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Identification of influencing factors of college students' pro-environmental behavior by DEMATEL-based ANP method

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ABSTRACT

To stimulate the pro-environmental behavior of college students and cultivate the public consciousness of protecting the ecological environment, based on referring to the current research results, this article summarizes five dimensions and 17 major variables that may impact college students' environmental behaviors and uses the decision making trial and evaluation laboratory based analytic network process method (DEMATEL-based ANP) combining decision making trial and evaluation laboratory (DEMATEL) and analytic network process (ANP). The regulation mechanism of influencing elements of college students' pro-environment behavior decision making is quantitatively studied, including impacting degree and mutual relations among factors, and key variables are identified. The results show that the emotion cognition, governmental and social dimensions of college students are the reason factors, while the subjective dimension of college students and the dimension of universities are both outcome factors and key factors; knowledge of the environment, geographical features, relational network, construction of environmental protection in colleges and universities, and national development idea are the most influential elements among the five dimensions respectively; The emotion cognition dimension of college students, campus environmental protection propaganda, environmental protection construction in colleges and universities, environmental protection course offering, model effect, personal responsibility, and values are the seven key factors. The study results not only confirm that DANP can effectively recognize the mechanism of influencing factors of college students' pro-environment behavior, but also offer conductive decision-making reference for standardizing college students' environmental behavior.

Keywords: Pro-environmental behavior; College students; Emotion cognition; DEMATEL-based ANP; Key factors

1. Introduction

For the past few years, the increasingly serious environmental pollution has caused people's wide attention, and everywhere in the world is suffering from different levels of environmental pollution disasters, protecting the environment and controlling environmental pollution has become the common aims of the public [1]. The shortage of natural resources and ecological environment deterioration in China, such as water pollution, air pollution, soil pollution and vegetation degradation, are still severe problems. To conduct multi-dimensional energy efficiency environmental governance and implement the whole regional "ecological excellence and environmental beauty" has become the bottleneck restricting the sustainable enhancement of the country [2,3]. In the report of the 19th national congress of the communist party of China (CPC), the CPC central committee proposed to "enhance the whole conservation and

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recycling of resources, realize national water-saving actions, reduce energy and material consumption, and implement circular links between production and living systems." China's environmental management model has mainly been a "from top to bottom" hierarchical management led by the government. However, due to China's environmental problems are complex and diverse, dispersed and hidden, environmental governance is often in the "government failure" embarrassing situation [4,5]. According to the new institutional economics, the induced institutional change that introduces public power is more effective than the compulsory institutional change that only the government intervenes, the public's profound cognition of environmental problems induces the formation of local internal logic operational regulation, grassroots social autonomy embedded in the legal system may be more effective to govern the root cause of environmental pollution [6]. Therefore, the social public, as the major micro-body of environmental pollution emission, standardizes its pro-environment production and lifestyle which is the key to fundamentally control the ecological and environmental pollution in China.

Pro-environment behavior refers to the activities that an individual intentionally avoids having negative impacts on the environment subjectively, to enhance the sustainable development of the economy, environment, and society the combination of a series of actions, specific extensions, such as water conservation, waste recycling, green consumption, low carbon travel, etc, also in the aspect of environmental protection, pollution, and other public discussions, exploration and civic action to settle the problem of environment. As a significant group of high energy consumers, college students are the backbone force leading the country's green growth. Their environmental behavior patterns play a strong driving role in driving the demonstration of other social groups, and cultivating their pro-environment behavior is the endogenous driving force to gain sustainable social enhancement. However, nowadays, college students' awareness of environmental protection is uneven, and they often produce environmental misconduct behaviors, such as littering, wasting food, wasting water and electricity resources, damaging public goods, etc, which are seriously deviated from the simple and moderate, green and low-carbon lifestyle advocated by the state. In order to clarify the formation logic of college students' pro-environment behavior, recognize key influencing elements and key control points, and train their good environmental awareness and behavior, this research carries out an in-depth study on pro-environmental behaviors of college students in Jiangsu Province by empirical investigation, which has stronger theoretical and practical meaning.

2. Literature review and research hypothesis

2.1. Literature review

Based on prosocial behavior, pro-environmental behavior is directly directed to the welfare of others, group interests or organizational interests, which is essentially a special form of prosocial behavior [7]. Presently, researches on ecological and environmental protection behaviors at home and abroad pay more attention to influencing elements, including three aspects: social psychological factors, demographic factors and other external factors. Social psychological factors mainly include attitude, environmental cognition, values, environmental sensitivity, behavior control, etc. For instance, came up with the planned behavior theory, demonstrating that individual behavioral attitude, subjective norms, and cognitive behavior control decide individual behavioral intention [8]; and others proposed the theory of values—beliefs—norms, pointing out that the sense of responsibility for environmental protection and the sense of environmental morality significantly impact individual environmental behavior, while self-interested values negatively affect environmental behavior [9]; research put forward that individual social norms, guilt, problem consciousness, and internal elements have an influence on environmental behaviors through behavior control, environmental cognition and moral norms [10–12]; measured public environmental behavior and discovered that environmental cognition and sense of environmental value positively affected citizens' pro-environmental behavior [13]; based on studying environmental behaviors of college students in three universities including Beijing Forestry University, Beijing Vocational Collage of Labour and Social Security in Beijing and Hohhot Minzu College in Inner Mongolia, got that college students' environmental values have an important influence on their pro-environmental behaviors, while environmental care plays a direct and indirect intermediary role according to the value categories [14].

In aspects of demographic factors, it mainly contains education level, gender, age, occupation, region, etc. For example, the more educated the public is, the more pro-environmental behaviors they engage in [15,16]. Nevertheless, a study found that there was no important relationship between education level and public pro-environment behavior [17]. A researched the environmental friendly behaviors of Chinese urban residents and gained that females are more active in environmental protection in the private sector, while males are more active in the public domain [18]. Previous research argued that men were more active than women. Also, the impact of gender on public environmental behavior relies on regional cultural differences, and participation in religious activities may enhance individual pro-environmental behavior [19,20]. Regional characteristics also generate obvious differences in the environmental behaviors of urban and rural residents [21–23]. Urban citizens show more environmental protection behaviors than rural residents, and large urban residents show more pro-environmental behaviors than small towns [24]. However, other research raised that regional elements did not play a significant role in college students' environmental protection behaviors in the private sector [25]. A study also found that children growing up in rural areas care more about the environment than urban ones [26].

About other external factors, mainly includes social capital, social system, information transmission, social structure and so on. A study put forward that the attitude—behavior—situation theory, showing that public environmental behaviors are jointly determined by environmental attitudes and external elements [27]. Based on CGSS2013 data analysis found that government satisfaction with environmental protection work was significantly correlated with environmental protection behavior, but there was no correlation between public environmental protection legal awareness

and environmental protection behavior [28]. The utilization of agricultural waste as an instance and discovered that interpersonal trust and institutional trust had a significant positive impact on farmers' willingness to participate in the utilization of agricultural waste [15]. Environmental education is also a significant element impacting environmental behavior; Studies show that environmental education in collages has a direct positive influence on pro-environmental behaviors [29,30]. Nevertheless, the "upper limit effect" may also happen in environmental education, that is, strong pro-social motivation is shown in the procedure of environmental education, but it is seldom put into practice afterward. Media has a significant influence on pro-environment behavior, and the role of traditional media is higher than that of new media [31]. Also found that social media, for example, effect and government behaviors all had positive impacts on residents' pro-environment behaviors [16]; a study also proves that the role model effect of social relationships such as relatives, colleagues and neighbors significantly affects residents' pro-environment behaviors [32].

In conclusion, existing studies provide some literature support for this article, however, researches on pro-environment behavior more focus on the social-psychological factors and demographic factors and focus on one or several elements and environmental behavior relationship. Especially in the study on the pro-environmental behavior of college students in China, the influencing elements are numerous and complex. There are few in-depth researches on these factors and lack of in-depth mechanism elaboration. In the context of the national emphasis on promoting the construction of ecological civilization awareness, cultivating the environmental protection consciousness and pro-environmental behavior of college students has become the key point to manage environmental problems. So this research attempts to be aimed at college students in Jiangsu Province, takes advantage of the DNAP (DEMATEL-based ANP) method combining decision making trial and evaluation laboratory (DEMATEL) and analytic network process (ANP), analyzes the main elements affecting college students pro-environmental behavior, network diagram drawing dimensions and elements, and states the role of the relationship between factors. The formation mechanism of pro-environmental behaviors based on multiple subjects is raised, and policy suggestions are put forward to guide college students to practice pro-environmental behaviors.

2.2. Research hypothesis

Based on the typical traits of college students, this research summarized 17 indicators of five dimensions impacting college students' pro-environment behaviors for analysis and hypothesis (as shown in Table 1).

2.2.1. Emotion cognition

The emotion cognition dimensions of college students major choose four influencing factors: environmental knowledge, model effect, individual accountability and values. "The unity of knowing and doing" regards cognition as the foundation of behavior, and believes that behavior is generally performed at a certain cognitive level. The more students understand environmental knowledge, the more they care about the environment, and the easier they are to do pro-environmental behavior. Individuals can heighten their environmental awareness by mastering environmental knowledge, such as the existing situation of environmental pollution and environmental benefits; Meanwhile, environmental knowledge also decides individual environmental attitudes [33]. Other research shows that individuals with positive environmental attitudes are more inclined to

Table 1
Research indexes and codes

Dimension (Level 1 indicators)	Name	Influencing factors (Level 2 indicators)	Name
Emotion cognition	*D*1	Environmental knowledge	*C*1
		Model effect	*C*2
		Individual accountability	*C*3
		Values	*C*4
Objective attribution	*D*2	Gender	*C*5
		Major	*C*6
		Region	*C*7
		College	*C*8
Social impact	*D*3	Media use	*C*9
		Social norm	*C*10
		Relational network	*C*11
College impact	*D*4	Campus propaganda	*C*12
		Courses offering	*C*13
		University construction	*C*14
Government impact	*D*5	National environmental policy	*C*15
		National development concept	*C*16
		Local environmental management	*C*17

waste recycling exercises [34]. Normative activation theory assumes that personal moral norms will show the occurrence of pro-environmental behaviors when they are activated, which mainly includes three terms: conscious outcome, responsibility attribution and individual norms [35]. The stronger the individual's sense of responsibility for the behavior results, the more conducive it is to implement the behavior mode consistent with individual norms, individual norms attach importance to the strong sense of moral responsibility shown by certain environmental behaviors, and abiding by individual norms is helpful to enhancing individual pride and self-esteem. College students are more susceptible to be impacted by their classmates and friends. Peer models play a good role in driving their positive environmental behaviors, which is conducive to further improving their moral responsibility [16]. According to value—belief—norm theory [9], values can be divided into altruistic values, egoistic values and ecological values, in which ecosystem values and altruistic values have significant positive impacts on residents' pro-environment behaviors; researched the energy recycling behaviors of students at the University of Rhode Island in South Africa, and discovered that personal values can activate students' pro-environmental behaviors, while facility convenience is helpful to the implementation of pro-environmental behaviors [36].

According to the above, we can hypothesize that the environmental knowledge, role model effect, personal responsibility and values of emotion cognition dimension have an influence on college students' pro-environmental behavior.

2.2.2. Objective attribution

The objective attribution dimensions of college students mainly select four impacting elements: gender, major, region and college. The influence of gender on environmental behavior depends on external circumstances. A study showed that women are generally more inclined to engage in pro-environment behaviors than men [37]. Women are gentle, and their dual family roles as mothers and children make them attach more importance to environmental protection [10] while holding the opposite opinion [38]. Major, college-level and the region also have a significant impact on college students' environmental attitudes. Students majoring in engineering science and social science showed different pro-environment behaviors [39]; studied the pro-environment behaviors of college students in developed states and emerging countries, and found that the key determinants of pro-environment behaviors of college students in various countries were quite different [37]; studied the UK and discovered that students who grew up in villages had more positive environmental orientation than those who grew up in urban areas [40].

From above, we can assume that the gender, major, region and college variables of the objective attribution dimension have an influence on the pro-environment behavior of college students.

2.2.3. Social impact

As for the dimension of social impact, three elements are mainly selected: social norms, relationship network and media application. The social norm is a social code of conduct or social standard of conduct that exerts a subtle influence on the formation of individual belief and evaluation structure through the evaluation of the surrounding social environment. Generally, it includes code of conduct, behavioral habit, morality and ethics, value standards and so on. Studies have indicated that social norms are a systemic behavior better prediction variables, social norms may be internalized into individual specifications and indirectly impact the individual environment behavior, social norms also may directly affect the individual environment behavior. Under the dual impact of social responsibility and social norms, the public is more likely to display altruistic behaviors to harvest social respect [41]. The network college students live in mainly covers relatives, friends, teachers, classmates, etc. the relationship network is the external manifestation of social capital, and the relationship network of relatives and friends is at the core of the whole network [42,43]. College students acquire information resources through social networks and display corresponding environmental behaviors. Media application is also an important element affecting college students' pro-environment behavior. Media environment will cause pressure of public opinion, and motivate individuals' pro-environmental behavior by propagandizing that pro-environmental behavior is in line with moral standards and social norms; Also, if an individual perceives that media transmission can effectively impact other individual's environmental behaviors, he/she will further enhance his/her environmental protection intention [42].

From above, we can assume that social norms, relationship networks and media application of social influence dimension have an impact on college students' pro-environment behavior.

2.2.4. Collage impact

On the college impact dimension, courses offering, campus publicity and college construction are mainly chosen. There is a strong correlation between environmental education and college students' environmental knowledge, which is an important element impacting the formation of college students' pro-environmental behavior. A study believed that the impact of environmental education mainly dates from the knowledge transfer function of environmental education itself or the intrinsic motivation of students to learn environmental knowledge spontaneously [37]. Different subject types or environmental protection lectures can affect the transmission process of college students' environmental attitudes on environmental behaviors. I also studied 14 majors in universities in Ankara [41], Turkey, and found that most students majoring in environment-related courses were mainly from the field of social sciences. Therefore, social sciences may have a more profound influence on college students' pro-environment behaviors. Green and the energy-saving environment in colleges and universities can affect students' environmental cognition and awareness and believed that a healthy school environment is helpful to students' study, life and growth [44,45]. Hill et al. [46] compared the influences of ordinary buildings and energy-saving certified buildings on residents' pro-environmental behaviors, indicating that

LEED-certified buildings can enhance citizens' environmental awareness and environmental protection behaviors; a recent study has put forward that the improvement of campus physical buildings and technologies can promote students' energy recycling [36].

So we make the hypothesis that curriculum offering, garden publicity and environmental protection construction in colleges and universities influence dimension have an influence on college students' pro-environment behavior.

2.2.5. Government impact

As for the impacting elements of the government, it mainly chooses three aspects: national environmental protection policy, national development concept and local environmental governance. Government plays a very significant role in environmental governance, the idea of national enhancement influences the government's environmental protection efforts, and the intensity of government's investment in environmental protection directly relates to the level of environmental excellence, and the government's environmental credibility plays a cohesive and normative role in public behavior. Researches have shown that the formulation of environmental policies is conducive to the formation of an environmental protection system and has a significant influence on public pro-environment behavior. A study believed that policy elements may motivate the public's spontaneous pro-environmental behavior. Switzerland has enacted legislation specifically for oil importers, demanding them to compensate for the pollution caused by imported oil [47]. Due to the close contact between local governments and the public, and found that local government environmental governance has a positive influence on residents' pro-environment behaviors, so local environmental governance also has an impact on college students' environmental behaviors [28].

So we assume that the government influence dimension mainly selects national environmental protection policy, national development concept and local environmental governance, which has an impact on college students' pro-environment behavior.

3. Research methods and data sources

3.1. Research methods

The decision experiment method is a scientific method to study the relationship between elements in a complex system. Further combined decision experiment analysis with network analytic hierarchy process and raised the multiple criteria decision marking method [48]. After constant evolution and enhancement, this new analytical method is defined by academia as the network analytic hierarchy process (DANP) of decision analysis. DANP method can not only research the relationship between elements in complex systems and form the network diagram of the relationship between elements but also count the impact weight of each dimension and element. Besides, compared with the traditional ANP method, the DANP method transforms the total relation matrix into a supermatrix, avoiding the tedious procedure of pairwise comparison. The specific steps are as follows:

Step 1: Supposing 0, 1, 2, 3, and 4 respectively represent different degrees of influence, such as "no influence", "low influence", "moderate influence", "high influence" and "very high influence", p experts are demanded to evaluate and score the direct influence degree of each element i on each factor j with the above five numbers, denoted by a_{ij}^{p}, a_{ij}^{p} represents the p-th expert evaluation score. Therefore, a direct impact matrix can be generated based on the evaluation and scoring results of each expert, and an initial average matrix A among the influencing factors can be obtained by calculating Eqs. (1) and (2).

$$A = \left[a_{ij}\right]_{n\times n},\ i,j = 1,2,\ldots\ldots,n \tag{1}$$

where,

$$a_{ij} = \frac{1}{p}\sum_{p=1}^{p} a_{ij}^{p} \tag{2}$$

Step 2: To establish the standardized direct impact matrix and standardize the initial average matrix A, that is, gain the direct impact matrix D through the following two Eqs. (3) and (4).

$$D = z \times A \tag{3}$$

where,

$$z = \mathrm{Min}\left[\frac{1}{\max\limits_{1\le i\le n}\sum_{j=1}^{n} a_{ij}}, \frac{1}{\max\limits_{1\le j\le n}\sum_{i=1}^{n} a_{ij}}\right] \tag{4}$$

Step 3: To calculate the composite impact matrix, after calculating the matrix D, due to $\lim_{n\to\infty} D^{n} = [0]_{n\times n}$ (0 is zero matrix), we can get composite impact matrix T by the Eq. (5) (where, I is the identity matrix).

$$T = D + D^{2} + D^{3} + \cdots + D^{n} = D(I - D)^{-1}$$
$$\lim_{n\to\infty} D^{n} = \left[0\right]_{n\times n} \tag{5}$$

Step 4: To draw the impact network diagram, sum the above comprehensive impact matrix T according to Eqs. (6) and (7) respectively, denoted by r and s:

$$T = \left[t_{ij}\right]_{n\times n},\ i,j = 1,2,\ldots,n \tag{6}$$

$$r = [r_i]_{n\times 1} = \left[\sum_{j=1}^{n} t_{ij}\right]_{n\times 1},\ s = \left[s_j\right]_{1\times n} = \left[\sum_{i=1}^{n} t_{ij}\right]_{1\times n} \tag{7}$$

r_i represents the sum of a row i in the matrix T, and is the sum of the influence degree of i a factor on other factors, which is called influence degree (D); similarly, the sum of column j in matrix T is represented by s_j. s_j is the sum of the extent to which j factor is affected by other factor indexes, which is called an influence degree (R). When $i = j$, $r_i + s_i$ is the total effect that is impacted by the factor i and other factors, called center degree ($D + R$); the difference between the effect of i a factor affecting other factors and that affected by other

factors is expressed as $r_i - s_i$, which is called causation degree ($D - R$). When $r_i - s_i > 0$, i called reason factor; when $r_i - s_i < 0$, i called result factor.

Step 5: The unweighted supermatrix is constructed, and the comprehensive impact matrix of dimension and index is defined as $T_d = [t_{ij}^{D}]_{m\times m}$ and $T_C = [t_{ij}]_{n\times n}$, specifically as Eqs. (8)–(11):

$$\mathrm{Tc} = \begin{array}{c} \\ D_1 \\ \vdots \\ D_i \\ \vdots \\ D_n \end{array} \begin{array}{c} \begin{array}{cccccc} D_1 & & \cdots & D_j & \cdots & D_n \\ C_{11} & C_{11}\ldots C_{1m_1} & \cdots & C_{j1}\ldots C_{jm_j} & \cdots & C_{n1}\ldots C_{nm_n} \end{array} \\ \begin{bmatrix} T_C^{11} & \cdots & T_C^{1j} & \cdots & T_C^{1n} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ T_C^{i1} & \cdots & T_C^{ij} & \cdots & T_C^{in} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ T_C^{n1} & \cdots & T_C^{nj} & \cdots & T_C^{nn} \end{bmatrix} \end{array} \tag{8}$$

$$T_c^{\alpha} = \begin{array}{c} \\ D_1 \\ \vdots \\ D_i \\ \vdots \\ D_n \end{array} \begin{array}{c} \begin{array}{cccccc} D_1 & & \cdots & D_j & \cdots & D_n \\ C_{11} & C_{11}\ldots C_{1m_1} & \cdots & C_{j1}\ldots C_{jm_j} & \cdots & C_{n1}\ldots C_{nm_n} \end{array} \\ \begin{bmatrix} T_C^{\alpha 11} & \cdots & T_C^{\alpha 1j} & \cdots & T_C^{\alpha 1n} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ T_C^{\alpha i1} & \cdots & T_C^{\alpha ij} & \cdots & T_C^{\alpha in} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ T_C^{\alpha n1} & \cdots & T_C^{\alpha nj} & \cdots & T_C^{\alpha nn} \end{bmatrix} \end{array} \tag{9}$$

$$T_C^{\alpha 11} = \begin{bmatrix} t_{c^{11}}^{11}/d_{c1}^{11} & \cdots & t_{c^{1j}}^{11}/d_{c1}^{11} & \cdots & t_{c^{1m_1}}^{11}/d_{c1}^{11} \\ \vdots & & \vdots & & \vdots \\ t_{c^{i1}}^{11}/d_{ci}^{11} & \cdots & t_{c^{ij}}^{11}/d_{ci}^{11} & \cdots & t_{c^{im_1}}^{11}/d_{ci}^{11} \\ \vdots & & \vdots & & \vdots \\ t_{c^{m_1}1}^{11}/d_{cm_1}^{11} & \cdots & t_{c^{m_1}j}^{11}/d_{cm_1}^{11} & \cdots & t_{c^{m_1}m_1}^{11}/d_{cm_1}^{11} \end{bmatrix} = \begin{bmatrix} t_{c^{11}}^{\alpha 11} & \cdots & t_{c^{1j}}^{\alpha 11} & \cdots & t_{c^{1m_1}}^{\alpha 11} \\ \vdots & & \vdots & & \vdots \\ t_{c^{i1}}^{\alpha 11} & \cdots & t_{c^{ij}}^{\alpha 11} & \cdots & t_{c^{im_1}}^{\alpha 11} \\ \vdots & & \vdots & & \vdots \\ t_{c^{m_1}1}^{\alpha 11} & \cdots & t_{c^{m_1}j}^{\alpha 11} & \cdots & t_{c^{m_1}m_1}^{\alpha 11} \end{bmatrix} \tag{10}$$

$$d_{ci}^{11} = \sum_{j=1}^{m_1} t_{ij}^{11}, i = 1,2,\cdots,m_1 \tag{11}$$

The comprehensive impact matrix T_C of indicators is shown in Eq. (8), then use Eq. (9) to normalize T_C to get a new matrix T_C^{α}.

Step 6: To transpose the matrix T_C^{α} to get the unweighted supermatrix $W = (T_C^{\alpha})'$, see Eq. (12):

$$W = (T_c^{\alpha})' = \begin{array}{c} \\ D_1 \\ \vdots \\ D_i \\ \vdots \\ D_n \end{array} \begin{array}{c} \begin{array}{cccccc} & D_1 & \cdots & D_j & \cdots & D_n \\ C_{11} \\ C_{12} & C_{11}\ldots C_{1m_1} & \cdots & C_{j1}\ldots C_{jm_j} & \cdots & C_{n1}\ldots C_{nm_n} \end{array} \\ \begin{bmatrix} W^{11} & \cdots & W^{1j} & \cdots & W^{1n} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ W^{i1} & \cdots & W^{ij} & \cdots & W^{in} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ W^{n1} & \cdots & W^{nj} & \cdots & W^{nn} \end{bmatrix} \end{array} \tag{12}$$

Step 7: To obtain the weighted supermatrix, multiply the matrix W by the standardized dimension comprehensive impact matrix T_D^{α}, and get the weighted supermatrix W^{α} according to Eqs. (13)–(14).

$$T_D^{\alpha} = \begin{bmatrix} t_D^{11}/d_1 & \cdots & t_D^{1j}/d_1 & \cdots & t_D^{1n}/d_1 \\ \vdots & & \vdots & & \vdots \\ t_D^{i1}/d_i & \cdots & t_D^{ij}/d_i & \cdots & t_D^{in}/d_i \\ \vdots & & \vdots & & \vdots \\ t_D^{n1}/d_n & \cdots & t_D^{nj}/d_n & \cdots & t_D^{nn}/d_n \end{bmatrix} = \begin{bmatrix} t_D^{\alpha 11} & \cdots & t_D^{\alpha 1j} & \cdots & t_D^{\alpha 1n} \\ \vdots & & \vdots & & \vdots \\ t_D^{\alpha i1} & \cdots & t_D^{\alpha ij} & \cdots & t_D^{\alpha in} \\ \vdots & & \vdots & & \vdots \\ t_D^{\alpha n1} & \cdots & t_D^{\alpha nj} & \cdots & t_D^{\alpha nn} \end{bmatrix} \tag{13}$$

$$W^{\alpha} = T_D^{\alpha} \times W = \begin{bmatrix} t_D^{\alpha 11} \times W^{11} & \cdots & t_D^{\alpha i1} \times W^{i1} & \cdots & t_D^{\alpha n1} \times W^{n1} \\ \vdots & & \vdots & & \vdots \\ t_D^{\alpha 1j} \times W^{1j} & \cdots & t_D^{\alpha ij} \times W^{ij} & \cdots & t_D^{\alpha nj} \times W^{nj} \\ \vdots & & \vdots & & \vdots \\ t_D^{\alpha 1n} \times W^{1n} & \cdots & t_D^{\alpha in} \times W^{in} & \cdots & t_D^{\alpha nn} \times W^{nn} \end{bmatrix} \tag{14}$$

Step 8: The ultimate supermatrix is obtained, and the weighted supermatrix W^{α} is taken to power $\lim_{\alpha\to\infty}(W^{\alpha})^{\alpha}$ until the result converges to a stable ultimate supermatrix W^*.

3.2. Data sources

In this paper, based on the DANP research process, six long engaged in environmental resource management, behavioral economics, and public policy research constitute expert groups are invited respectively in Jiangsu Province academy of social sciences, Nanjing University, China, Nanjing Normal University, Jiangnan University, China, Nanjing Agricultural University, and other units to collect the fuzzy evaluation results of 17 influencing factors in five dimensions of college students' pro-environment behaviors. Based on the way of ANP, the college student group survey is carried out. Because of the complicated ANP survey process, the number of respondents should not be too large, preferably between 5–15 [49]. According to the level of economic enhancement, Jiangsu Province could be divided into southern Jiangsu, middle Jiangsu and northern Jiangsu three areas, and seven undergraduate universities including Nanjing University of Information Engineering, Jiangnan University, Nanjing University of Finance and Economics,

etc. were chose by using multi-stage random sampling and considering data availability. Through online research in the form of a questionnaire and face-to-face interview, a total of 1,500 students were chosen, research content involves individual statistical characteristics, environmental cognition, behavior decision, influence elements school education, the policy interventions from several terms, 1,460 valid questionnaires, the recovery rate was 97.3%.

4. Results and discussion

4.1. Characteristics of survey data of college students

Among the surveyed college students, 37% are male and 63% are female; the majors are evenly distributed, with a relatively high proportion of liberal arts and science and engineering, about 75%; more students live in cities, accounting for 65.4%; it can be seen that the data distribution of this survey is relatively consistent with the actual situation and has certain representativeness. As for college students' awareness of environmental protection, about half of the students (606 students) are not familiar with pro-environment behaviors, but about 89% of them would like to take part in environmental activities, but about 11% are not willing to participate; at present, 81.3% of the students said that their schools have conducted environmental protection propaganda, while 273 students said that their schools have not carried out environmental protection propaganda; the Internet (71.3%) and television and radio (62%) are the main ways for college students to gain environmental protection information, followed by newspapers and magazines (41.5%), propaganda boards or posters (37.5%) and environmental protection organizations (38.4%), but less environmental information is obtained through classroom teaching and educational institutions (as shown in Table 2). On the whole, college students are highly motivated to participate in environmental protection activities, but their awareness and willingness to participate in environmental protection still require to be improved. Meanwhile, colleges and universities should actively expand the basic ways of environmental protection publicity and education.

Table 3 is the measurement results of various types of pro-environment behaviors of college students. College students show positive pro-environmental behaviors in terms of turning off lights, turning off faucets, avoiding disposable tableware as much as possible, carrying packaging bags, green travel, cleaning plate campaigns, double-sided printing and caring for animals and plants. The proportion of "often" is higher than 60%, among which 80.4%, 83.3% and 92.2% respectively turn off the tap, clean plate when eating food, and cherish animals and plants; However, the enthusiasm of participating in environmental protection activities, persuading others to protect the environment and garbage sorting is relatively low, and all of them have a certain proportion of "almost no" behaviors. Among them, the proportion of using disposable tableware and persuading others to protect the environment is as high as 22.4% and 25.7% respectively. Many college students are used to eating take-away food. Even if they know that disposable

Table 2
College students' personal characteristics and environmental awareness (n = 1460)

Variable		Sample number	%
Gender	Male	540	37
	Female	920	63
Major	Liberal arts	496	34
	Consultant	603	41.3
	Arts	248	17
	Other	112	7.7
Residence	City	955	65.4
	Village	505	34.6
Environmental awareness	Yes	854	58.5
	No	606	41.5
Environmental activities participating	Willing	1,299	89
	Unwilling	161	11
School environmental protection publicity	Yes	1,187	81.3
	No	273	18.7
Access to information	Internet	1,041	71.3
	Newspapers and periodicals	606	41.5
	Television broadcasting	905	62
	Billboard or poster	548	37.5
	Environmental protection organization	561	38.4
	Lecture	358	24.5
	Educational institution	190	13
	Other	64	4.4

Table 3
Classification measurement of college students' pro-environment behavior (n = 1460)

Variable categories	Variable options (%)		
	Frequently	Occasionally	Scarcely
Participating in environmental activities	34.4	54.6	11
Turning off lights when leaving	63	30.5	6.5
Readily off the tap	80.4	15.3	4.3
Trying not to use disposable utensils	63.2	14.4	22.4
Persuading others to go green	45.2	29.1	25.7
Carrying package shopping	60	27	13
Green travel	70.2	27.8	2
Garbage sorting	55	31	14
Clean your plate campaign	83.3	13.2	3.5
Printing on both sides	64.9	29.1	6
Caring for animals and plants	92.2	6.6	1.2

tableware pollutes the environment, they still use it for convenience.

4.2. Analysis of the relationship between dimensions and factors of college students' pro-environment behavior

After calculation, the average difference rate between the evaluation results of 6 experts and the evaluation results of seven surveyed schools is <5%, and the evaluation results tend to be consistent. Table 4 is the initial average matrix A calculated based on the evaluation results; Table 5 is the general relation matrix T derived from Eqs. (3)–(6); Table 6 is the D, R, $D - R$ and $D + R$ values among the five dimensions and 17 influencing elements of college students' pro-environment behavior calculated directly based on Eq. (7). According to the study of [50], $D - R$ is used to analyze the correlation between dimensions and influencing factors. Among them, $D - R$ values of objective attribution (D_2), social influence (D_3) and government influence (D_4) are positive, which have positive effects on other dimensions in the system, so it is called reason dimension; The $D - R$ value of emotion cognition ($D1$) and college influence ($D5$) is negative and impacted by other elements in the system, so it is the result dimension (as shown in Table 6). According to the values of $D - R$ and $D + R$ to draw Fig. 1, the specific network relationship of 5 dimensions is $D2 \rightarrow D4$, $D2 \rightarrow D3 \rightarrow D4$, $D2 \rightarrow D1 \rightarrow D4$, $D2 \rightarrow D5 \rightarrow D4$, $D2 \rightarrow D5 \rightarrow D1 \rightarrow D4$, $D2 \rightarrow D3 \rightarrow D1 \rightarrow D4$, $D2 \rightarrow D5 \rightarrow D3 \rightarrow D4$, $D2 \rightarrow D5 \rightarrow D3 \rightarrow D1 \rightarrow D4$; among them, the objective attribution dimension is the cause of the total dimension system and influences the other four dimensions as well as all the elements of the whole factor system. The University dimension is the result of the whole dimension system, which is impacted by other dimensions. According to the degree of centrality, affective cognition dimension and college dimension have the largest impact on the degree of centrality, 3.556 and 3.530 respectively, which are the two most significant first-level indicators in the whole dimensional relationship framework and have a more direct relationship with college students' pro-environment behaviors. Just as the study results of [51] showed that emotional factors are recognized as important potential factors impacting environmental behaviors, [52–54] conducted empirical analysis on how emotional factors impact friendly environmental behaviors. The school environment can significantly affect students' performance. Previous research put forward attention recovery theory and stress reduction theory, and a green campus environment that can enhance students' learning ability could be well explained [44].

According to Fig. 2, the relationships among the four influencing factors of college students' affective cognition dimension (D_1) are as follows: $C1 \rightarrow C3$, $C1 \rightarrow C2 \rightarrow C3$, $C1 \rightarrow C4 \rightarrow C3$, $C1 \rightarrow C2 \rightarrow C4 \rightarrow C3$; among them, environmental knowledge (C_1) is the starting point of the network relationship of D_1 dimension factors, and personal responsibility (C_3) is the endpoint of the network relationship of factors. $C1$ and $C3$ are relatively centered, respectively 4.628 and 4.684, which are the key influencing factors of the D_1 dimension. The relationships among the four influencing factors of objective attribution dimension (D_2) are $C7 \rightarrow C6$, $C7 \rightarrow C8 \rightarrow C6$, $C7 \rightarrow C5 \rightarrow C6$, $C7 \rightarrow C5 \rightarrow C8 \rightarrow C6$; where, region ($C_7$) is the starting point of $D2$ dimensional factor network relations, and specialty (C_8) is the endpoint of factor network relations. Among them, C_6 and C_8 have a relatively large degree of centrality, 3.644 and 3.029 respectively, which are the key influencing factors of the D_2 dimension. This further shows that college students' majors have a significant impact on their pro-environment behaviors. The relationship between the three influencing factors in the dimension of social influence (D_3) is as follows: $C11 \rightarrow C9$, $C11 \rightarrow C10 \rightarrow C9$; network relationship ($C_{11}$) has the largest centrality (5.253), which is the key influencing factor of D_3 dimension. The relationships among the three influencing factors of the influence dimension (D_4) of colleges and universities are as follows: $C14 \rightarrow C12$, $C14 \rightarrow C13 \rightarrow C12$; among them, campus publicity (C_{12}), as the endpoint of network relationship of this dimension, has the largest centrality (4.453), which is the key influencing factor of D_4 dimension. Therefore, the publicity of environmental protection knowledge in schools plays a direct role in the formation of the pro-environmental behaviors of college students. The relationship among the three influencing factors of the government influence dimension (D_5) is: $C16 \rightarrow C17$, $C16 \rightarrow C15 \rightarrow C17$; National development concept (C_{16}) and

Table 4
Initial direct influence matrix *A* among the 17 influencing factors of college students' pro-environment behavior

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}	C_{11}	C_{12}	C_{13}	C_{14}	C_{15}	C_{16}	C_{17}
C_1	0.000	3.833	4.000	3.833	0.333	0.500	0.500	0.500	3.500	1.667	3.500	1.167	1.167	1.333	3.167	1.500	3.500
C_2	3.333	0.000	3.333	3.500	1.167	3.333	0.667	0.667	3.667	2.167	2.167	1.333	0.333	0.833	0.667	2.000	0.833
C_3	3.667	3.333	0.000	3.500	0.333	2.167	0.333	2.167	0.833	2.000	2.500	3.333	0.667	2.167	1.167	0.167	1.167
C_4	1.333	3.500	3.500	0.000	0.333	1.000	0.500	2.000	3.333	2.167	1.000	0.833	0.667	1.000	2.167	2.500	2.000
C_5	0.833	0.333	0.833	1.000	0.000	2.833	0.000	1.167	2.000	0.833	0.667	1.667	0.500	0.000	1.167	1.333	0.833
C_6	3.667	2.333	3.500	2.167	0.333	0.000	0.000	1.500	3.333	2.167	3.667	3.000	0.333	0.333	0.500	0.833	0.000
C_7	2.167	1.167	2.167	1.000	0.500	0.333	0.000	1.167	3.500	3.500	1.667	1.167	1.167	1.000	0.667	0.500	0.667
C_8	2.000	3.333	3.667	2.167	0.167	2.833	2.167	0.000	3.167	1.333	1.333	2.333	2.000	0.500	0.833	2.500	0.833
C_9	3.500	3.500	3.833	3.000	0.667	2.167	0.833	3.000	0.000	3.167	4.000	0.833	0.667	0.833	0.500	0.167	1.000
C_{10}	2.667	3.833	3.833	3.500	1.000	1.833	0.167	1.167	1.167	0.000	3.500	3.500	1.667	1.667	3.833	3.333	3.667
C_{11}	3.500	3.500	3.833	3.333	0.667	3.167	1.167	2.167	3.333	4.000	0.000	3.000	3.167	3.500	4.000	3.167	4.000
C_{12}	3.500	3.500	3.500	3.500	0.500	3.167	0.000	1.167	3.000	3.667	3.667	0.000	3.167	3.500	1.833	2.167	1.000
C_{13}	3.667	3.333	3.500	3.167	1.167	3.167	0.000	1.167	4.000	3.167	2.000	3.000	0.000	3.667	1.500	2.000	1.833
C_{14}	3.500	3.333	4.000	3.833	0.333	2.333	1.000	3.167	3.167	3.500	3.167	3.833	4.000	0.000	1.667	1.167	1.833
C_{15}	3.333	4.000	3.167	3.167	1.000	3.833	1.000	0.333	4.000	3.833	3.833	3.167	3.167	3.333	0.000	4.000	3.167
C_{16}	3.333	3.333	3.833	3.833	0.333	3.000	0.833	3.000	3.500	3.500	3.833	4.000	3.833	3.333	3.667	0.000	3.833
C_{17}	4.000	3.500	3.667	4.000	0.500	3.000	2.167	0.167	3.833	3.167	3.000	3.000	2.000	1.667	3.000	2.667	0.000

Table 5
Total relation matrix *T* among the 17 influencing factors of college students' pro-environment behavior

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}	C_{11}	C_{12}	C_{13}	C_{14}	C_{15}	C_{16}	C_{17}
C_1	0.106	0.180	0.189	0.177	0.028	0.092	0.035	0.061	0.164	0.124	0.158	0.102	0.079	0.087	0.128	0.094	0.131
C_2	0.146	0.094	0.159	0.152	0.038	0.125	0.032	0.058	0.149	0.115	0.120	0.091	0.053	0.065	0.073	0.089	0.073
C_3	0.153	0.154	0.102	0.154	0.024	0.107	0.027	0.081	0.103	0.114	0.126	0.126	0.062	0.089	0.084	0.061	0.079
C_4	0.110	0.152	0.158	0.089	0.023	0.085	0.030	0.078	0.140	0.114	0.097	0.081	0.059	0.067	0.095	0.097	0.091
C_5	0.065	0.059	0.072	0.069	0.010	0.090	0.012	0.055	0.084	0.059	0.059	0.069	0.037	0.029	0.055	0.055	0.046
C_6	0.148	0.132	0.157	0.126	0.023	0.064	0.019	0.070	0.138	0.112	0.142	0.116	0.052	0.055	0.069	0.067	0.057
C_7	0.106	0.094	0.115	0.089	0.023	0.058	0.015	0.055	0.125	0.122	0.093	0.072	0.058	0.057	0.059	0.051	0.058
C_8	0.128	0.155	0.168	0.133	0.022	0.120	0.059	0.047	0.145	0.106	0.109	0.111	0.085	0.062	0.076	0.099	0.073
C_9	0.154	0.161	0.173	0.149	0.031	0.109	0.037	0.099	0.089	0.136	0.154	0.086	0.062	0.068	0.074	0.063	0.079
C_{10}	0.172	0.200	0.207	0.192	0.043	0.131	0.033	0.081	0.144	0.111	0.176	0.148	0.101	0.105	0.155	0.139	0.148
C_{11}	0.214	0.223	0.239	0.216	0.043	0.168	0.056	0.112	0.206	0.205	0.141	0.171	0.141	0.151	0.175	0.154	0.170
C_{12}	0.190	0.199	0.207	0.195	0.035	0.155	0.029	0.084	0.177	0.178	0.183	0.100	0.127	0.118	0.153	0.120	0.104
C_{13}	0.186	0.188	0.199	0.183	0.045	0.149	0.027	0.082	0.187	0.163	0.149	0.146	0.067	0.134	0.110	0.110	0.111
C_{14}	0.190	0.195	0.215	0.200	0.032	0.139	0.046	0.090	0.179	0.175	0.173	0.165	0.140	0.075	0.118	0.101	0.116
C_{15}	0.209	0.227	0.224	0.211	0.048	0.182	0.051	0.081	0.215	0.200	0.206	0.172	0.139	0.147	0.104	0.163	0.154
C_{16}	0.216	0.226	0.245	0.230	0.038	0.175	0.052	0.129	0.214	0.201	0.212	0.192	0.156	0.152	0.173	0.100	0.170
C_{17}	0.200	0.196	0.211	0.204	0.035	0.151	0.067	0.068	0.193	0.171	0.173	0.152	0.101	0.106	0.143	0.128	0.086

national environmental protection policy (C_{15}) have a relatively large degree of centrality, 4.569 and 4.572 respectively, and both point to local government governance (C_{17}), which are the two most influential indicators in the D_5 dimension.

4.3. *Influencing weight of dimensions and factors of college students' pro-environment behavior*

Based on the calculation process of the whole influence matrix T and analytic network process (ANP) among the 17 influencing factors of college students' pro-environment behavior in seven Undergraduate Universities in Jiangsu Province including Nanjing University of Information Engineering, Jiangnan University, Nanjing University of Finance and Economics, etc., the influence weight of the five dimensions 17 influencing factors of influencing college students' pro-environment behavior were harvested. The ultimate supermatrix W^* is obtained by Eqs. (8)–(14). According to Table 7, each row of W^* represents the influence weight of various factors that affect college students' pro-environment

Table 6
Calculated values of D, R, $D-R$, and $D+R$ of the influencing dimensions and factors of college students' pro-environmental behavior

Dimension	r_i	s_j	$r_i - s_j$	$r_i + s_j$	Influencing factors	r_i	s_j	$r_i - s_j$	$r_i + s_j$
					C_1	1.934	2.694	–0.760	4.628
D_1	1.444	2.112	–0.668	3.556	C_2	1.630	2.834	–1.203	4.464
					C_3	1.645	3.039	–1.394	4.684
					C_4	1.567	2.769	–1.202	4.337
					C_5	0.924	0.538	0.386	1.462
D_2	1.694	0.766	0.928	2.459	C_6	1.547	2.097	–0.550	3.644
					C_7	1.250	0.696	0.624	1.877
					C_8	1.698	1.331	0.366	3.029
					C_9	1.722	2.653	–0.932	4.375
D_3	1.511	1.356	0.155	2.867	C_{10}	2.284	2.405	–0.121	4.688
					C_{11}	2.783	2.470	0.313	5.253
					C_{12}	2.354	2.099	0.255	4.453
D_4	1.167	2.363	–1.196	3.530	C_{13}	2.236	1.518	0.718	3.754
					C_{14}	2.348	1.566	0.782	3.914
					C_{15}	2.730	1.842	0.888	4.572
D_5	1.999	1.218	0.781	3.217	C_{16}	2.879	1.690	1.189	4.569
					C_{17}	2.384	1.743	0.641	4.128

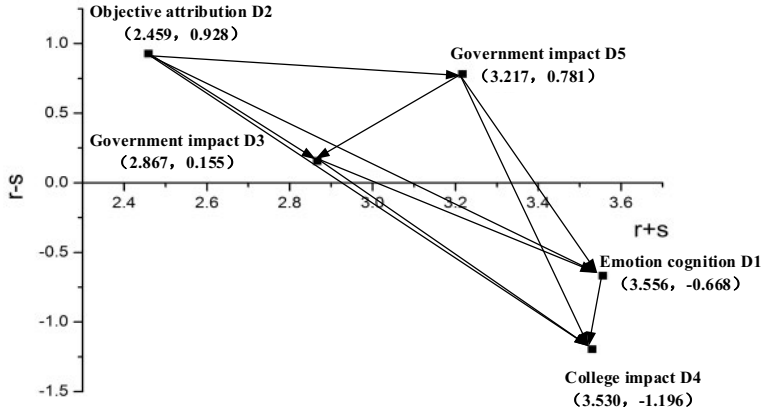

Fig. 1. Network relationship diagram of influence among the five dimensions of college students' pro-environment behavior.

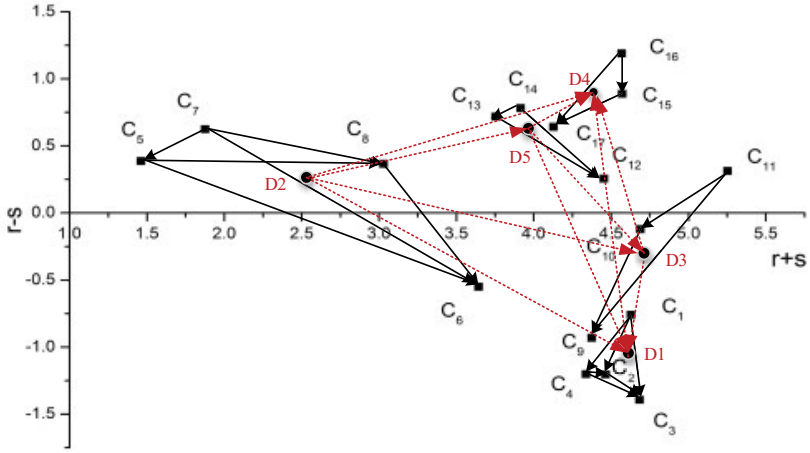

Fig. 2. Network diagram of 17 influencing factors of college students' pro-environment behavior.

Table 7
Limit supermatrix *W** among 17 influencing factors of college students' pro-environment behavior

	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}	C_{11}	C_{12}	C_{13}	C_{14}	C_{15}	C_{16}	C_{17}
C_1	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066
C_2	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.069
C_3	0.074	0.074	0.074	0.074	0.074	0.074	0.074	0.074	0.074	0.074	0.074	0.074	0.074	0.074	0.074	0.074	0.074
C_4	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068	0.068
C_5	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
C_6	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049
C_7	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
C_8	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031
C_9	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062	0.062
C_{10}	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057	0.057
C_{11}	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.058	0.059
C_{12}	0.121	0.121	0.121	0.121	0.121	0.121	0.121	0.121	0.121	0.121	0.121	0.121	0.121	0.121	0.121	0.121	0.121
C_{13}	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085	0.085
C_{14}	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091
C_{15}	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060
C_{16}	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054
C_{17}	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056	0.056

Table 8
Dimensions of college students' pro-environmental behavior and the weight of influencing factors

Dimension	Weight	Rank	Influencing factors	Weight	Rank
D_1	0.277	2	C_1	0.066	7
			C_2	0.069	5
			C_3	0.074	4
D_2	0.107	5	C_4	0.068	6
			C_5	0.013	17
			C_6	0.049	14
			C_7	0.014	16
			C_8	0.031	15
D_3	0.177	3	C_9	0.062	8
			C_{10}	0.057	11
			C_{11}	0.059	10
D_4	0.297	1	C_{12}	0.121	1
			C_{13}	0.085	3
			C_{14}	0.091	2
D_5	0.170	4	C_{15}	0.060	9
			C_{16}	0.054	13
			C_{17}	0.056	12

behavior, and the influence weight of all dimensions and factors that affect college students' pro-environment behavior is obtained by adding the weight of each row. According to the ranking and absolute influence weights of the dimensions and influencing factors in Table 8, the weight values of college dimension (D_4) and affective cognition dimension (D_1) are 0.297 and 0.277, ranking first and second respectively, which are significant dimensions impacting college students' pro-environment behaviors. The weights of campus publicity (C_{12}), university construction (C_{14}), course offering (C_{13}), personal responsibility (C_3), role model effect (C_2) and values (C_4) are 0.121, 0.091, 0.085, 0.074, 0.069, and 0.068 respectively, ranking among the top six and being the key factors affecting college students' pro-environment behavior.

5. Conclusion and implication

While fully considering the personal characteristics and emotional cognition factors that impact college students' pro-environmental behaviors, this study divides the

external influencing factors into three influencing levels: society, universities and the government and puts forward that college students' pro-environment behavior is impacted by five dimensions and 17 factors. The relationship between dimensions and factors is systematically sorted out, and the influence degree, action path, and influence mechanism of different dimensions and influencing factors are found. Objective attribution (*D*2), social factors (*D*3) and government factors (*D*5), as reason factors, positively affect emotional cognition (*D*1) and college factors (*D*4) in the system; personal responsibility (*C*3), professional (*C*6), media use (*C*9), campus publicity (*C*12) and national environmental policy (*C*15) are the most influential factors among the five dimensions respectively; emotional cognitive (*D*1) and the impact of colleges and universities (*D*4) is the most important two dimensions, the campus propaganda (*C*12), construction (*C*14), the curriculum of colleges and universities (*C*13), personal responsibility (*C*3), an example effect (*C*2), values (*C*4), the relationship between the network (*C*11), social norms (*C*10), environmental knowledge (*C*1) and state environmental protection policy (*C*15) is the 10 key factors that affect college students pro-environmental behavior.

Based on the current study conclusions and by referring to the collective practice theory and symbiosis theory, this article proposes the incentive path of multiple subjects, interaction, mutualism and co-cultivation, providing policy reference for cultivating college students' pro-environment behavior and exporting talents with environmental awareness to the society. In the context of national environmental protection, colleges and universities should be taken as the core to enhance students' environmental awareness and promote their pro-environmental behaviors. Universities should implement the idea of environmental protection, and conduct as many joint enterprises and social organizations as possible into relevant environmental protection activities, such as "waste fashion exhibition", "waste DIY", etc; University should take full advantage of campus radio, propaganda board and canteen graffiti wall to spread garbage classification, food conservation, and other environmental protection knowledge, and praise advanced environmental protection students, set a good example; teachers should attach importance to environmental knowledge teaching in class; In particular, environmental protection concepts should be included in compulsory ideological and political courses, and open courses related to environmental resources protection, climate change, and species diversity should be provided at the school level; also, in terms of hardware and technical facilities, the school should take the concept of beauty, low carbon and wisdom to build a green and environment-friendly campus, install classified recycling garbage cans in appropriate locations, so that students can easily and reasonably dispose of garbage, establish energy-saving classrooms and libraries, and equip them with energy-saving control lights and faucets; Through "school—teacher—student" interaction and mutual promotion, the university may spread environmental protection knowledge and improve the environmental protection values of college students effectively. The government and society should build a good external environment to provide an effective carrier for cultivating college students' pro-environment behaviors. Grasping the direction of environmental policy by the central government, local governments make detailed environmental policy rules through reasonable use of punishment, ban, reward policy, propaganda and education, etc; littering, destruction to grass trees should be fined, and environmental pollution behavior to report should be a reward; Environment protection information can be widely publicized with the help of Internet, television, newspapers and other social media; civil affairs and other government departments can organize community activities regularly to expand community residents and enterprise cooperation, and mine the environmental publicity function through the social public rights reengineering, and guide the community environmental protection into the grassroots governance closely to promote effective integration of autonomy, rule of virtue, the rule of law of environmental governance, which could offer a good social atmosphere for college students. Meanwhile, effective environmental policies can enhance the formation of orderly social norms, eventually, induce the formation of personal environmental norms, make environmental protection a daily habit, and help college students build a positive interpersonal network. Universities, the society and the government should keep close contact with each other to open up linkage channels and provide more opportunities for university participation in social services. Based on Government authorization and society dependency, colleges and universities promote the university students embedded in the environmental protection practice, motivating them by a bystander, participants into practitioners, organizer, stimulate produce environmental thinking, empathy to promote its social responsibility, which could call for further response to the school and the government environmental protection, and finally implement the environmental behavior intention into practice under the reasonable social norm and interpersonal constraints.

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