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Research on Environmental Awareness, Behavioral Status and Influencing Factors Among College Students in China: An Empirical Analysis Based on 348 Questionnaires

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ABSTRACT

To explore the practical characteristics of environmental awareness and behaviors among college students in China's new era, analyze the core influencing factors of environmental behaviors, and evaluate the effectiveness of environmental education systems in universities, this study conducted a questionnaire survey from March 12 to March 16,2026, collecting data from 348 enrolled college students across multiple universities in 31 provincial-level administrative regions (including22 provinces: Shaanxi, Jiangsu, Zhejiang, Gansu, Guangdong, Henan, Heilongjiang, Hunan, Sichuan, Anhui, Shandong, Fujian, Hubei, Jiangxi, Shanxi, Hebei, Liaoning, Jilin, Guizhou, Yunnan, Qinghai, Hainan; 4 municipalities: Beijing, Shanghai, Tianjin, Chongqing; and 5 autonomous regions: Inner Mongolia Autonomous Region, Guangxi Zhuang Autonomous Region, Tibet Autonomous Region, Xinjiang Uygur Autonomous Region, Ningxia Hui Autonomous Region). Reliability and validity analyses were performed using SPSS software, along with correlation and regression analyses. The results indicate that students generally demonstrate strong understanding of core environmental concepts, with nearly 70% of respondents achieving "very familiar" or "fairly familiar" levels. Over 70% of students frequently engage in environmental behaviors, but there is a "knowledge-action gap," with less than 40% actively intervening in environmentally harmful behaviors. Personal environmental awareness, environmental knowledge reserves, and the development of university environmental education systems are key factors influencing student environmental behaviors. While university environmental education has established foundations in curriculum design, publicity campaigns, and student organization development, challenges remain, including uneven course quality, monotonous publicity formats, and insufficient organizational vitality. Based on China's national "dual carbon" strategy and relevant policies on ecological civilization education, this study proposes targeted improvement strategies from three perspectives—individuals, universities, and society—by integrating research findings. These strategies aim to enhance college students' environmental literacy and refine the university environmental education system, providing empirical references for practical implementation.

KEYWORDS

College students; Environmental awareness; Environmental behavior; Environmental education in higher education institutions; Ecological civilization education.

1. INTRODUCTION

In the "Five-Sphere Integrated Plan" emphasized by General Secretary Xi Jinping, ecological civilization construction is a crucial component that concerns the sustainable development of the Chinese nation. The 14th Five-Year Plan period marks a critical stage for China's ecological civilization construction to transition from "concept dissemination" to "systematic education." At the national level, ecological civilization education will be deeply integrated into the entire process of

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moral education, emphasizing the fundamental guidance of Xi Jinping's ecological civilization thought and promoting the shift from knowledge transmission to value shaping and practical cultivation in education [1]. The Ministry of Education and eight other departments jointly issued the "Work Plan for Deepening the 'Beautiful China, I Am an Action Taker' Series Activities," explicitly incorporating ecological civilization education into the national education system [2]; the "14th Five-Year Plan for Comprehensive Water Environment Management in Key River Basins" first proposed the governance concept of "three-water coordination" (water resources, water environment, and water ecology) and required its transformation into educational content that students can understand and participate in [3].

Globally, numerous countries are actively implementing environmental protection concepts and advancing eco-education initiatives. Taking Sweden as an example, its education system incorporates comprehensive environmental practice courses from elementary school levels. Students participate in organic gardening projects at community gardens to experience firsthand the relationship between plant growth and ecological cycles. Middle school curricula further deepen environmental science knowledge through in-depth studies of Sweden's local ecosystems. At universities, environmental principles are deeply integrated into academic programs to cultivate interdisciplinary professionals with comprehensive environmental literacy [4]. In the United States, many institutions align with government environmental policies. The University of California system, for instance, not only vigorously promotes green energy initiatives on campus but also establishes environmental research programs encouraging student participation. Student-led environmental organizations conduct community outreach activities ranging from waste sorting campaigns to renewable energy education, fostering a strong environmental awareness culture. These practices align closely with content guidelines from the U.S. Environmental Protection Agency's environmental education materials [5].

As a vital force among young people, college students serve as the backbone of future societal development. Their environmental awareness and behaviors hold significant implications for sustainable social progress. In recent years, the United Nations 'Sustainable Development Goals (SDGs) have placed heightened emphasis on environmental protection and education, advocating global collaboration in environmental initiatives [6]. Against this backdrop, domestic scholars have conducted extensive research on college students' environmental cognition and behaviors. Findings indicate that while students generally demonstrate strong environmental consciousness, there exists a notable "knowledge-action gap" in behavioral implementation, and the effectiveness of university environmental education remains suboptimal. Previous studies often focused on localized regions or singular perspectives, failing to adequately address the unique characteristics of college student demographics, while also encountering limitations in research methodologies and model development.

Against this backdrop, this study was conducted in accordance with China's national "Dual Carbon" strategy and ecological civilization education policy requirements [7-8]. Using questionnaire surveys, we examined 348 college students across multiple universities in 31 provincial-level administrative regions (covering 22 provinces, 4 municipalities directly under the central government, and 5 autonomous regions). Distinct from previous research, our questionnaire model comprehensively considered the diversity of students across different geographical areas and educational backgrounds. SPSS software was employed for rigorous reliability and validity analysis, as well as correlation and regression analyses. The study aims to systematically analyze current environmental awareness and behavioral patterns among college students, identify key influencing factors, evaluate university environmental education systems, and propose targeted strategies at individual, institutional, and societal levels. These findings provide scientifically grounded and comprehensive references for enhancing environmental literacy among students and improving university environmental education frameworks.

2. DEMOGRAPHIC CHARACTERISTICS AND METHODS

2.1. Demographic Characteristics

Using random sampling method, college students enrolled in various types of higher education institutions (985 Project universities, 211 Project universities, regular undergraduate programs, and vocational colleges) across China were selected as research subjects, with a total of 348 valid questionnaires collected. The survey participants covered 31 provincial-level administrative regions nationwide, including 22 provinces (Shaanxi Province, Jiangsu Province, etc.), 4 municipalities (Beijing Municipality, Shanghai Municipality, etc.), and 5 autonomous regions (Inner Mongolia Autonomous Region, Guangxi Zhuang Autonomous Region, etc.). Participants ranged from freshmen to postgraduate levels and included students from multiple academic disciplines such as science, engineering, literature, economics and management, and arts. The demographic composition showed 186 males (53.45%) and 162 females (46.55%); 71 freshmen (20.40%), 126 sophomores (36.21%), 94 juniors (27.01%), 49 seniors (14.08%), and 8 postgraduates or above (2.30%). Academic distributions included 102 engineering students (29.31%), 65 science students (18.68%), 78 literature students (22.41%), 60 economics and management students (17.24%), 37 art students (10.63%), and 6 other categories (1.72%). University affiliations were represented by 132 students from 985 Project universities (37.93%), 91 from 211 Project universities (26.15%), 102 from regular undergraduate programs (29.31%), 22 vocational college students (6.32%), and 1 student from other categories (0.29%). The sample demonstrated balanced representation in gender, academic year, discipline, and institutional type, effectively reflecting the overall characteristics of contemporary university students as illustrated in Figures 1, 2, and 3 below:

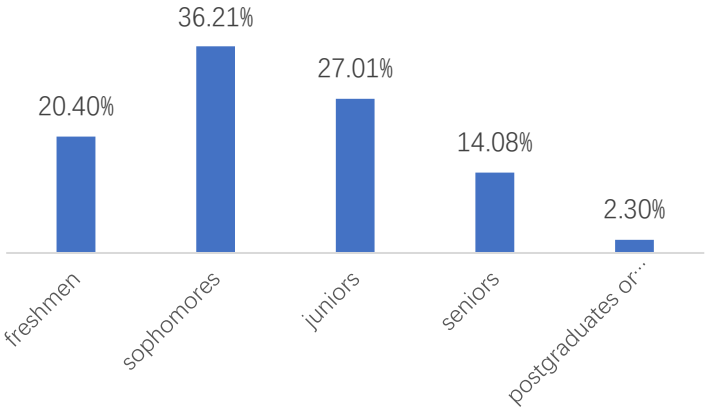


Figure 1. What grade are you in?

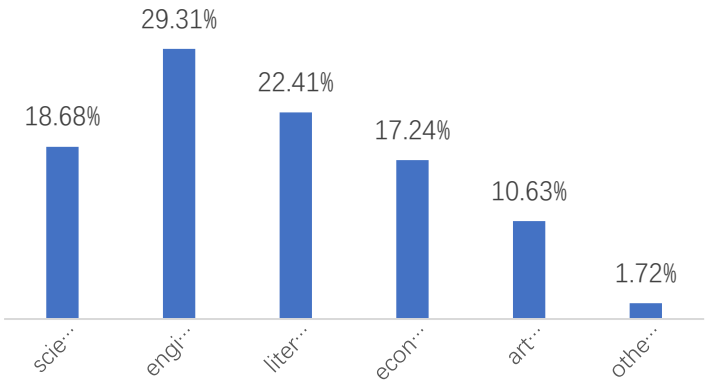


Figure 2. What is your professional category?

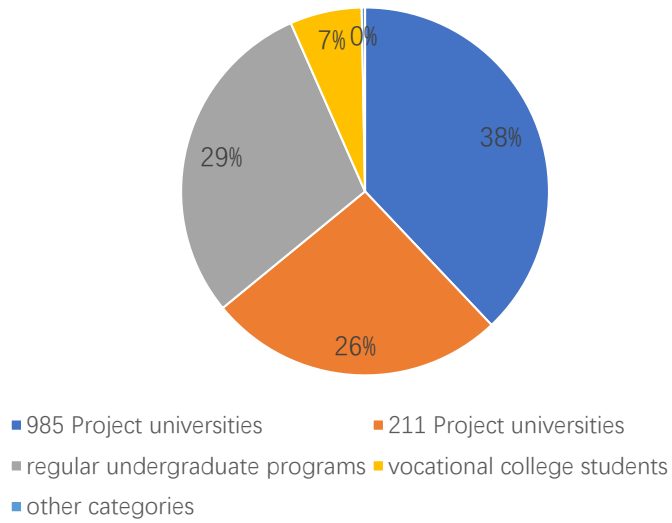


Figure 3. What type of university are you affiliated with?

2.2. Research Tools

Referring to domestic surveys on environmental awareness and behaviors among college students and aligning with the research objectives, we developed the National College Students' Environmental Awareness and Behavior Survey Questionnaire [9]. The questionnaire comprises six dimension—basic information, current environmental awareness status, environmental behaviors and their evaluation, influencing factors of environmental behaviors, university environmental education systems, and open-ended suggestions—totaling 24 items.

Reliability and validity testing of the questionnaire was conducted as follows: Cronbach's α coefficient was used to assess reliability, yielding a value of 0.778, exceeding the commonly accepted threshold of 0.7, indicating high internal consistency and robust reliability. Factor analysis was employed to evaluate structural validity, with a KMO value of 0.877 (above 0.8) and a Bartlett's test statistic of 621.629 ($p<0.001$), confirming suitability for factor analysis. All item factor loadings exceeded 0.5, with most commonality coefficients above 0.35. Post-rotation variance explained reached 42.36%, demonstrating strong structural validity and reliable survey data.

2.3. Research Methods

1. Questionnaire survey method: Questionnaires were distributed through an online survey platform to collect data on college students' environmental awareness, behaviors, and university environmental education, ensuring the breadth and convenience of the research.

2. Statistical analysis method: The survey data were processed using SPSS 26.0 statistical software, employing descriptive statistics, correlation analysis, and multiple linear regression analysis to provide quantitative data support for research conclusions. The core calculation formulas are as follows:

Pearson correlation coefficient: Used to explore the linear correlation degree between environmental awareness, university environmental education systems, and environmental behaviors, with the formula as follows:

$$r=\frac{\sum_{i=1}^{n}(X_i-\bar{X})(Y_i-\bar{Y})}{\sqrt{\sum_{i=1}^{n}(X_i-\bar{X})^2}\cdot\sqrt{\sum_{i=1}^{n}(Y_i-\bar{Y})^2}} \quad (1)$$

Here, r denotes the Pearson correlation coefficient, with a value range of −1 to 1; Xi and Yi represent the i-th observations of the two variables, respectively; $\bar{X}$ and $\bar{Y}$ denote the mean values of the

observations for the two variables, respectively; and n is the sample size. A larger absolute value of |r| indicates stronger linear correlation between the variables; r>0 signifies positive correlation, while r<0 indicates negative correlation.

Multiple linear regression equation: Used to identify core factors influencing college students' environmental behavior and analyze the explanatory power and impact degree of independent variables on dependent variables, with the formula as follows:

$$Y = \beta_0 + \beta_1 X1 + \beta_2 X2 + \ldots + \beta_k Xk + \varepsilon \quad (2)$$

Here, Y denotes the dependent variable (frequency of environmental behaviors); β_0 represents the intercept term; β_1, β_2,..., β_k are regression coefficients reflecting the influence of independent variables (including environmental awareness, university curricula, publicity campaigns, and club development) on the dependent variable; X_1, X_2,..., X_k are independent variables; and ε is the random error term, satisfying the basic assumptions of zero mean and homogeneous variance.

Cronbach's α coefficient: Used to assess the internal consistency reliability of questionnaires, calculated as:

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum_{i=1}^{k} \sigma_{X_i}^2}{\sigma_X^2}\right) \quad (3)$$

Here, α denotes the reliability coefficient; k represents the number of questionnaire items; $\sigma_{X_i}^2$ indicates the variance of the i-th item; and σ_X^2 denotes the variance of the total item scores. A higher α value signifies better internal consistency of the questionnaire, with a reliability threshold generally considered to be α>0.7.

2.4. Data Processing

The valid questionnaires collected were coded, and invalid data were excluded before data entry into SPSS 26.0 software for statistical analysis. Descriptive statistics were presented as percentages and means; correlation analysis employed Pearson correlation $\alpha = 0.05$ $p < 0.05$ analysis to test linear relationships between variables; regression analysis utilized multiple linear regression analysis, with statistical significance thresholds defined as p-values <0.05.

3. RESEARCH RESULTS AND ANALYSIS

3.1. Current Status of Environmental Awareness Among College Students

3.1.1. Overall good understanding of core environmental protection concepts

The survey results indicate that college students demonstrate high awareness of core environmental concepts such as "sustainable development" and "carbon peaking/carbon neutrality," with nearly 70% of respondents reporting "very familiar" (37.36%) or "relatively familiar" (36.49%). Only 10.92% indicated "not very familiar" (4.02%) or "completely unfamiliar" (6.90%), while 15.23% showed "moderate understanding." Among different student groups, sophomores exhibited the highest cognitive levels, with 33.85% and 39.37% respectively identifying themselves as "very familiar" and "relatively familiar." Engineering students stood out, leading all disciplines with 27.69% and 28.35% of respondents describing their understanding as "very familiar" and "relatively familiar," respectively—a clear demonstration of how academic background positively influences environmental concept comprehension. These findings are closely linked to the nationwide promotion of environmental education in higher education institutions following China's "dual carbon" strategy [7-8], as illustrated in Figure 4 below:

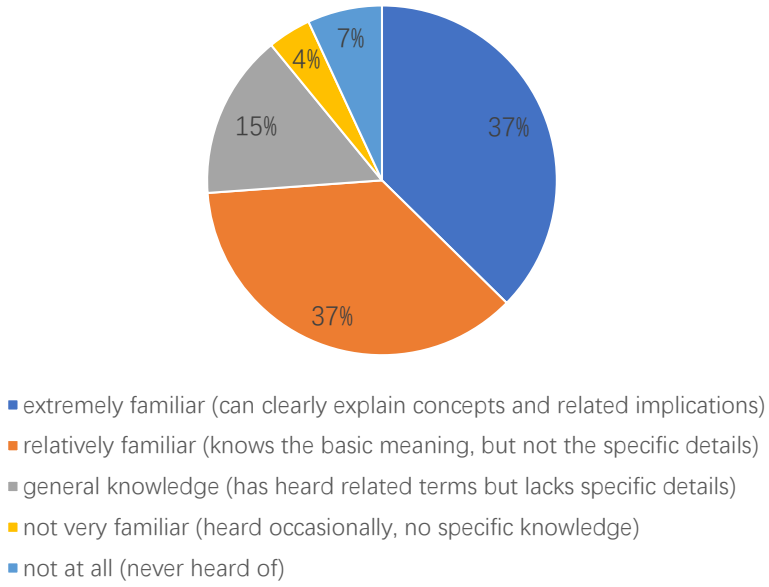


Figure 4. How familiar are you with core environmental concepts such as 'sustainable development,' 'carbon peaking,' and 'carbon neutrality'?

3.1.2. Environmental Issue Awareness Focusing on Atmospheric and Water Environments

College students demonstrate distinct preferences in addressing current environmental issues, with air pollution (64.94%) and water pollution (53.74%) being the most prominent concerns, significantly higher than other issues such as soil pollution (40.52%) and plastic pollution (22.99%). Cognitive differences in environmental awareness vary across academic disciplines: Economics and management majors show the highest concern for air pollution (70%), engineering students exhibit greater awareness of plastic pollution (26.47%), while art majors demonstrate significantly higher attention to soil pollution (48.65%). Gender differences in environmental perception show no statistically significant impact, as illustrated in Figure 5 below:

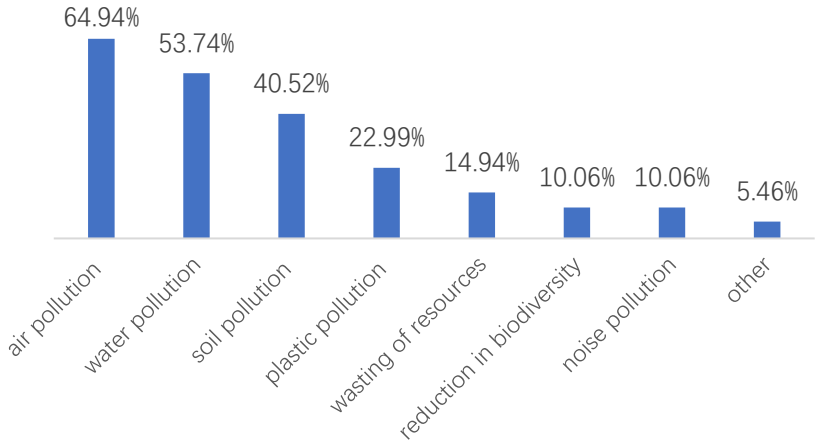


Figure 5. Which of the following environmental issues do you consider to be the most prominent at present?

3.1.3. Environmental knowledge acquisition primarily occurs through school curricula as the core channel

University courses remain the primary channel for college students to acquire environmental knowledge, accounting for 50.86% of total exposure, significantly surpassing other sources such as campus promotions (45.69%), social media (38.79%), and news media (33.62%). Knowledge

acquisition patterns vary across demographics: female students demonstrate higher course participation rates (57.41%) compared to male students (45.16%), while family influence plays a more prominent role among males (30.11%) than females (15.43%). Third-year undergraduates show stronger reliance on campus promotions (52.13%), fourth-year students prioritize news media (40.82%), and graduate students predominantly use social media (50%). Course offerings directly shape knowledge acquisition methods—students without comprehensive environmental education programs demonstrate greater dependence on campus outreach and social media platforms. This highlights the pivotal role of environmental education courses in knowledge dissemination within higher education institutions, as illustrated in Figure 6 below:

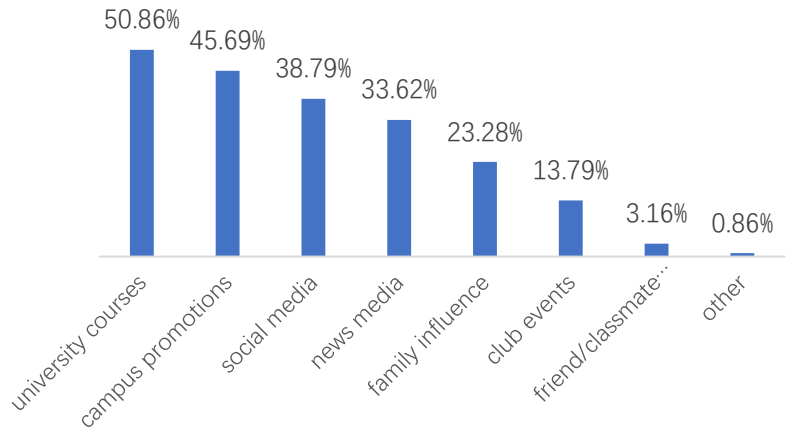


Figure 6. Through which primary channels do you acquire environmental protection-related knowledge?

3.1.4. Environmental Awareness: Integrating Macro Value with Personal Growth

College students demonstrate comprehensive understanding of environmental protection's significance, balancing macro ecological values with personal growth considerations. The two predominant perceptions—"protecting the ecological environment and safeguarding our shared home" (62.64%) and "enhancing personal competencies and cultivating responsibility awareness" (57.18%)—each received over 50% support. Environmental awareness correlates positively with depth of perception: students who "exactly understand" environmental concepts show stronger endorsement of macro ecological values (66.15%), while those who "completely lack understanding" focus more on immediate environmental improvements (33.33%). This pattern reflects contemporary students' tendency to integrate social values with personal development, as illustrated in Figure 7 below:

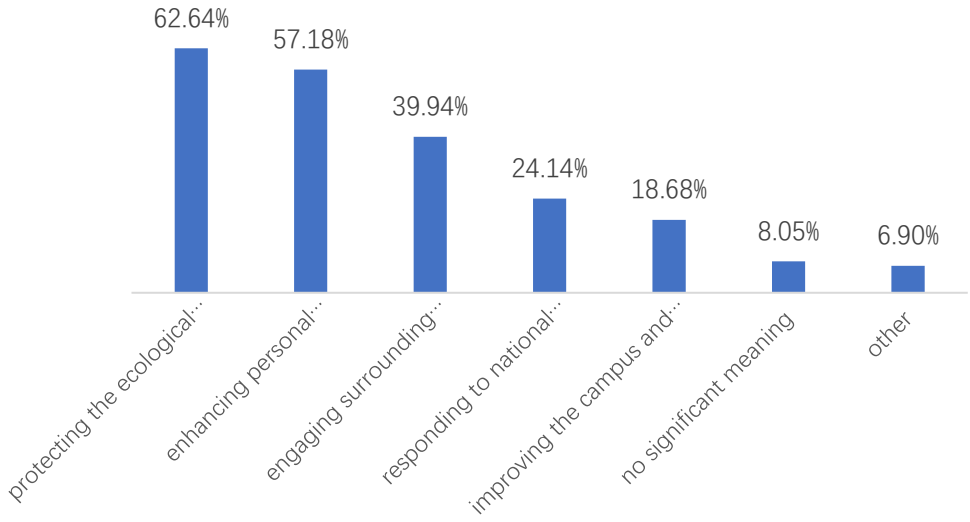


Figure 7. What do you think are the main significance of college students' participation in environmental protection?

3.2. Current Status of Environmental Behavior and Evaluation Among College Students

3.2.1. The overall frequency of environmental behavior practices is relatively high, but there are group differences

Over 70% of college students frequently engage in eco-friendly behaviors, with 37.36% consistently practicing and 36.49% doing so regularly, totaling 73.85%. The proportions of "rarely doing" (5.46%) and "never doing" (4.89%) were notably lower. By academic year, sophomores demonstrated the highest consistent practice rate (37.69%), while juniors showed particularly strong regular engagement (29.13%). Engineering students led all majors with 30% consistent practice rate. These findings indicate that university environmental education has achieved measurable success in cultivating foundational eco-conscious behaviors [10], as illustrated in Figure 8 below:

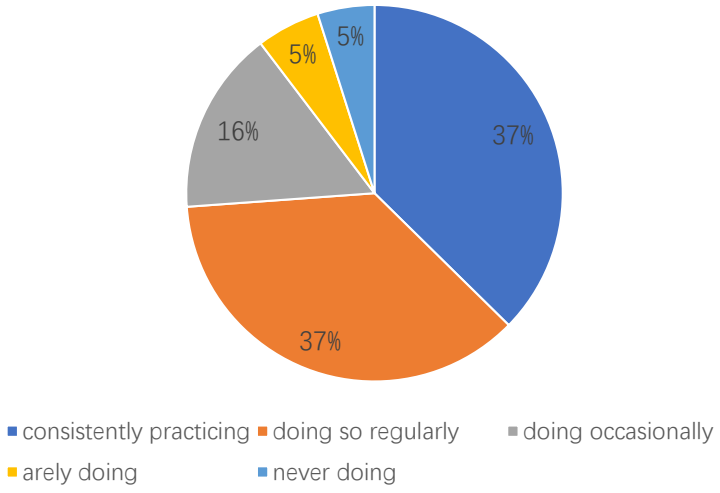


Figure 8. How often do you practice environmental behaviors yourself (such as turning off lights when leaving a room, conserving water, and sorting waste)?

3.2.2. The overall environmental behavior evaluation of college students is predominantly positive

68.68% of respondents rated college students 'overall environmental behavior as "very good" (40.52%) or "fairly good" (28.16%), while 31.33% still rated it as "average" or below. This indicates that although college students demonstrate positive environmental behaviors overall, there remains significant room for improvement. There is a significant positive correlation between individual environmental practice frequency and group evaluations: Among respondents who consistently practice environmental behaviors, 50% rated college $r = 0.43$, $p < 0.01$ students' overall environmental behavior as "very good"; whereas among those who rarely practice, only 5.26% chose "very good," with 63.16% considering it "poorly performed" or "poorly executed." Pearson correlation analysis revealed a statistically significant positive correlation coefficient between individual environmental behavior frequency and group evaluations, which aligns well with the influence of individual behavior on group cognition as described in planned behavior theory [11-12], as illustrated in Figure 9 below:

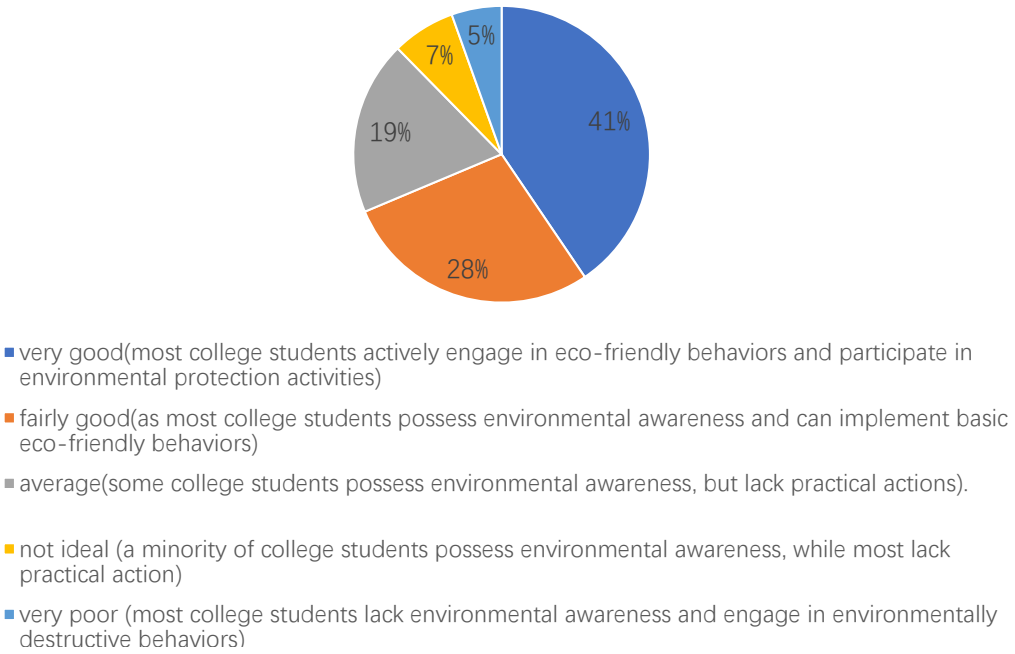


Figure 9. How would you rate the overall environmental behavior of current college students?

3.2.3. Negative attitude toward environmentally harmful behaviors and weak awareness of proactive intervention

College students exhibit significant gaps in awareness regarding monitoring and intervening in environmentally harmful behaviors around them. Only 37.64% of respondents reported actively stopping such behaviors and reminding others to pay attention to environmental protection, while 62.36% chose "disagree internally but don't intervene proactively" (36.21%), "indifferent as it doesn't concern me" (17.82%), or "occasionally engage in similar behaviors but find it inconvenient to stop" (8.33%). There's a positive correlation between environmental behavior frequency and intervention attitudes: Among respondents who consistently practice eco-friendly behaviors, 41.54% actively stop harmful actions, compared to merely 5.88% of those who "never do so." Moreover, 41.18% of these respondents find it difficult to intervene due to their own similar behaviors. This phenomenon exemplifies the classic "knowledge-action gap" in college students' environmental awareness [13-14], as illustrated in Figure 10 below:

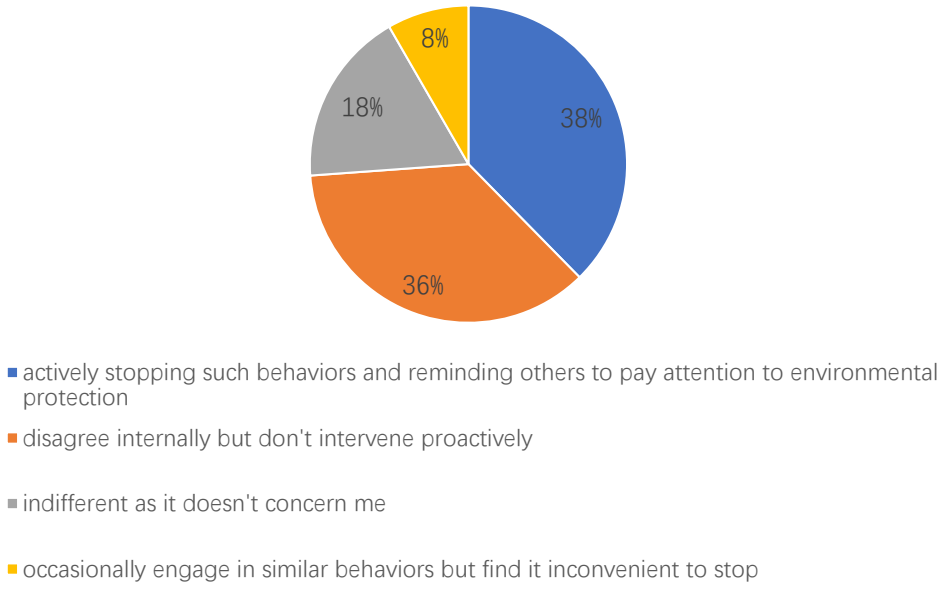


Figure 10. How do you respond to environmentally harmful behaviors around you?

3.2.4. Environmental protection activities involve extensive participation, with club activities serving as the primary format

College students demonstrate high participation rates in environmental activities, with only 0.29% having never engaged in any eco-friendly initiatives. Environmental club activities recorded the highest participation rate at 46.26%, followed by eco-related competitions (43.10%), daily environmental actions (41.95%), sharing environmental science content (39.37%), and volunteer environmental services (35.92%). Sophomores form the core participant group, accounting for the largest proportion across all activities. Environmental clubs in regular undergraduate institutions stand out, with 35.92% of respondents reporting frequent club activities and high participation levels. This highlights the crucial role of university environmental clubs as practical platforms for fostering student engagement in environmental protection, as illustrated in Figure 11 below:

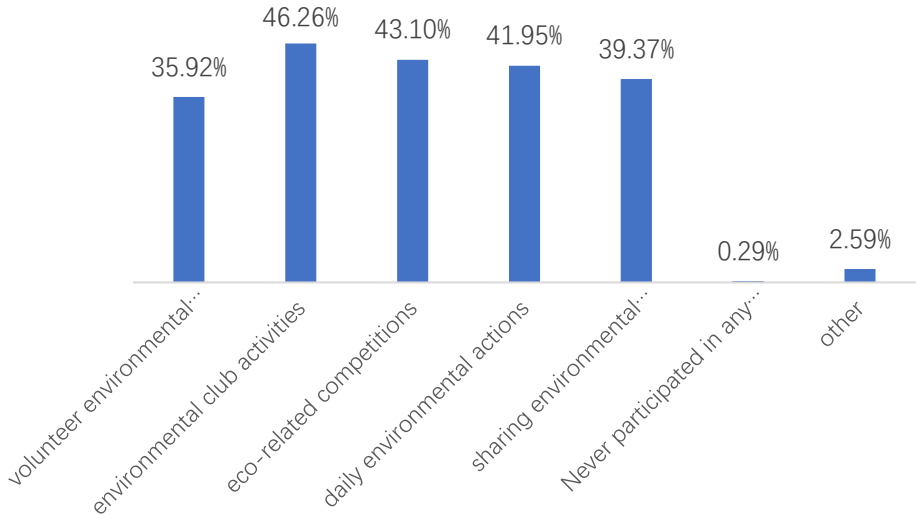


Figure 11. Have you participated in any of the following environmental protection activities?

3.3. Analysis of Influencing Factors on Environmental Behavior Among College Students

3.3.1. Internal Factors: Core driver as environmental awareness

Environmental awareness serves as the most fundamental intrinsic factor influencing college students' eco-friendly behaviors, with an average score of 4.15 out of 5 significantly higher than other factors. Among respondents, 46.84% perceived their environmental awareness as having "extreme influence" on eco-friendly behaviors, while 31.61% considered it "significant influence," accounting for nearly 78.45% of total responses. A univariate linear regression analysis using environmental behavior frequency as dependent variable and core environmental concept cognition as independent variable revealed a statistically significant positive correlation (regression coefficient $\beta=0.39$, $p=0.000$). Pearson correlation analysis further confirmed a strong positive relationship ($r=0.41$, $p<0.01$), indicating that higher environmental awareness correlates with increased behavioral implementation frequency. These findings validate the core driving role of cognitive attitudes in individual behavior as proposed by the Planned Behavior Theory, while highlighting the critical importance of environmental education in cultivating sustainable practices among university students [15].

3.3.2. External Factors: The university environmental education system serves as a critical support

The university environmental education system (including courses, publicity campaigns, and student organizations) exhibits a significant positive correlation with college students' environmental behaviors, serving as a key external factor influencing such behaviors. Pearson correlation analysis revealed that the availability of environmental courses showed a correlation coefficient of $r=0.37$ ($p<0.01$) with environmental behavior frequency, while environmental publicity campaigns demonstrated a correlation coefficient of $r=0.18$ ($p<0.01$). Similarly, the development of environmental student organizations exhibited a correlation coefficient of $r=0.27$ ($p<0.01$), all indicating statistically significant positive correlations.

A multiple linear regression model was constructed with environmental behavior frequency as the dependent variable and environmental education courses, publicity campaigns, and student organization development as independent variables. The regression results demonstrated that all three independent variables significantly positively influenced environmental behavior frequency, with environmental education courses showing the strongest impact ($\beta=0.32$). A comprehensive environmental education system in higher education institutions effectively enhances students' environmental awareness, thereby promoting practical environmental behaviors. For instance, students enrolled in diverse environmental courses exhibited a significantly higher proportion of "highly familiar" with environmental concepts (34.62%) compared to those without such courses (8.33%).

3.3.3. Hindering Factors: Insufficient knowledge, lack of channels, and absence of incentives

The primary barriers to college students' participation in environmental protection efforts can be categorized into three main factors: Lack of environmental knowledge (40.23%) is the foremost obstacle, followed by insufficient incentive mechanisms leading to low engagement (37.36%) and limited access to effective participation channels (33.91%). Additional challenges include academic commitments (25.57%), lack of awareness among peers (25.86%), and perceptions of limited individual impact (28.74%). These barriers vary across different cognitive groups: Students eager to participate but lacking access channels demonstrate stronger demand for environmental education (45.86%), while those with environmental awareness but limited action experience greater need for incentive mechanisms (38.46%). This highlights significant gaps in university environmental education regarding the transition from theory to practice.

3.4. Current Status and Evaluation of Environmental Education System Construction in Higher Education Institutions

3.4.1. Environmental protection courses are offered with a solid foundation, but their quality and coverage are uneven.

Survey results indicate that 72.99% of universities have introduced environmental protection-related courses (with 30.75% offering diverse programs and 42.24% providing only 1-2 foundational courses). However, 27.01% of institutions still lack adequate course development, including 9.20% that offer no environmental education programs or activities. Quality variations exist across university types: 211 Project universities demonstrate the highest course diversity (37.36%), while 985 Project institutions show significant polarization—46.88% lack environmental education offerings. Regular undergraduate and vocational colleges primarily provide basic courses, with 13.64% of vocational colleges offering no such programs. Course availability correlates positively with students' environmental awareness and satisfaction levels. Among students without environmental courses, 33.33% show complete ignorance of environmental concepts, and satisfaction with university environmental education systems stands at merely 28.13%, as illustrated in Figure 12 below:

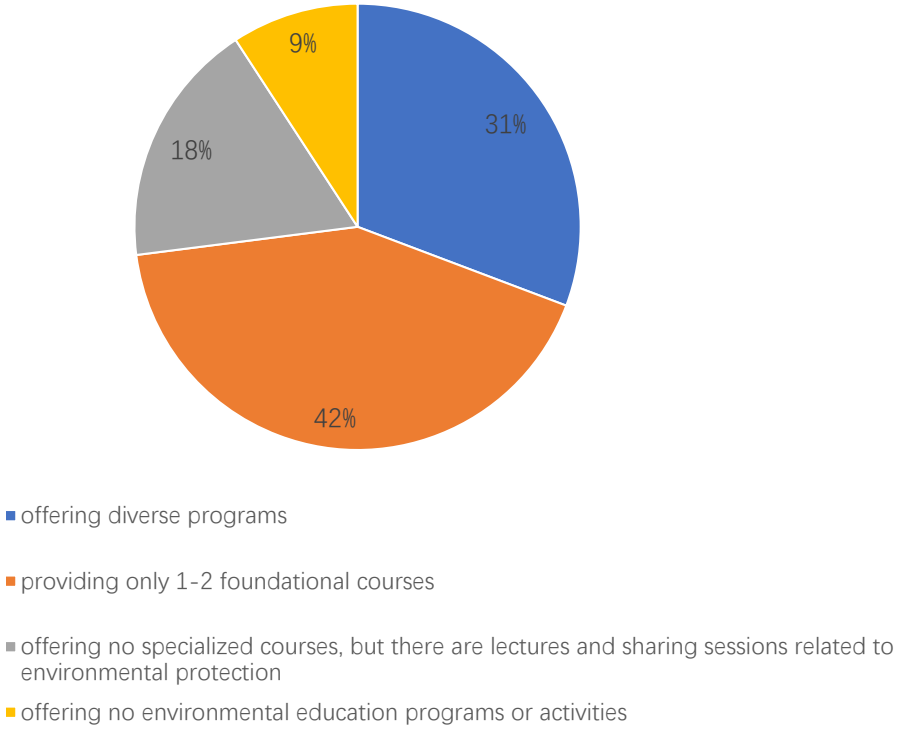


Figure 12. Does your university offer environmental protection-related courses (including both compulsory and elective courses)?

3.4.2. Environmental awareness campaigns exhibit monotonous formats and lack regularity

Environmental awareness campaigns at universities predominantly adopt "occasional and monotonous formats." A staggering 41.95% of institutions report conducting such activities "occasionally with limited formats," while only 29.60% maintain "regular campaigns featuring diverse formats and broad coverage." Notably, 28.45% of universities conduct campaigns "rarely" or "never." Top-tier 985 universities demonstrate stronger engagement, with 37.12% consistently organizing "diverse-format campaigns." In contrast, conventional undergraduate institutions exhibit weaker initiative, as 50% merely conduct "occasional campaigns." Campaign frequency shows a positive correlation with student satisfaction: universities that never implement awareness programs report only 22.22% student satisfaction with environmental education systems, with 77.78% rating it

as "average" or lower. Traditional communication methods struggle to align with modern college students' information consumption habits, significantly undermining environmental education effectiveness—as illustrated in Figure 13 below:

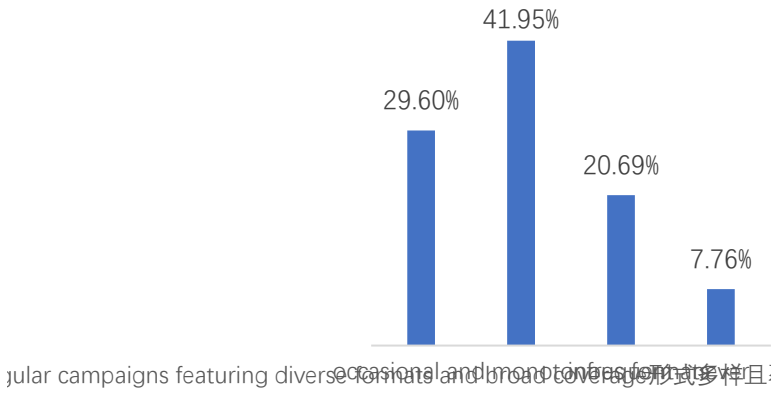


Figure 13. Does your university conduct environmental awareness campaigns (such as Environmental Protection Month, poster promotions, or WeChat public account posts)?

3.4.3. Environmental protection clubs have high participation rates, but exhibit insufficient activity quality and vitality

Nearly 90% of Chinese universities have established environmental protection clubs, yet activity quality shows significant disparities: Only 29.60% of clubs maintain "frequent activities with high participation rates," while 63.79% exhibit "limited engagement or virtually no activities." A striking 6.61% of institutions lack any environmental clubs altogether. Regular undergraduate colleges demonstrate the highest club activity levels (36.27% frequent participation), whereas vocational colleges show particularly low engagement rates (59.09%). Over 20% of clubs at 985/211 universities "rarely conduct activities." Club activity levels positively correlate with student participation rates and satisfaction: Clubs with frequent activities achieve 79.61% satisfaction in environmental education, compared to merely 8.70% at universities without clubs. Persistent funding shortages and inadequate guidance for these clubs hinder their potential as practical platforms, as illustrated in Figure 14 below:

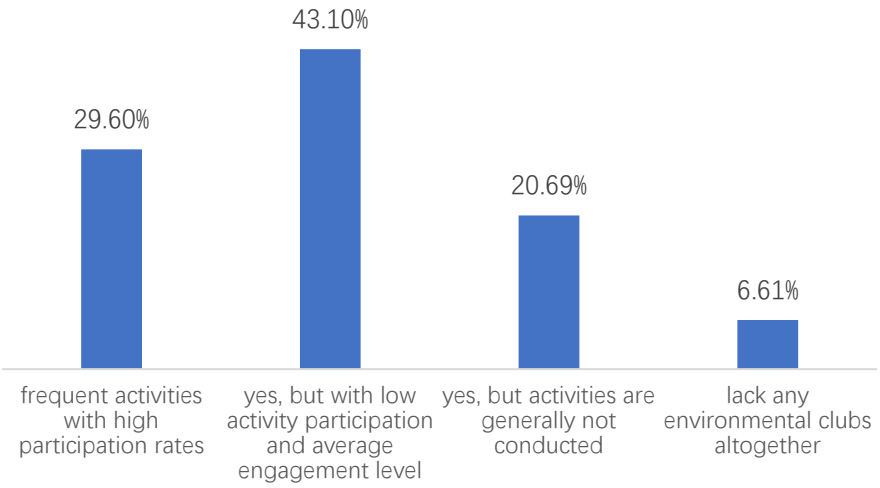


Figure 14. Does your university have any environmental protection-related clubs or organizations?

3.4.4. The overall satisfaction with the environmental education system is relatively high, with curriculum being the core influencing factor

69.25% of students expressed "high satisfaction" (37.64%) or "fair satisfaction" (31.61%) with their university's environmental education system, while only 10.63% reported "low satisfaction" or "strong dissatisfaction," indicating overall high satisfaction levels. A multiple linear regression analysis conducted with student satisfaction as the dependent variable and environmental courses, publicity campaigns, and student organizations as independent variables revealed significant positive impacts from environmental courses (regression coefficient $\beta=0.32$, $p<0.01$), publicity campaigns ($\beta=0.18$, $p<0.01$), and student organizations ($\beta=0.27$, $p<0.01$). These factors collectively explained 21.1% of satisfaction variance, with course-related factors demonstrating the strongest influence. No significant differences in environmental education satisfaction were observed across university types ($F=0.12$, $P=0.911>0.05$), suggesting that improving environmental education quality depends not on institutional hierarchy but requires coordinated efforts in curriculum development, publicity initiatives, and student organization development across all universities. These findings provide unified reference directions for optimizing environmental education systems across higher education institutions.

3.4.5. Students' Improvement Needs for Environmental Education Focus on Publicity and Facilities

College students demonstrate clear priorities for improving university environmental education systems. The two most prominent demands are enhancing environmental awareness campaigns and innovating communication methods (50.86%) and upgrading eco-friendly facilities (46.55%), followed by increasing environmental activities (32.76%), expanding environmental education courses (33.62%), and establishing incentive mechanisms (28.74%). Demand patterns vary across student demographics: students without environmental courses show the strongest need for new curriculum offerings (40.63%); those experiencing limited environmental activity formats prioritize expanded participation channels (37.67%); while students dissatisfied with existing facilities simultaneously emphasize facility improvements (52.63%) and additional course offerings (52.63%). These student needs align with existing gaps in university environmental education [16], providing targeted directions for institutional reforms as illustrated in Figure 15 below:

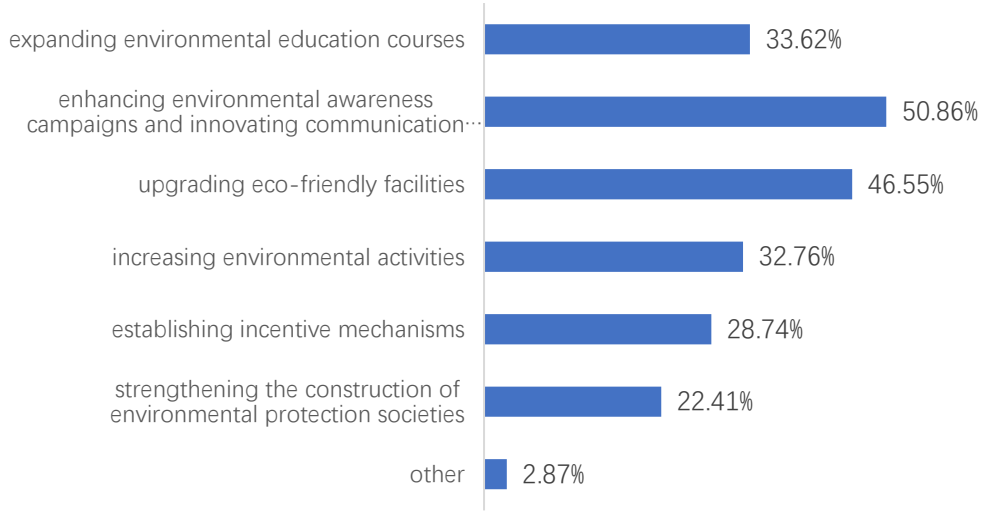


Figure 15. What do you think are the most critical areas for improvement in environmental education at universities?

3.5. Impact of Regional Factors on College Students' Environmental Awareness and Behavior

3.5.1. Sample distribution by region

The 348 recovered questionnaires covered 31 provincial-level administrative regions across China, with sample distribution across different areas providing diverse perspectives for the study. Specifically, the sample composition included 40 responses from Shaanxi Province, 35 from Jiangsu Province, 30 from Beijing Municipality, 25 from Shanghai Municipality, 22 from Guangdong Province, 18 from Sichuan Province, and 16 from Shandong Province.

3.5.2. Environmental Awareness Performance Under Regional Differences

From an environmental awareness perspective, students in municipalities represented by Beijing and Shanghai scored an average of 3.7 and 3.6 points respectively in understanding environmental strategies such as the "dual carbon" goals. As the capital, Beijing has vigorously promoted national environmental policies through extensive publicity campaigns. The city hosts numerous research institutions and universities with abundant academic resources, frequently organizing environmental lectures and seminars that provide students with ample opportunities to access cutting-edge environmental knowledge. Shanghai, as an international financial hub, closely aligns with global environmental concepts. Multinational corporations and international organizations introduce diverse environmental perspectives, while university curricula increasingly integrate international environmental trends—such as teaching and research in environmental management and green finance—thereby enhancing students' cognitive understanding.

In inland provinces such as Gansu and Qinghai, students 'average cognitive scores in environmental education were merely 3.1 and 3.0 respectively. These regions face challenges including relatively underdeveloped economies, limited funding for environmental education resources, narrow curricula in university environmental programs, and restricted geographical accessibility that hinders international academic exchanges. These factors collectively restrict students' exposure to cutting-edge environmental concepts and knowledge.

3.5.3. Environmental Behavior Practices Under Regional Differences

In terms of environmental conservation practices, coastal provinces with developed economies such as Jiangsu and Guangdong have demonstrated remarkable achievements. In Jiangsu Province, 65% of students actively participate in environmental protection activities, while Guangdong Province reports a similar rate of 62%. The high level of openness in coastal regions, coupled with international environmental trends, has led to strong engagement and support from businesses and social organizations in eco-friendly initiatives. This creates abundant practical platforms for students, including corporate energy-saving projects and community-based marine conservation programs. Meanwhile, local governments actively promote green development policies, providing financial and policy incentives to encourage student participation in environmental practices.

In contrast, students in inland provinces such as Shaanxi (58%) and Sichuan (55%) exhibit higher environmental awareness. While some students in these regions demonstrate strong environmental commitment, their participation in eco-practices remains limited due to the region's traditional industrial and agricultural structure. Additionally, the absence of large-scale environmental enterprises and social organizations like those in coastal areas restricts student engagement to basic campus activities such as waste sorting, with few opportunities for fieldwork beyond school premises.

3.5.4. Impact of Typical Regional Policies and Environment on Environmental Awareness and Behavior

Taking Hainan as an example, since the establishment of its free trade port, "green development" has become a key concept. Local university students have shown significantly increased awareness and participation in environmental protection efforts. The survey reveals that Hainan students

demonstrate high understanding of environmental policies and strong willingness to engage in local ecological conservation projects, which is closely linked to the government's implementation of ecological protection measures and emphasis on environmental education [17-18].

Take Shandong Province as another example. As a major industrial hub, the region has seen growing demand for environmental professionals in recent years under the new-old kinetic energy transition policy, prompting universities to strengthen environmental education programs [19]. Students have demonstrated significant improvements in environmental awareness, particularly regarding industrial pollution control knowledge. However, further guidance is needed to translate theoretical knowledge into practical environmental actions. The environmental consciousness and behaviors of college students are shaped by a complex interplay of regional policy orientations, economic structures, cultural backgrounds, and other factors.

4. DISCUSSION

4.1. Core Characteristics of Environmental Awareness and Behavior Among College Students: Strong Cognitive Abilities but Discrepancy Between Knowledge and Practice

The study reveals that college students currently demonstrate strong understanding of core environmental concepts, with high awareness of national strategies such as the "Dual Carbon Goals" and "Sustainable Development." Their environmental concerns align closely with key priorities in China's ecological civilization construction. This progress stems from sustained national environmental education initiatives and robust university environmental education systems. Particularly since the introduction of the "Dual Carbon Goals" strategy, universities have effectively enhanced students' environmental literacy through diversified approaches including curriculum integration and public awareness campaigns.

However, the study also revealed a significant "discrepancy between knowledge and action" in environmental protection among college students. On one hand, over 70% of students frequently engage in basic eco-friendly behaviors (such as turning off lights and conserving water), yet fewer than 40% actively intervene against environmentally harmful practices around them, with most students adopting a "passive acceptance" attitude toward such behaviors. On the other hand, most environmental activities remain confined to traditional campus formats, with limited participation in community-based or social practice initiatives. Some activities even exhibit issues like "utilitarian participation" and "going through the motions," resulting in insufficient depth and breadth of behavioral transformation. This phenomenon stems not only from students 'weak environmental responsibility awareness but also from universities' environmental education that prioritizes theory over practice, lacking effective guidance and incentives for students' eco-friendly actions.

4.2. Influencing Factors of Environmental Behavior Among College Students: Dual Effects of Intrinsic Awareness and Extrinsic Support

This study demonstrates that college students 'environmental behaviors stem from the combined influence of intrinsic awareness and extrinsic support. Self-awareness of environmental protection serves as the core driving force, with environmental cognition levels showing significant positive correlation with behavioral frequency. The key tenets of planned behavior theory indicate that cognitive attitudes directly shape behavioral intentions and actual actions. As the most critical extrinsic support factor, university environmental education systems—through their curriculum design, publicity initiatives, and student organization development—directly impact the deepening of students' environmental cognition and the implementation of eco-friendly practices.

The study reveals that insufficient knowledge, limited access to resources, and inadequate incentives are major barriers to college students' environmental protection practices. This highlights shortcomings in university environmental education during the "theory-to-practice" transition phase. On one hand, environmental education predominantly focuses on theoretical knowledge dissemination while lacking practical skills training, resulting in students who "understand environmental principles but lack implementation capabilities." On the other hand, universities fail to establish diversified environmental practice platforms or effective incentive mechanisms, leading to students who "want to engage in environmental initiatives but lack access or motivation." Additionally, the relatively weak influence of family and social environments underscores the absence of a collaborative "home-school-community" education framework in current environmental education systems.

4.3. Shortcomings in the Construction of Environmental Education Systems in Higher Education Institutions: Emphasis on Formalities Over Practical Outcomes and Insufficient Coordination

As the primary platform for environmental education among college students, universities have established foundational systems encompassing curriculum design, publicity campaigns, and student organizations. However, research findings reveal persistent challenges in current environmental education practices, characterized by an overemphasis on formalities at the expense of practical outcomes and insufficient coordination across operational components. Firstly, curriculum development remains uneven: many institutions, particularly vocational colleges, lack systematic environmental education programs, while 985 Project universities exhibit polarized course offerings, leaving non-environmental majors with limited access to in-depth environmental education. Secondly, promotional methods remain monotonous, predominantly relying on traditional approaches like poster displays and leaflet distribution. These approaches often feature dry content lacking interactive or immersive elements relevant to student lifestyles, resulting in poor engagement effectiveness. Thirdly, environmental clubs struggle with operational vitality due to insufficient funding, limited venues, and inadequate professional guidance. Their conventional activity formats and narrow outreach scope fail to effectively motivate student participation. Fourthly, there is inadequate synergy among curriculum development, publicity initiatives, and club operations, lacking a closed-loop mechanism of "theoretical instruction → concept dissemination → practical implementation." This structural gap significantly compromises the effectiveness of environmental education programs.

Furthermore, environmental education in higher education institutions faces challenges such as inadequate hardware facilities and the absence of supervision and evaluation mechanisms. Issues include poorly designed waste sorting bins, incomplete recycling systems for used items, failure to incorporate environmental literacy into students 'comprehensive quality assessments, and insufficient recognition and commendation of environmentally conscious individuals and groups. These factors further hinder the normalization of students' eco-friendly behaviors.

4.4. Optimization Direction of Environmental Education in Higher Education Institutions Supported by Policies: Aligning with the "Dual Carbon" Strategy and Implementing Moral Education

The advancement of the "Dual Carbon" strategy has imposed new requirements on environmental education in higher education institutions—not only to popularize fundamental environmental concepts but also to cultivate students' green development mindset and low-carbon practical skills. Currently, the development of environmental education in universities still lags behind national policy objectives. There is an urgent need to align with national strategies, prioritize moral education as the core mission, and enhance the environmental education system through four dimensions: curriculum design, public awareness campaigns, practical implementation, and incentive mechanisms. This approach aims to shift from knowledge transmission to competency cultivation.

Meanwhile, the "Opinions on Comprehensively Strengthening Labor Education in Primary, Secondary, and Higher Education Institutions in the New Era" advocates integrating ecological civilization education with green labor practices [20]. This initiative offers a novel approach to environmental education in universities by combining environmental awareness with labor training. Through hands-on activities such as waste sorting, campus greening initiatives, and community environmental services, students can deepen their understanding of environmental protection, cultivate sustainable habits, and effectively address the disconnect between knowledge and action.

4.5. Impact of Regional Factors on Research Findings and Research Significance: Exploring New Approaches in Environmental Protection Research Based on Regional Data

The findings of this study reveal multifaceted characteristics of environmental awareness and behaviors among college students. Compared with previous studies that overlooked regional disparities, our analysis incorporating geographical factors demonstrates significant differences in environmental cognition and behavior across different regions. For instance, in terms of environmental awareness, students from economically developed areas with abundant educational resources exhibit higher cognitive levels, while those in some inland central and western regions show relatively lower awareness—results that complement other studies focusing solely on macro-level observations.

From a research perspective, incorporating regional factors enables more precise identification of environmental education needs among college students. For instance, tailored strategies can be developed based on disparities between coastal and inland regions, as well as economically developed and underdeveloped areas. This study also provides valuable insights for subsequent research, demonstrating that regional factors constitute a critical variable when examining environmental issues among college students. Future studies could further explore how regional culture and policies profoundly influence students' environmental awareness and behavioral patterns.

5. COUNTERMEASURES AND RECOMMENDATIONS

Based on the findings of this study and in alignment with national policy requirements, targeted strategies are proposed from three perspectives: individuals, universities, and society. These measures aim to enhance college students' environmental literacy, facilitate the transformation of environmental awareness into practical actions, improve university environmental education systems, and establish a collaborative environmental education framework involving families, schools, and communities.

5.1. Individual Level: Strengthen intrinsic awareness, practice green living, and proactively assume environmental protection responsibilities

1. Enhance environmental awareness depth: Proactively study core environmental concepts such as "dual carbon" goals, sustainable development, and national environmental policies, while focusing on key environmental issues like air pollution and water pollution. Expand the scope of environmental knowledge, not only understanding basic environmental principles but also mastering practical environmental skills such as waste sorting and low-carbon transportation.

2. Cultivate green lifestyle habits: Integrate environmental protection concepts into daily life by refusing non-degradable single-use plastic products, carrying reusable bags when shopping, and bringing water bottles and tableware when going out; practice the "Clean Plate Campaign" by taking meals as needed to eliminate waste; prioritize second-hand items and engage in rational consumption to avoid competitive spending; opt for low-carbon modes of transportation such as walking or cycling for short trips, and reduce the use of electric vehicles and taxis.

3. Strengthen environmental responsibility awareness: Transition from "passive environmental protection" to "active environmental protection". Not only should individuals practice environmental behaviors themselves, but also proactively prevent non-environmental behaviors around them, encouraging classmates and family members to participate in environmental protection efforts. Actively engage in campus and social environmental protection practices, rejecting "utilitarian participation", and deepen the understanding of environmental significance through practical experience.

5.2. University Level: Improve the environmental education system, strengthen practical guidance, and establish a closed-loop framework of "curriculum + publicity + clubs + practice"

As the primary platform for environmental education, universities must align with the national "dual carbon" strategy by integrating environmental education throughout the entire talent cultivation process. This involves addressing issues such as "formalism over substance" and "disconnection between knowledge and practice," thereby establishing a systematic and routine environmental education framework.

1. Optimize the environmental education curriculum system to enhance course quality and coverage: First, achieve full curriculum coverage by requiring all universities to offer at least 1-2 compulsory environmental literacy courses. Vocational colleges should draw lessons from 211 Project universities by diversifying course offerings, while 985 Project universities should promote balanced curriculum development to avoid polarization. Second, enrich course content by incorporating cutting-edge environmental topics such as the "dual carbon" strategy, biodiversity conservation, and plastic pollution control, while designing interdisciplinary courses tailored to specific majors (e.g., green manufacturing for engineering disciplines, green economics for business and management programs). Third, strengthen practical teaching through environmental skill workshops and field research activities, enabling students to master environmental methodologies through hands-on experience.

2. Innovate environmental awareness campaigns to enhance relevance and engagement: Moving beyond traditional methods like posters and flyers, we leverage college students' digital habits through integrated online-offline approaches including short videos, live streams, eco-knowledge quizzes, and creative competitions. Content should resonate with student lifestyles by minimizing didactic tones and highlighting real-world environmental cases and role models, embedding sustainability concepts deeply. Tailored strategies address different academic cohorts—third-year students benefit from campus event promotions, while seniors engage with updates on societal environmental trends.

3. Boosting Environmental Clubs' Vitality and Building Diverse Practice Platforms: Enhance financial support, venue allocation, and professional guidance for environmental clubs to establish sustainable operational mechanisms. Encourage innovative activity formats such as tree planting, waste sorting supervision, and community environmental awareness campaigns, expanding eco-initiatives from campus to neighborhood levels. Strengthen partnerships with social environmental organizations to provide students with internships and volunteer positions, enabling hands-on exposure to real-world environmental practices.

4. Enhance environmental protection facilities and incentive mechanisms to institutionalize eco-friendly practices: Optimize campus environmental infrastructure layout with clearly marked waste sorting bins, establish recycling systems for courier packaging, used batteries, and secondhand clothing, and create book-sharing corners and idle-item exchange platforms. Develop robust incentive mechanisms by incorporating environmental literacy into students' comprehensive evaluations, recognizing exemplary individuals and groups through bonus points, prizes, and other rewards to boost participation enthusiasm. Integrate environmental initiatives into school performance assessments with clearly defined departmental responsibilities to prevent accountability evasion.

5. Integrating diverse educational approaches to foster environmental awareness: Combine environmental education with labor education and ideological-political education through initiatives such as campus greening and eco-friendly labor practices, enabling students to apply environmental principles in hands-on activities. Incorporate environmental education into campus culture by creating eco-themed landscapes and information boards, cultivating a campus atmosphere where "everyone participates in environmental protection, every action contributes to sustainability, and environmental awareness permeates all aspects of campus life" [21-22].

5.3. Social Level: Strengthening Policy Support, Establishing Collaborative Platforms, and Creating an Environmental Education Atmosphere Through Home-School-Community Collaboration

The enhancement of environmental literacy among college students cannot be achieved without societal support and collaboration. It requires leveraging social resources to establish a collaborative education platform involving families, schools, and communities, thereby forming a synergistic force for environmental education and implementing the national ecological civilization construction requirements of "collective governance by all citizens and source prevention."

1. Enhancing policy support and public awareness campaigns: The government should introduce policies to encourage universities to strengthen environmental education and practical training, providing financial incentives to institutions that demonstrate significant achievements in establishing environmental education systems. Environmental awareness campaigns tailored to student interests should be promoted on popular platforms such as Douyin, Xiaohongshu, and Weibo. Media outlets should prioritize coverage of environmental issues affecting college students and showcase positive environmental initiatives, fostering a supportive social atmosphere for environmental protection.

2. Establishing Environmental Practice and Employment Platforms: Environmental organizations, enterprises, and universities collaborate to implement summer social practice programs and environmental internship bases, providing college students with more opportunities for environmental practice. Policy and financial support is offered for student-led environmental entrepreneurship projects to encourage participation in the environmental industry, thereby integrating environmental value with personal development.

3. Enhance the social environmental protection service system: Standardize recycling channels for used clothing and waste materials around campuses, improve the waste sorting and disposal system, and provide convenient social support for college students to practice environmental behaviors; Launch environmental content and interactive activities such as eco-check-ins and low-carbon travel points on commonly used college student apps and platforms to guide students in developing routine environmental behaviors.

4. Promoting collaborative education among families, schools, and communities: Through community and school outreach initiatives, enhance parents' environmental awareness and encourage families to adopt green lifestyles, enabling students to practice eco-friendly behaviors within their households. Communities, schools, and enterprises should jointly organize environmental activities such as community environmental campaigns and parent-child eco-practices, establishing an environmental education framework characterized by "school instruction, family guidance, and societal promotion."

6. CONCLUSION AND PROSPECTS

6.1. Research Conclusions

Through an empirical study involving 348 college students, this research employs quantitative methods including descriptive statistics, Pearson correlation analysis, and multiple linear regression

analysis to systematically examine environmental awareness, behavioral patterns, and influencing factors among university students. It also evaluates the effectiveness of environmental education systems in higher education institutions, yielding the following five key conclusions:

1. College students demonstrate generally strong understanding of core environmental concepts, with nearly 70% of respondents achieving "very familiar" or "fairly familiar" proficiency. Their environmental concerns primarily focus on air and water pollution, while school curricula serve as the primary channel for acquiring environmental knowledge. The recognition of environmental significance encompasses both macro ecological values and personal growth benefits, a characteristic closely aligned with the advancement of national ecological civilization education initiatives.

2. College students demonstrate relatively high engagement rates in environmental protection behaviors, yet exhibit a notable disconnect between awareness and action, with less than 40% actively intervening in environmentally harmful behaviors. Environmental activities are widely participated in, primarily through club initiatives, with sophomores forming the core participant group. Correlation analysis reveals a significant positive correlation ($r=0.43$, $p<0.01$) between individual environmental behavior frequency and group evaluations. While university environmental education has achieved progress in foundational behavior cultivation, practical guidance remains inadequate.

3. Environmental awareness serves as the core intrinsic factor influencing college students 'eco-friendly behaviors, with univariate linear regression revealing a significant regression coefficient of $\beta=0.39$ ($p<0.001$). The university's environmental education framework (including curricula, awareness campaigns, and student organizations) constitutes a key extrinsic factor, where the multiple linear regression model accounts for 21% of environmental behavior variance. Conversely, insufficient environmental knowledge, limited participation channels, and inadequate incentive mechanisms emerge as major barriers, demonstrating the dual influence of intrinsic cognition and extrinsic support on environmental behavior patterns.

4. Higher education institutions have established a foundational environmental education system with generally high student satisfaction rates, yet challenges persist including uneven course quality and coverage, monotonous promotional approaches, lack of student organization engagement, and poor interdepartmental coordination. Regression analysis using satisfaction as the dependent variable reveals that courses, publicity initiatives, and student organizations collectively account for 21.1% of satisfaction variance. Students' demands for environmental education improvement primarily focus on innovative communication strategies and enhanced infrastructure. All universities should prioritize practical effectiveness in environmental education rather than relying solely on institutional advantages.

5. Regional factors significantly influence college students 'environmental awareness and behaviors. There are notable disparities between economically developed regions and inland areas in terms of cognitive levels and practical engagement frequency, while coastal and inland universities differ in access to environmental education resources and practical opportunities. However, this study lacks in-depth analysis of regional factors, with uneven sample distribution across regions. Future research should expand sample sizes from diverse regions to further explore the specific impacts of regional policies and cultural factors on students' environmental cognition and behaviors.

6.2. Research Perspectives

While this study has revealed the current status and influencing factors of environmental awareness and behaviors among college students, validated core research hypotheses through quantitative formulas and models, and proposed targeted countermeasures, it still presents certain limitations: the survey sample shows a relatively low proportion of postgraduate students and vocational college students, indicating room for enhancing sample representativeness; the research primarily focuses on internal university factors influencing students' environmental behaviors, with insufficient analysis of deeper impacts from family and social environments.

Future research could expand sample coverage by incorporating graduate students, vocational college students, and regional university participants to enhance representativeness. Longitudinal tracking studies combined with panel data models could analyze dynamic patterns in college students 'environmental awareness and behaviors. Investigating collaborative mechanisms among families, society, and universities through structural equation modeling (SEM) would provide comprehensive insights into direct and indirect influences on environmental actions. Integrating AI and big data technologies could explore digital transformation pathways for university environmental education, improving its effectiveness and precision to better support China's "dual carbon" strategy and ecological civilization development.

The construction of ecological civilization is a long-term systematic project, and the improvement of college students 'environmental literacy requires the joint efforts of individuals, universities, and society. Universities need to closely align with the national "dual carbon" strategy and relevant policies on ecological civilization education, continuously improve the environmental education system, and strengthen practical guidance. College students need to enhance their intrinsic environmental awareness and translate environmental concepts into concrete actions. Society needs to establish collaborative education platforms and foster a favorable environmental atmosphere. Only by forming a synergistic force among families, schools, and society can we effectively improve college students' environmental literacy, enabling them to become active practitioners and promoters of ecological civilization construction, and contribute youthful energy to the building of a beautiful China!

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