Research Paper

Exploring Cognitive Biases and Their Impact on College Students' Blood Donation Decision-Making Behavior

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Abstract
This study focuses on the low participation rate of college students in voluntary blood donation, exploring the cognitive biases and their influencing mechanisms in college students' blood donation decision-making from the perspective of behavioral decision-making. A questionnaire survey of 1,200 college students from 5 universities in East China found that 82.3% of students had significant cognitive biases regarding the health impacts of blood donation (e.g., overestimating the risk of impaired immunity), and 67.5% exhibited decision avoidance due to factors such as fear of pain and unfamiliarity with the process. In-depth interviews with 30 relevant individuals revealed that information asymmetry, emotional drive, and conformity psychology are the main causes of cognitive biases. The research indicates that interventions such as "cognitive bias correction education", "situational simulation experience", and "social norm guidance" should be adopted to correct cognitive biases in college students' blood donation decisions, enhance their rational decision-making abilities, and thereby effectively improve the participation rate of voluntary blood donation.

I. Introduction

1.1 Introduction

With the continuous growth of clinical blood demand, college students have become one of the core reserves groups for voluntary blood donation due to their age and health suitability. As a key application-oriented university in western Guangdong, Guangdong University of Petrochemical Technology has over 20,000 students. In recent years, the participation rate in campus blood donation activities has remained between 12% and 15%, lower than the average level of universities in Guangdong Province (18.7%), and the proportion of repeat blood donors is less than 8% of the participants. The problems of "low conversion rate and poor sustainability" in blood donation decision-making are prominent[1], [2].

Existing studies mostly analyze college students' blood donation willingness from rational perspectives such as "blood donation cognition, social support, and policy incentives", but rarely focus on the impact of "cognitive biases"—an irrational factor—on decision-making. Cognitive bias refers to systematic judgment deviations produced by individuals in information processing due to subjective experience and thinking inertia, which often influence key links of decision-making.

Taking college students from Guangdong University of Petrochemical Technology as specific research samples, this paper focuses on the entire process of their blood donation decision-making, identifies core cognitive biases at each stage, analyzes the formation and influence paths of these biases, aiming to provide a new research perspective and practical basis for universities to accurately design blood donation mobilization programs and improve the participation rate and sustainability of college students' blood donation[3], [4].

1.2 Research Design and Methods

Research Objects: This study adopts a cross-sectional research design and collects data through a questionnaire survey. The research objects are undergraduate students from Guangdong University of Petrochemical Technology in China.

Research Procedures: The questionnaire focuses on freshmen, covering four dimensions: basic information, cognition of voluntary blood donation, attitudes and participation barriers, and educational needs and evaluations as shown in Figure 1. It not only finds out freshmen's understanding of voluntary blood donation, participation willingness and concerns, but also accurately locates core cognitive biases such as "blood donation harms health", "blood donation has no rights and interests", and "misjudgment of reasonable blood donation volume". Meanwhile, it grasps the correction effect of existing university blood donation education on biases and freshmen's needs, ultimately providing a basis for optimizing educational strategies and helping freshmen change cognitive biases.

To ensure the reliability and validity of the questionnaire, this study considers the cultural background and language habits of Chinese college students. Stratified random sampling is used for data collection to ensure sample availability. A total of 455 valid questionnaires are recovered. Data analysis mainly adopts Structural Equation Modeling (SEM) to test the explanatory power and predictive power of the TPB theoretical model on college students' blood donation intention, and clarify the path relationships and influence intensities among various core variables[5], [6].

1.3 Data Collection and Processing

The questionnaire survey is conducted from September to November 2025 (1-2 months after freshmen enroll).A total of 500 questionnaires are distributed during the survey period, and 455 valid ones are recovered, with an effective recovery rate of 91.0%. Among them, 55 students have blood donation experience (accounting for 12.1%), 200 students are willing but have not acted (accounting for 43.9%), and 200 students have no willingness to donate blood (accounting for 43.9%). Statistical software (SPSS 26.0) is used for basic statistics, group comparison and correlation analysis of the data; two core directions of "group influence" and "incentive design" are summarized[7], [8]. Figure2.
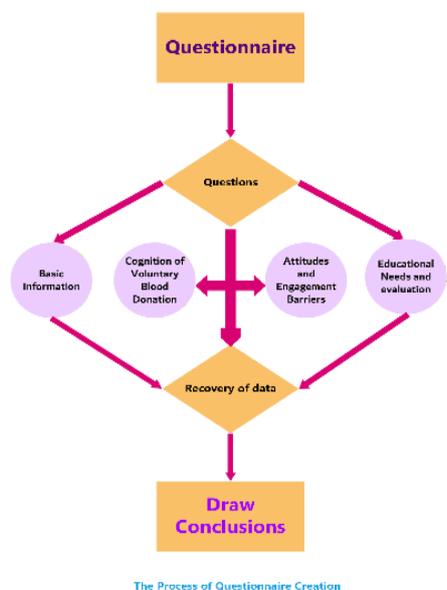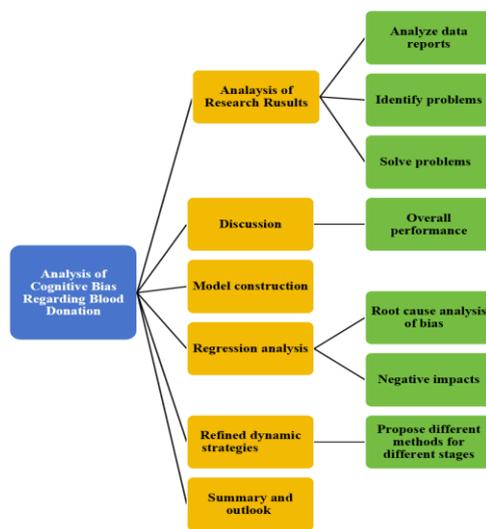

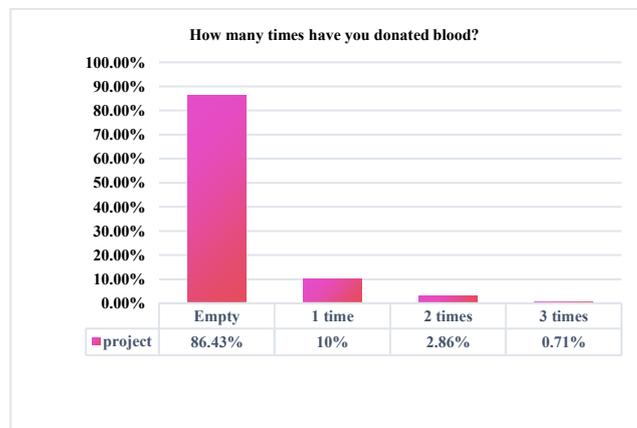Figure1. The process of questionnaire creation
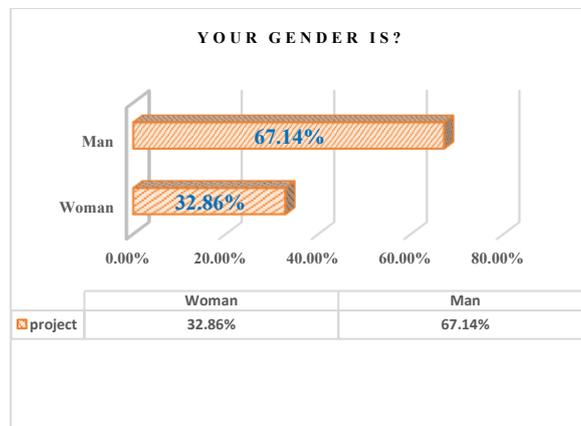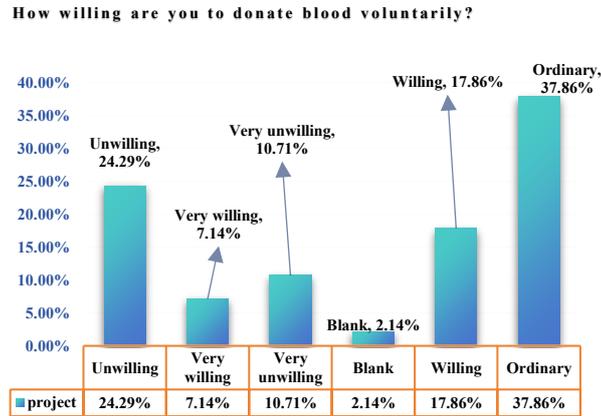

Figure2. Analysis of cognitive bias regarding blood donation

II.   Analysis of Research Results

2.1 Overall Performance and Construction of Cognitive Bias Model

Based on the questionnaire survey data, this study aims to explore the cognitive biases existing in college students' voluntary blood donation decision-making process and their impact on blood donation willingness. First,

descriptive statistics are conducted on the sample's blood donation willingness. The results show that among 455 valid respondents, only 12.14% have blood donation experience. Regarding the willingness to donate blood in the next year, the proportion of students holding "very willing" and "relatively willing" attitudes is 25% in total, and 37.86% of students hold a neutral attitude, reflecting a generally low blood donation willingness as shown in Figure 3.

How willing are you to donate blood voluntarily?

	Unwilling	Very willing	Very unwilling	Blank	Willing	Ordinary
■ project	24.29%	7.14%	10.71%	2.14%	17.86%	37.86%

YOUR GENDER IS?

	Woman	Man
▨ project	32.86%	67.14%

How many times have you donated blood?

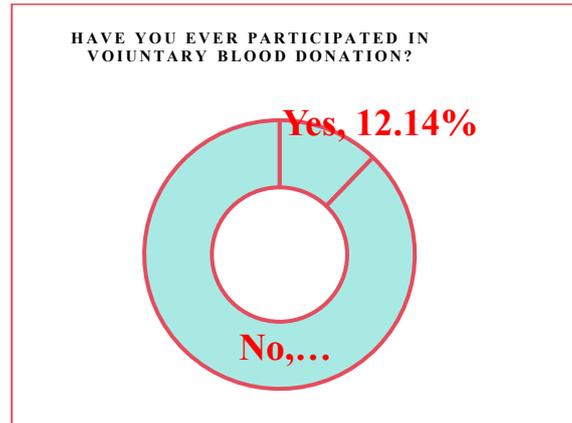|	Empty	1 time	2 times	3 times
■ project	86.43%	10%	2.86%	0.71%

Figure 3. Overall Performance and Construction of Cognitive Bias Model

To systematically test the mechanism of cognitive biases on blood donation willingness, this study constructs a multiple linear regression theoretical model. Taking blood donation willingness as the dependent variable, four core independent variable dimensions are summarized based on cognitive bias theory as shown in Figure 4.
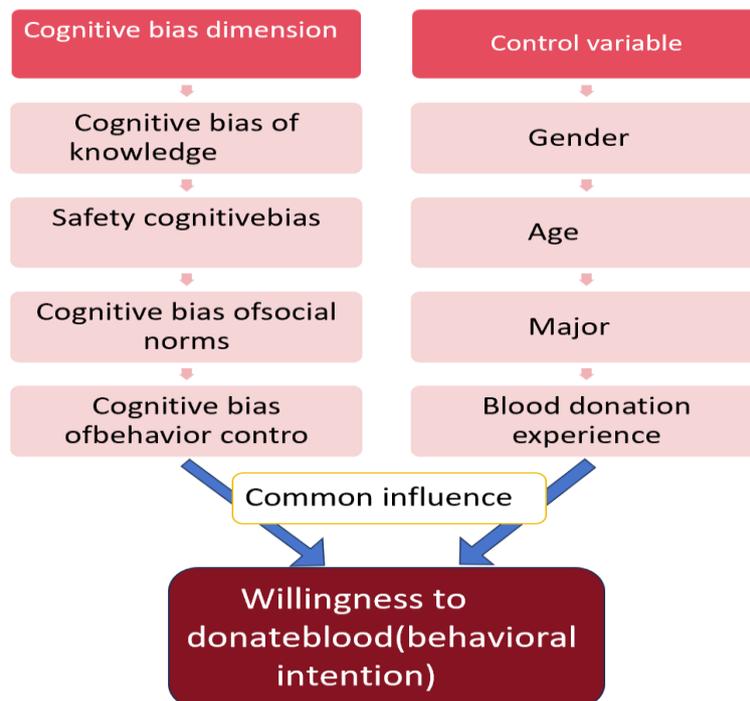

Figure 4. Willingness to donate blood (behavioral intention)

2.2 Knowledge Cognitive Bias

Insufficient understanding or misunderstandings about blood donation-related knowledge (such as processes, safety, and blood use), especially inadequate knowledge of blood donation procedures and subsequent handling[9].

Safety Cognitive Bias: The main cognitive bias, especially excessive worries about infection risks and health damage during blood donation[10].

Social Norm Cognitive Bias: Individuals have high recognition, but they are very concerned about the social identity of blood donation behavior and the attitudes of people around them (classmates, friends).

Behavioral Control Cognitive Bias: Perceived behavioral barriers, such as cumbersome processes, long queues, fear of needles, over-reliance on external factors such as rewards, leading to reduced subjective initiative[11]. Figure 5.

Figure 5. On-site photograph of college student blood donation

2.3 Regression Analysis of Cognitive Biases on Blood Donation Willingness

To quantify the impact of various cognitive biases, this study classifies and integrates the questionnaire data, and conducts correlation and regression analysis[12]. Correlation analysis results indicate that all four cognitive bias dimensions are significantly positively correlated with blood donation willingness ($p < 0.01$), that is, the smaller the cognitive bias, the stronger the blood donation willingness. Among them, social norm cognition ($r = 0.63$) and behavioral control cognition ($r = 0.51$) have the highest correlation with willingness.

Further regression analysis verifies the significant impact of cognitive biases. The model is overall significant ($F = 28.74$, $p < 0.001$), and the adjusted R^2 is 0.503, indicating that the four cognitive bias dimensions jointly explain 50.3% of the variation in blood donation willingness. The standardized regression coefficients (Beta) and significance of each dimension are shown in Figure 6 and Figure 7.

Regression Analysis Results of cognitive Biases on BloodDonationintention(N=140)				
IndependentVariable	Unstandardize d Coefficient(B)	Standardized Coefficient (Beta)	t-value	Significance(p)
(Constant)	0.451		1.871	0.064
KnowledgeCoanitive Bias	0.138	0.152	2.123	0.036*
SafetyCognitive Bias	0.194	0.21	2.732	0.007**
Social NormCognitive Bias	0.316	0.344	4.676	0.000***
Behavioral ControlCognitive Bias	0.227	0.246	3.914	0.000***
ModelSummary	R^2=0.521	Adjusted R^2= 0.503	F= 28.24	p≡0.0****

*p<0.05.**p<0.01.***p<0.001
Based on the regression analysis results,
this study constructed the following model diagram illustrating the impact mechanismof cognitive biases,
which visually displays the influence paths and effect strengths of various factors:

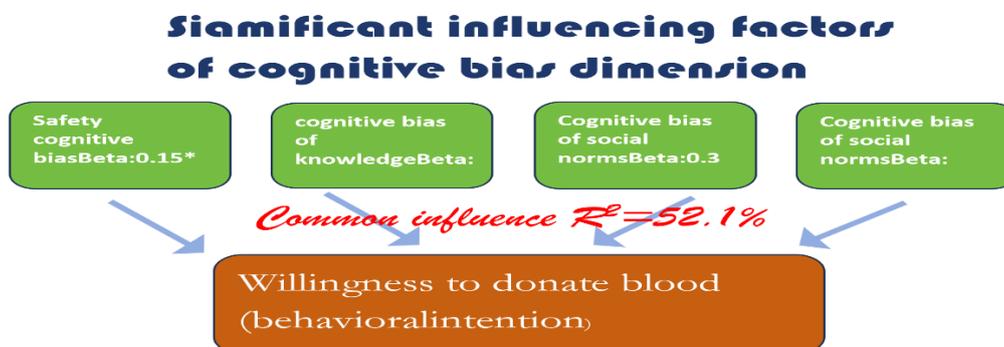Figure 6. Regression Analysis of Cognitive Biases on Blood Donation

Figure 7. Willingness to Blood Donation

2.4 Assessment of Cognitive Bias Status and Group Differences

Regression analysis reveals differences in the impact of different cognitive biases. Social norm cognitive bias (Beta = 0.344, p < 0.001) has the most prominent impact, reflecting students' perception of whether blood donation behavior is recognized by peers, which is the most critical factor in their decision-making. Behavioral control cognitive bias (Beta = 0.246, p < 0.001) and safety cognitive bias (Beta = 0.210, p < 0.01) also have significant negative impacts, indicating that worries about cumbersome processes, long queues, fear of pain, and health risks are the main obstacles preventing students from donating blood. Although the impact of knowledge cognitive bias (Beta = 0.152, p < 0.05) is relatively small, it is still significant, reflecting that the popularization of basic knowledge is the foundation for the formation of willingness.

In addition, analysis of basic information shows certain group differences. Freshmen account for a very high proportion (88.57%) in the survey sample, indicating that early intervention on freshmen's blood donation willingness is crucial. The survey also shows that students majoring in science, engineering, agriculture, and medicine (70.00%) are the main group, suggesting that students with different professional backgrounds may have cognitive differences due to different knowledge structures. However, due to the uneven distribution of samples in grades and majors, in-depth analysis of this difference awaits further research with an expanded sample size.

III. Cognitive reasons and influences

3.1 Analysis of the Root Causes of Cognitive Biases

This study confirms that four types of cognitive biases—knowledge, safety, social norm, and behavioral control—significantly restrict college students' blood donation willingness. The formation of these biases is not accidental but the result of the interplay of individual, information environment, social culture, and other factors. Figure 8.
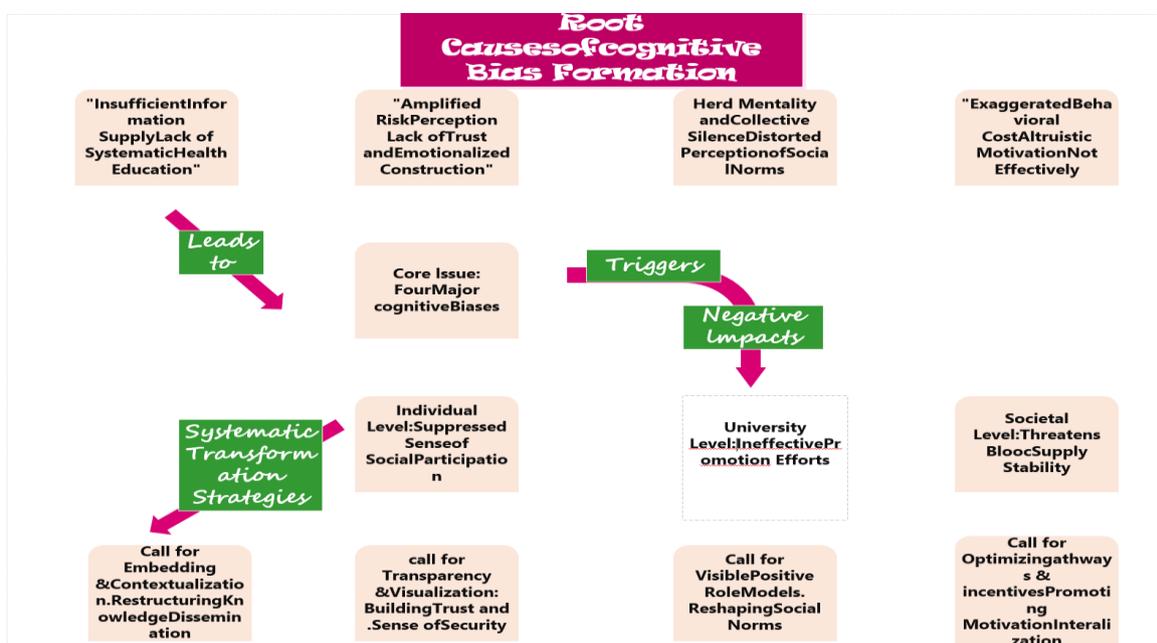

Figure 8: Discussion on Cognitive Biases: Causes, Detrimental Impacts, and Transformation

Insufficient Information Supply and Knowledge Transformation: Lack of Systematic Health Education. The core of knowledge cognitive bias lies in the lack of systematic health education. Although students may have been exposed to blood donation information through fragmented channels, the survey shows that their understanding of specific processes such as blood testing, storage and use is the vaguest. This reflects that current information supply mostly stays at slogan-based publicity, failing to transform abstract knowledge into specific perceptions that students can perceive and trust. Information has not been effectively integrated with students' learning and living scenarios in the transmission process.

Amplified Risk Perception and Lack of Trust: Emotional Construction of Safety Anxieties. Safety cognitive bias, especially worries about health damage, reflects the "amplification effect of risk perception". On the one hand, college students lack understanding of physiological knowledge; on the other hand, in the case of information asymmetry, individuals will excessively worry about low-probability negative events. This worry is essentially a reflection of insufficient trust in the professionalism of blood collection institutions and the health and safety system. When authoritative and transparent information cannot be effectively delivered, doubts and fears occupy a dominant position in cognition through emotional construction, leading to reluctance to donate blood.

Conformity Psychology and Collective Silence: Distorted Perception of Social Norms. Social norm cognitive bias has the greatest impact, whose root cause lies in the "conformity psychology" of college freshmen and the "collective silence" of the group. Freshmen are in the adaptation period and especially rely on peer behavior to judge what behaviors are worth doing and will be praised. However, blood donation behavior usually does not have high visibility, making most students with neutral or positive attitudes remain silent. This silence is mistakenly interpreted as "everyone does not support or care", forming a distorted perception of social norms, thereby strongly inhibiting individuals' willingness or courage to donate blood.

Exaggerated Behavioral Costs and Misplaced Incentives: Cognitive Barriers at the Motivational Level. Behavioral control cognitive bias reveals students' cognitive barriers at the motivational level. They subjectively "exaggerate" the behavioral costs of blood donation (such as time consumption, location finding, tedious queuing, and pain tolerance), while forming a "dependency on external incentives". This reflects that "altruistic motivation has not been effectively internalized", and most people are more egoistic. When the behavior is not firmly bound to deeper values (such as self-actualization and social responsibility), external convenience barriers and insufficient incentives will be amplified, becoming decisive factors in decision-making.

3.2. Main Negative Impacts of Cognitive Biases

Individual Level: Leads to irrational avoidance behavior, making students who are willing to contribute give up blood donation due to unnecessary fears and misunderstandings, and suppressing their sense of social participation.

University Level: Renders voluntary blood donation publicity inefficient, falling into the predicament of "repeated publicity with little effect" and wasting public educational resources.

Social Level: In the long run, it will reduce the mass base of the voluntary blood donation cause and affect the stable supply of blood sources.

3.3. Mitigation & Transformation Strategies for Cognitive Biases: Systematic Intervention from "Knowledge Acquisition" to "Behavioral Implementation"

Based on the above causes, university blood donation publicity should shift from "one-way indoctrination" to "systematic intervention", aiming at precise bias correction and effective transformation.

Reconstruct the Knowledge Dissemination System to Achieve "Embedding" and "Contextualization".

Strategy: Make full use of new media platforms and role model sharing preferred by students in the questionnaire, and embed blood donation knowledge into public courses such as "Physical Education and Health", freshmen orientation education, and community activities. Produce process Vlogs and animated illustrations starring students to transform abstract knowledge into embodied experience.

Goal: Change "passive reception" to "active exposure" and fundamentally correct knowledge cognitive bias.

Build Trust and Transparency to Realize the Materialization of "Sense of Security".

Strategy: Invite blood station staff and school doctors to hold open lectures and display disinfection and blood collection equipment on site. Establish and widely promote a "blood destination feedback mechanism" to allow donors to witness the results of their kindness.

Goal: Break the "black box" of safety cognitive bias and establish solid institutional trust through process transparency and authoritative interpretation.

Break Collective Silence and Shape Visible "Positive Norms".

Strategy: Vigorously promote "blood donation role models", such as posting commendation lists in prominent campus locations and holding "Blood Donation Star" sharing sessions. Encourage students to share their blood donation experiences on social media.

Goal: Make active blood donors "emerge" to break collective silence and reshape the positive social norm that "blood donation is a new campus trend". Guide college students to actively participate by using conformity psychology.

Optimize Behavioral Paths and Incentive Feedback to Reduce "Action Thresholds".

Strategy: Regularize "blood donation vehicles entering campuses" to provide "one-stop" convenient services. Design a diverse incentive combination, such as combining "volunteer service certification", "comprehensive evaluation extra points" with commemorative "customized cultural and creative gifts".

Goal: Significantly reduce behavioral control cognitive bias by providing convenience and immediate positive feedback. At the same time, through the organic combination of spiritual and material incentives, guide students to shift their focus from external rewards to the recognition of internal values.

IV. Mobilization Strategies for College Students Informed by Cognitive Biases

Based on the research results, precise mobilization strategies are formulated for Guangdong University of Petrochemical Technology and similar institutions, following the principle of "offsetting cognitive biases, and adapting to campus contextual characteristics".

4.1 For the Awareness Stage: Substitute Negative Cognitive Biases with "Easily Accessible Positive Information"

Build a "Case Library of People Around". Collect real blood donation cases of students from various majors and grades of Guangdong University of Petrochemical Technology, and produce them into "short videos" and "graphic stories", which are pushed through the school's official WeChat public account, class groups, and electronic screens downstairs in dormitories. For example, "Student XX from the School of Chemical Engineering: No discomfort after blood donation, and helped a parturient get through the difficult time" and "Graduate student XX from the School of Computer Science: Free detection of iron deficiency during blood donation, and adjusted diet in time". Use "people and events around" familiar to students to replace negative fragmented information and reduce the impact of availability bias.

Conduct "Contextualized Publicity" Combined with Majors. For science and engineering students, set up publicity points in laboratories and training bases, and distribute adaptive content such as "Blood donation time = 2 experimental breaks" and "Short-term fatigue after blood donation can be recovered through one night's sleep, without affecting experimental operations". For liberal arts students, set up publicity displays in libraries

and teaching buildings, highlighting information such as "Blood donation can be included in volunteer service hours to help with awards and evaluations" to improve the pertinence of publicity.

4.2 At the Evaluation Stage: Quantitative Comparison for Alleviating Loss Aversion and Amending Anchoring Bias

Quantify "Costs and Benefits" to Offset Loss Aversion. Clearly mark in publicity: "The entire blood donation process only takes 1.5 hours (including physical examination and rest), which is equivalent to the duration of 1 elective course" and "Free routine blood test is worth 50 yuan, which can help understand your own hemoglobin and liver function in a timely manner". Bind "short-term losses" to students' daily learning scenarios and quantify "long-term benefits" into specific values, allowing students to intuitively perceive that "benefits outweigh losses".

Context Embedding: Correct Anchoring Bias with "Visualized Data". Set up a "Blood Knowledge Display Board" next to the campus blood donation vehicle, using visualized analogies such as "200ml blood ≈ the volume of 1 ordinary mineral water bottle" and "Human blood is updated by 1%-2% every day, and can be fully recovered 1-2 weeks after blood donation" to replace abstract data, helping students correct the initial anchor of "blood donation = massive blood loss". At the same time, organize school hospital doctors to answer questions on site, and address doubts such as "blood donation damages vitality" one by one to strengthen scientific cognition. Set up "interactive blood donation knowledge displays" (e.g., "Can I exercise after blood donation? - Click to view the answer") in high-frequency campus scenarios such as canteens, libraries, and dormitory buildings, and cooperate with the school hospital to set up a "blood donation consultation window" (open once a week) to solve freshmen's "immediate doubts".

4.3 At the Action Stage: "Group Guidance + Immediate Incentives" for Combating Procrastination and Rectifying Conformity Bias

Organize "Collective Blood Donation Activities" to Utilize Conformity Bias. Cooperate with blood stations to carry out "Collective Blood Donation Days" in the form of classes, communities, and majors. Establish a "Freshmen Blood Donation Ambassador Team": select senior students with blood donation experience (5-8 per college), and after professional training by blood stations, share blood donation experiences from a "peer perspective" through forms such as "dormitory visits", "class sharing sessions", and "integration into group activities" (e.g., "Will the first blood donation hurt?" "How to recover after blood donation?") to alleviate freshmen's "fear psychology". Figure 9.

Figure 9: Collective Blood Donation Days

Build "Freshmen Blood Donation Exchange Communities". Within 1 month after freshmen enroll, establish "blood donation exchange groups" by college, with blood donation ambassadors as group leaders. Regularly share "blood donation knowledge", "blood station demand notices", and "thank-you letters from aided patients", and organize "pre-blood donation question-and-answer sessions" (1 week before the blood donation vehicle enters the campus) to form a "peer mutual assistance" atmosphere.

Carry Out "Freshmen Blood Donation Theme Activities". Such as holding "Blood Donation Story Essay Competition" and "Blood Donation Public Welfare Poster Design Competition", encouraging freshmen to take the initiative in content creation and deepen their understanding of the value of blood donation through "independent expression".

Content Embedding: Adopt "fragmented + visualized" forms to convey core knowledge—such as producing "blood donation process comic booklets" (distributed to freshmen dormitories), shooting "senior students' blood donation vlogs" (launched on campus short video platforms), and developing "blood donation knowledge challenge mini-programs" (linked to freshmen's "second classroom credits"), transforming key information such as "health impacts" and "process details" into content easily accepted by freshmen. Avoid "temporary rush".

Timing Embedding: Incorporate blood donation education into the "freshmen orientation education system", setting fixed modules during military training breaks (10-15 minutes/time), freshmen class meetings (1 time/semester), and health lectures at the school hospital (2 times/academic year). Figure 10.

For example, "School of Petroleum Engineering Blood Donation Day" and "Student Union Public Welfare Blood Donation Activity" allow students to "participate in groups", reducing the worry of "being special". At the same time, launch immediate incentives such as "2 extra hours of community volunteer service" to resolve procrastination bias.

Set Up "Immediate Action Reminders". Build a "university-local cooperative" guarantee network: universities sign "long-term cooperation agreements" with local blood stations, specifying that "blood donation vehicles will enter the campus 1-2 fixed days a month" (announced 1 week in advance through the campus public account and class groups), and launch a "blood donation appointment mini-program" (supporting freshmen to book time and query processes online) to reduce the "time cost" and "process barriers" of participation. 3 days before the campus blood donation vehicle arrives, send reminders such as "The blood donation vehicle will be parked at the canteen gate from X month X Day to X month X Day, open from 10:00 to 16:00 every day, and milk + bread can be collected on site" through the school academic affairs system and class groups, clarifying the time, location and immediate benefits, and reducing students' procrastination reasons such as "no time" and "too troublesome".
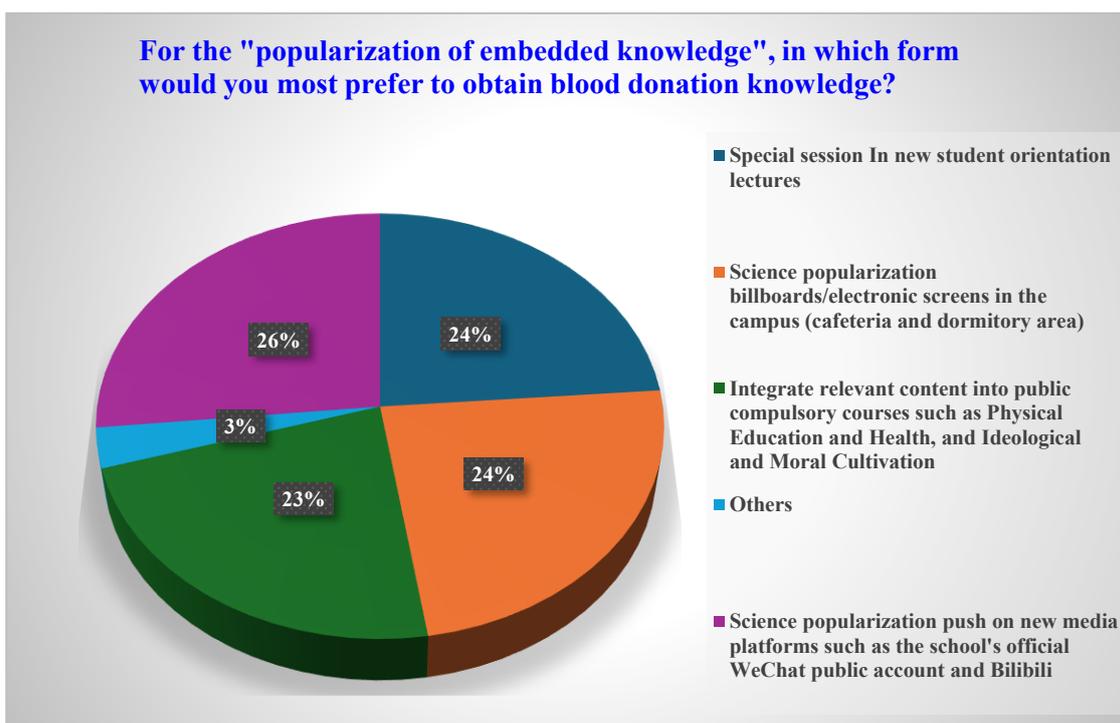

Figure 10. Analysis of Experience Exchange and Opinions on Blood Donation among

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4.4 At the Subsequent Repetition Stage: "Positive Feedback" for Reinforcing Positive Cognition and Constructing a Diversified Incentive Feedback Mechanism

Establish a "Follow-up Mechanism After the First Blood Donation". Provide freshmen with "free physical examination vouchers from the school hospital" (1 time/year) and "post-blood donation nutrition supply packages" (including milk, red dates, etc.) after blood donation. Within 1 week after blood donation, the school hospital or volunteers send "post-blood donation recovery tips" (e.g., "Eating more lean meat and spinach can supplement iron") through WeChat, and share feedback information such as "The blood you donated has been used for the treatment of patients in XX hospital" to strengthen the positive cognition of "blood donation is valuable", allowing freshmen to intuitively feel the value of blood donation and avoid negative associations due to "no feedback".

Build "Repeat Blood Donation Role Models". Award the title of "Campus Public Welfare Blood Donation Star" to students who have donated blood repeatedly 2 times or more, publicize their deeds on the school official website and campus radio, and provide rewards such as "extra points for awards and evaluations" and "priority recommendation for social practice positions", making repeat blood donors "positive cases" to influence other students and break the vicious circle of "bias-behavior".

Establish a "Dual Incentive of Credits + Honors". Incorporate blood donation into the "recognition scope of college students' social practice credits" (1 blood donation can earn 0.5 credits), set up a "blood donation honor wall" on campus (displaying the names and messages of freshmen blood donors), and issue "electronic blood donation certificates" (signed by the principal) to strengthen freshmen's "sense of honor".

V. Conclusion

Based on the research analysis, the cognitive biases in the blood donation decision-making process of current college freshmen can be summarized as follows.

Misaligned Educational Timing: Most universities arrange blood donation education "when the blood donation vehicle enters the campus", which is a "temporary rush" education, failing to align with the "golden period of knowledge reception" after freshmen enroll.

Single Content Form: More than 80% of educational forms are "poster publicity" and "lecture indoctrination", lacking interactivity and contextual sense, making it difficult to attract freshmen's attention.

Weak Incentive Feedback: Only 35% of universities link blood donation with "volunteer hours", and there is a lack of long-term feedback such as "post-blood donation honor display" and "community maintenance", leading to freshmen "participating once and then stopping".

Through empirical investigation, this study finds that the core contradiction of voluntary blood donation education for college freshmen lies in "many cognitive misunderstandings" and "insufficient educational effectiveness". The proposed strategies of "embedded knowledge popularization", "peer-led independent communication", and "diversified incentive feedback" can effectively solve the problems of freshmen's "unwillingness to learn, lack of trust, and inconvenience to participate", forming a complete closed loop of "cognitive improvement - emotional identification - behavioral transformation".

The limitation of this study is that the sample is only from one university. Future research can expand the sampling scope and conduct longitudinal tracking or experimental intervention studies to further verify the effectiveness of cognitive bias intervention strategies. The generalizability of the conclusions needs to be further verified through cross-regional surveys; in the future, "artificial intelligence" technology (such as developing a personalized blood donation knowledge push system) can be combined to further improve the accuracy of education. In addition, how to deeply integrate freshmen's blood donation education with "college ideological and political education" and "public health literacy cultivation" is also an important direction for subsequent research.

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