasive species examples (e.g., water hyacinth, Vicia, and crayfish) for instructional purposes. Additionally, it incorporates teaching activities on "Xi Jinping's Ecological Civilization Thought."

(4) Adherence to social ethics

Social ethics, with environmental protection as its core principle, is the focus of this study's teaching activities on the theme "Population, Resources, and Environment". The expanded curriculum includes: (A) Nature conservation visuals and the documentary "Our Earth"; (B) Case studies on the Loess Plateau crisis, sandstorm risks, and ecological impacts of the Hong Kong-Zhuhai-Macao Bridge; (C) Theoretical reinforcement: Ecological preservation is not the responsibility of any single individual, organization, or department, but a collective endeavor for all humanity. We advocate for sustainable, low-carbon lifestyles, fostering awareness of conservation, environmental protection, and ecological stewardship, while promoting nationwide green initiatives; (D) Practical assignment: Starting with daily actions, discuss what individuals can contribute to a greener planet.

(5) Consciously abide by, study, observe, and apply the law

Regarding the conscious compliance with, study of, observance of, and application of laws, this study integrates ecological civilization education for college students throughout. The referenced laws include: China's "Environmental Protection Law", "Air Pollution Prevention and Control Law", "Water Pollution Prevention and Control Law", and "Land Management Law". Combining legal regulations and policy support, this study conducts a special lecture on ecological education titled "Ecological Legal Education" to enhance students'

ecological legal awareness and practical spirit, thereby fostering and generating ecological civilization behaviors among students.

2.4.2. Course planning

This study utilizes textbooks approved by China's Ministry of Education. To cultivate students' ecological civilization literacy, the research integrates ecological civilization education into teaching based on curriculum objectives and textbook content features, as detailed in **Table 1**.

Table 1. Course teaching plan

Chapter and Week	course content	instructional objectives	instructional strategies	Course Teaching Evaluation	Class Schedule
Introduction 2-3 weeks	practical activity: Ecological Civilization Protection and Beautiful Rural Construction	1. Master the knowledge of ecological civilization; 2. Understand the current ecological status and enhance awareness of ecological protection; 3. Enhance the emotional connection with ecological conservation; 4. Improve the literacy of ecological civilization behavior.	1. Arrange practical activities; 2. Conduct research and complete the research report; 3. Present the research report.	1.Participation in the research; 2. Group assignments.	4 class hours
chapter three 8 weeks	The theme is that green mountains and clear waters are as valuable as gold and silver. Topic: Energy security Topic: Ecological security		Before class: Watch the video on Zhihuishu and display the learning tasks. In class: inquiry-based learning, case study; After class: Take the ZhiDao APP test.	1. Pre-class preparation status; 2. Classroom participation; 3. Post-class test.	1 class period
chapter four 10 weeks	Subject: Harmony between Man and Nature		Before class: Show the learning tasks; In class, students explore independently while the teacher supplements. After class: Take the ZhiDao APP test.	1. Pre-class preparation status; 2. Classroom participation; 3. Post-class test.	1 class period
Chapter Five 13 weeks	Topic: Population, Resources and Environment		Before class: Show the learning tasks; In class: students explore independently while the teacher delivers lectures. After class: Take the ZhiDao APP test.	1. Pre-class preparation status; 2.Classroom participation; 3. Post-class test.	1 class period
chapter 6 15 weeks	Special Topic: Ecological Rule of Law Education		Before class: Learn laws and regulations on the ZhiDao APP, including the Environmental Protection Law, Air Pollution Prevention and Control Law, Water Pollution Prevention and Control Law, and Wildlife Protection and Pollution Prevention Law promulgated by China; After class: Take the ZhiDao APP test.	1. Pre-class preparation status; 2. Classroom participation; 3. Post-class tests; 4. Final exam.	2 class hours

3. Experimental results and analysis

3.1 Homogeneity testing of benchmark point horizontal capability

In accordance with quasi-experimental design methodology, pre-test assessments were conducted for both experimental and control groups prior to the experiment. As shown in **Table 2**, questionnaire measurements revealed that the mean values across four dimensions were comparable between the two groups. This indicates that the participating students in both groups had similar learning experiences prior to the experiment. No significant differences were observed in the four-dimensional competencies between the experimental and control groups before the teaching experiment, demonstrating homogeneity in their baseline performance levels. This outcome aligns with the homogeneity requirements established by the pre-test protocol.

Table 2. Independent sample t-test for pretest

	group	M	SD	F	p
ecological civilization knowledge	experimental group	20.231	4.037	.080	.936
	control group	20.173	3.228		
ecological civilization consciousness	experimental group	25.077	3.746	1.743	.084
	control group	23.865	3.332		
ecological civilization emotion	experimental group	12.000	2.536	1.104	.272
	control group	12.558	2.615		
ecological civilization behavior	experimental group	11.154	2.782	.226	.821
	control group	11.269	2.401		
test	experimental group	43.500	13.691	1.182	.240
	control group	46.615	13.175		

3.2. Performance in ecological civilization assessment

As shown in **Table 3**, both the experimental and control classes demonstrated higher post-test average scores than pre-test scores. Paired sample testing revealed significant differences in learning outcomes between the experimental class ($t = 18.327$, $p < 0.001$), with a 38.327-point improvement in average scores. Similarly, the control class showed significant differences ($t = 12.605$, $p < 0.001$), achieving a 33.308-point improvement in average scores.

Table 3. Summary of paired sample t-test for learning outcomes assessment between experimental and control classes

group	mean of pretest	post hoc mean	mean difference	t	P
experimental group	43.500	82.346	38.846	18.327	.000
control group	46.615	79.923	33.308	12.605	.000

Note: $p < 0.001$

3.3. Analysis of the experimental group in the questionnaire measurement of learning outcomes before and after teaching

A paired-sample t-test was conducted to evaluate whether there were significant differences in ecological civilization literacy between the experimental group before and after the intervention. As shown in **Table 4**, the post-test scores for ecological civilization knowledge ($M = 29.250$, $SD = 3.406$) and ecological civilization awareness ($M = 42.788$, $SD =$

4.667) in the experimental group were significantly higher than the pre-test scores (M = 20.231, SD = 4.037 and M = 25.077, SD = 3.746, respectively). Similarly, the post-test scores for ecological civilization emotion (M = 17.5000, SD = 2.005) and ecological civilization behavior (M = 17.423, SD = 2.042) were significantly higher than the pre-test scores (M = 11.154, SD = 2.782). These results indicate that the experimental group demonstrated significant improvement in ecological civilization literacy after the teaching experiment, particularly in ecological civilization awareness and behavior, which showed highly significant enhancements.

Table 4. Paired sample t-test for pretest and posttest in the experimental group

dimension	class	M	SD	t	p
ecological civilization knowledge	before measurement	20.231	4.037	13.811	.000
	aftertest	29.250	3.406		
ecological civilization consciousness	before measurement	25.077	3.746	20.181	.000
	aftertest	42.788	4.667		
ecological civilization emotion	before measurement	12.000	2.536	11.421	.000
	aftertest	17.500	2.005		
ecological civilization behavior	before measurement	11.154	2.782	14.074	.000
	aftertest	17.423	2.042		

3.4. ANCOVA analysis of learning outcomes in ecological civilization between experimental and control groups

3.4.1. Homogeneity ANCOVA test

Homogeneity testing is a prerequisite for conducting ANCOVA analysis. ANCOVA analysis can only be performed when the two groups meet the homogeneity testing criteria ($p > 0.050$). In this study, two weeks prior to the teaching experiment, pre-test data collected from ecological civilization awareness surveys of students in both groups were analyzed through homogeneity testing. The results showed that the F-value for ecological civilization knowledge was 3.571 ($p = 0.062$), the F-value for ecological civilization awareness was 0.006 ($p = 0.939$), the F-value for ecological civilization emotion was 0.353 ($p = 0.554$), and the F-value for ecological civilization behavior was 0.622 ($p = 0.432$). All four dimensions had p-values greater than 0.050, indicating that the baseline levels of the two groups were equivalent. Additionally, a pre-test on ecological civilization literacy conducted before the teaching experiment yielded an F-value of 0.090 ($p = 0.764$), which also exceeded 0.050. This suggests that there were no statistically significant differences between the experimental group and the control group after controlling for the pre-test.

3.4.2. ANCOVA analysis

The interaction term of the experimental group, control group, and pre-test in ecological civilization knowledge yielded a sum of squares (388.060) with 1 degree of freedom, an F-value of 17.369, and a p-value of 0.000 ($p < 0.001$). The F-value for ecological civilization awareness was 40.032 ($p < 0.001$), while that for ecological civilization emotion was 5.878 ($p > 0.017$). The F-value for ecological civilization behavior was 20.040 ($p < 0.001$). Post-test results showed an F-value of 20.527 ($p > 0.01$), indicating significant differences in ecological civilization knowledge, awareness, and behavior between pre-and post-tests, as well as significant differences in teaching outcomes. However, no significant differences were observed in ecological civilization emotion or between post-tests. See **Table 5** for details.

Table 5. ANCOVA analysis of ecological civilization literacy

dimension	Source	SS	DF	MS	F	P
ecological civilization knowledge	Pretest	183.251	1	183.251	8.202	.005
	Classes	388.060	1	388.060	17.369	.000
	Error	2256.556	101	22.342		
	Total	80386.000	104			
ecological civilization consciousness	before measurement	33.710	1	33.710	1.002	.319
	group	1480.689	1	1480.689	40.032	.000
	wrong	3396.405	101	33.628		
	amount to	163530.000	104			
ecological civilization emotion	before measurement	3.041	1	3.041	.505	.479
	group	35.422	1	35.422	5.878	.017
	wrong	608.632	101	6.026		
	amount to	30333.000	104			
ecological civilization behavior	before measurement	15.873	1	15.873	4.484	.037
	group	70.932	1	70.932	20.040	.000
	wrong	357.493	101	3.540		
	amount to	29121.000	104			
ecological civilization test	before measurement	210.246	1	210.246	.142	.069
	group	1966.401	1	1966.401	20.527	.021
	wrong	9675.215	101	9675.215		
	amount to		104			

4. Discussion

4.1. Course design content

In the Moral Education and Rule of Law curriculum, the outcome-based education (OBE) philosophy should guide teaching practices by evaluating instructional processes and learning outcomes, clarifying educational objectives, and refining teaching methodologies. This study applied OBE principles to design the curriculum while integrating ecological civilization education. Pre-and post-test data on ecological literacy demonstrated that the experimental class achieved significantly higher improvements than the control group. Through OBE-based design, the study systematically explored ecological civilization knowledge points in the curriculum. By employing observation and practical methods, the research conducted comparative teaching experiments between groups. Post-test surveys addressed potential limitations in qualitative research, including objective assessment challenges and process evaluation issues[5].

4.2. Teaching effect

After teaching demonstration, the ecological civilization literacy of China students has been significantly improved. OBE, or Outcome-Based Education, is an educational theory that focuses on specific goals in all aspects of the educational process, requiring each student to achieve predetermined objectives after undergoing the teaching process. Moreover, in an education framework based on final outcomes, everything must be results-oriented, and achievement evaluation should

align with teaching goals. Meanwhile, the core issues under the OBE framework are the content students learn and the extent of their acquisition. If the course's educational process, methods, or tools fail to promote student learning or task completion, adjustments to teaching content and methods are necessary. Therefore, phased teaching outcomes are not goals but means. Hence, in practical educational practice, targeted teaching models should be adopted to achieve better teaching effects.

5. Conclusion

This study establishes an ecological civilization literacy course for the Ideological and Moral Education and Rule of Law course based on the fundamental perspectives and steps of OBE. Through the Ideological and Moral Education and Rule of Law course, ecological civilization education can be provided to college students, which can inspire their moral concepts of loving the motherland and protecting the environment, thereby cultivating their ecological civilization awareness, enhancing their emotions, and promoting the formation of ecological civilization behavior habits. After a 6-week teaching experiment, this study found that applying OBE to the design of the basic course for China accounting majors is applicable, and this course design can improve the ecological civilization literacy of Chinese university accounting students. Additionally, the experimental analysis revealed that the experimental group showed higher improvements in ecological civilization knowledge, ecological civilization awareness, ecological civilization emotions, and ecological civilization behaviors compared to the control group. Notably, the application of OBE concepts in course teaching can promote the improvement of students 'ecological civilization emotional literacy. However, in the comparative experiment between traditional classrooms and OBE-designed teaching classrooms, the data results showed little difference, which requires further strengthening in future research. Therefore, applying the inquiry-based teaching model of the Ideological and Moral Education and Rule of Law course as a guide for each lesson's teaching methods, and designing classroom activities according to different teaching contents, can enhance the ecological civilization literacy of China accounting majors.

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Disclosure statement

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