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Article

The impact of ideological and political education on the psychological and behavioral biomechanisms in medical students' life concept formation: A multidisciplinary exploration

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Abstract: In the cultivation of medical ethics, sense of responsibility and humanistic care, the role of Ideological and political education is increasingly significant. This paper studies and analyzes the practical path of Ideological and political education in the concept of life education, and explores its shaping effect on medical students' values of life, professional ethics and humanistic quality. Through a questionnaire survey of 300 medical students, combined with quantitative data analysis, the study found that ideological and political education can significantly improve students' cognition level of outlook on life ($p < 0.05$), and has a positive effect in strengthening medical ethics and professional ethics. In addition, in terms of practice path, combined with case analysis and classroom teaching mode innovation, the study proposed a systematic implementation scheme of Ideological and political education, and verified that the scheme has high operability and effectiveness in cultivating the effect of students' Outlook on life (the effect increased by about 22%). The results show that the value of Ideological and political education in the life outlook education of medical majors has become an important support point for the cultivation of medical talents, and has far-reaching significance for improving the comprehensive quality and humanistic care consciousness of medical students.

Keywords: ideological and political education; medical major; life philosophy education; practical path; value embodiment

1. Introduction

Medical students' Outlook on life, professional ethics and humanistic care consciousness are important manifestations of their comprehensive quality, which is directly related to their future medical practice ability and career development [1,2]. Medical students' ability to confront ethical dilemmas and pressure in medical practice not only involves psychological and cognitive processes but may also be influenced by underlying biomechanical mechanisms such as neuroplastic changes in the brain and the impact of stress hormones on cognition and behavior. These neurobiological factors influence how students respond to moral and ethical challenges, potentially altering their decision-making processes, emotional regulation, and stress resilience. However, traditional medical education focuses more on the teaching of technology and knowledge, ignoring the cultivation of students' humanistic quality and ethical awareness, which leads to the lack of sufficient theoretical support and practical guidance for medical students in the face of ethical difficulties. Recent advancements in neuroscience and endocrinology suggest that the brain's neuroplasticity and hormonal regulation could be fundamental to understanding how education, particularly Ideological and political education, shapes moral and emotional

development. As an important part of China's education system, the role of Ideological and political education in medical education is gradually recognized and valued. In the cultivation of medical ethics, sense of responsibility, and humanistic care, ideological and political education can play a pivotal role in helping students regulate their psychological and physiological responses through both cognitive-behavioral and biomechanical mechanisms, influencing not only their thoughts but also their neural and endocrine systems. In recent years, with the continuous promotion of medical education reform, how to effectively integrate ideological and political education into the teaching system of medical specialty, especially in cultivating students' Outlook on life and sense of social responsibility, has become an important topic in the current field of medical education [3,4]. This research aims to investigate how ideological and political education can influence medical students' physiological systems, particularly their neural systems (e.g., prefrontal cortex, amygdala) and endocrine systems (e.g., stress hormones like cortisol), thereby shaping cognitive and behavioral patterns in the process of forming their life outlook. Through the questionnaire survey of 300 medical students, combined with quantitative data analysis, the study verified the role of Ideological and political education in improving students' cognition of life outlook, and discussed the practice path of classroom teaching mode innovation and case analysis, and further proposed a systematic implementation plan of Ideological and political education. The study will explore whether ideological and political education can enhance neural connectivity in brain areas responsible for moral decision-making and emotional regulation—such as the prefrontal cortex and amygdala. This neurobiological change could potentially lead to behavioral alterations, such as improved moral reasoning and professional ethics, thereby enhancing medical students' ethical literacy and social responsibility. which provides a new perspective and method for the deepening of humanistic care education in medical education. By examining these neurobiological changes and their behavioral outcomes, the study moves closer to a molecular and cellular biomechanics framework, offering a novel perspective on how educational interventions can biologically influence the ethical and professional development of future healthcare providers.

2. Methods

2.1. Theoretical basis

The study provides multidimensional theoretical support for the role of ideological and political education in the education of medical students' outlook on life by combining interdisciplinary theories such as neuroscience, endocrinology, and psychology. Specifically, the neuroplasticity theory of neuroscience, hormone regulation mechanisms of endocrinology, and emotional regulation and social cognition theories of psychology provide a powerful framework for understanding how ideological and political education affects students' cognition, emotions, and behavior through biomechanical mechanisms., Neuroscience emphasizes the neural plasticity of the brain, pointing out that the brain can dynamically adjust its neural connections after experiencing learning and environmental stimuli. This process enables ideological and political education, under the guidance of emotional support and values, to profoundly influence students' brain function, especially in areas related

to decision-making, emotional regulation, and memory such as the prefrontal cortex and hippocampus. Studies have shown that targeted interventions, like emotional support and cognitive training, can enhance neural connections in these regions, improving students' emotional regulation and cognitive abilities. Therefore, the neurobiological changes brought about by ideological and political education are crucial for shaping students' life outlook by fostering their moral and ethical decision-making capacity. The perspective of endocrinology further reveals the physiological effects of ideological and political education on students' emotions and cognition. Cortisol, as a hormone related to stress, can lead to emotional instability and cognitive decline if secreted excessively.

Ideological and political education, by promoting stable emotional support and positive social interactions, can help regulate cortisol levels, which in turn reduces stress and enhances emotional stability. Oxytocin, often referred to as the "pro-social hormone", is another key element in this process. Oxytocin promotes emotional connections and social bonding, which can enhance students' sense of social identity, belonging, and collective responsibility. By fostering a positive, supportive social environment, ideological and political education not only helps stabilize emotional responses but also strengthens students' social adaptability, essential for both their personal development and professional roles. From a psychological perspective, the theories of emotion regulation and social cognition provide in-depth theoretical support for understanding the effects of ideological and political education. The theory of emotion regulation suggests that an individual's ability to manage their emotions significantly impacts their cognitive performance and behavioral choices. Ideological and political education, through the teaching of emotion regulation strategies, enables students to maintain emotional stability when confronted with challenges or setbacks. This emotional resilience is pivotal in the development of their life outlook and in making ethical decisions under pressure. Social cognitive theory emphasizes that individuals internalize social values by observing and imitating the behavior of others. Through role modeling and behavioral demonstrations, ideological and political education helps students establish correct values, which influence their future behavioral decisions and social interactions, enhancing their moral development and professional ethics.

In summary, neuroscience, endocrinology, and psychology provide a comprehensive explanatory framework for the effects of ideological and political education. By interacting with neural and hormonal mechanisms, ideological and political education not only influences students' emotions and cognition but also enhances their social adaptability by regulating the nervous and endocrine systems. This interaction between biological systems and educational content helps shape students' life outlook and strengthens their moral and social responsibility, providing a solid biological basis for the successful integration of ideological and political education in medical education.

2.2. Research framework and assumptions

The study hypothesized that ideological and political education could affect the formation of medical students' Outlook on life, professional ethics and social

responsibility through a systematic education process. To describe this process, the research will build a research framework based on educational psychology model, social learning theory and value formation theory, and verify it with questionnaire data and interview data [5,6]. Through multi angle theoretical analysis, the research aims to explore how ideological and political education affects students' values and behavior changes at multiple levels and dimensions. The technical route of the study is shown in **Figure 1**.

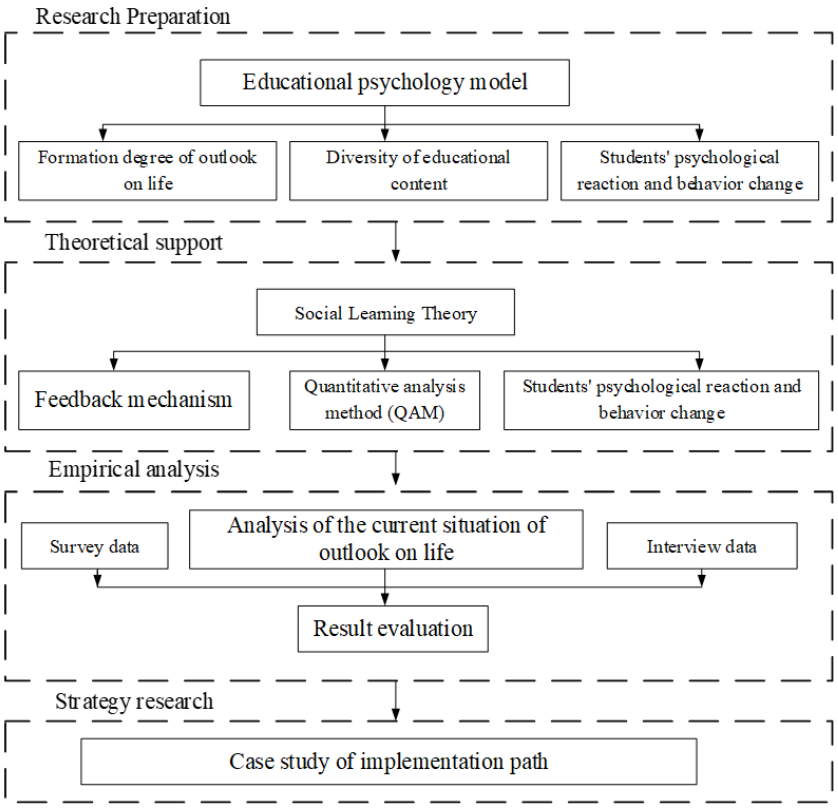

Figure 1. Technical route of research.

The educational psychology model is used to describe the cognitive and behavioral changes of students under different educational modes. The key factors in the model include the degree of life view formation, the diversity of educational content, the students psychological response and behavior change. The degree of formation of life view describes the influence of ideological and political education on students values, reflects the degree of students cognitive transformation and value shaping in the process of education, and further analyzes the internalization process of students ethics and morality in combination with the moral development theory.

Diversity of Educational Content: The study introduces three distinct levels of educational intervention:

1) Basic Theory Courses: These courses focus on foundational political theory, philosophy, and general ethical principles. They are designed to establish students' fundamental values, including concepts of social justice, equality, and personal responsibility.

2) Applied Intermediate Courses: These focus on professional ethics and the integration of ideological principles into real-world scenarios. The aim is to help

students understand how ethical dilemmas emerge in medical practice and how social responsibility can guide decision-making.

3) Practical Advanced Courses: These courses emphasize hands-on activities, including community service, clinical ethics discussions, and role-playing exercises. They provide real-world contexts in which students can directly engage with the social implications of their work as future medical professionals.

The educational content is distributed into experimental groups and control groups as follows:

1) Experimental Group: Receives a comprehensive intervention that includes all three levels of educational content. This group undergoes a multi-faceted approach, combining basic theory, intermediate applied knowledge, and advanced practical applications. The intervention will be delivered through lectures, seminars, workshops, and community-based projects, with an emphasis on active student participation.

2) Control Group: Receives standard medical education without the integrated ideological and political education intervention. This group participates in traditional medical curriculum courses, without the inclusion of specific political or ethical training.

The research will analyze how different types of educational content contribute to the formation of students' life view, with a focus on the moral development of students as measured through cognitive and behavioral changes. Psychological responses and behavior changes will be assessed using quantitative questionnaires and qualitative interviews to explore shifts in students' cognition of life view, ethics, and social responsibility, as well as emotional resonance during the educational process.

In the educational psychology model, the change rate of the students life view is directly proportional to the intensity of the influence of the educational content, as shown in Equation (1).

$$\frac{dL(t)}{dt} = dE(t) - bL(t) \tag{1}$$

In formula (1), $L(t)$ represents the maturity of students' Outlook on life at time t, $E(t)$ is the intensity of educational content, which represents the influence of Ideological and political education content, and d and b are constant coefficients, which represent the positive and negative effects of educational influence, respectively [7,8]. In practice, the "maturity of outlook on life" will be quantified through specific measurement indicators, and the formation degree of students' Outlook on life and the development level of ethics will be assessed through questionnaires, behavior observation and interviews on students' self-report.

According to social learning theory, education has a significant impact on the change of student behavior, and this change is highly correlated with students participation and educational feedback mechanism. This process is shown in Equation (2).

$$B(t) = gP(t) + dF(t) \tag{2}$$

In Equation (2), $B(t)$ represents the range of student behavior changes, $P(t)$ is student participation, $F(t)$ is the intensity of educational feedback, and g and d are correlation coefficients, indicating the impact of participation and feedback

mechanism on behavior changes. On this basis, the study further refined the specific performance of students' participation, such as classroom interaction, after-school discussion, online platform participation, etc., and assessed the actual impact of education on behavior changes through a quantitative feedback mechanism [9,10]. The study introduced a feedback mechanism to describe the continuous impact in the process of educational intervention, as shown in equation (3).

$$F(t) = fK(t) - lF(t-1) \tag{3}$$

In Equation (3), $F(t)$ the intensity of educational intervention is the current state of students life view, and the incentive coefficient and inertia coefficient of feedback, respectively, and indicates the timeliness and continuity of educational feedback. In the process of life view education of medical students, the implementation, feedback and effect evaluation of ideological and political education as the core content adopt the quantitative analysis method (QAM), conduct data processing through SPSS software, and verify the effectiveness of the hypothesis model through regression analysis. In the data analysis, an appropriate level of significance ($P < 0.05$) was set to ensure the statistical significance and utility of the study results.

In equation (3), $F(t)$ represents the intensity of educational intervention, $K(t)$ is the current state of students' Outlook on life, f and l are the incentive coefficient and inertia coefficient of feedback, respectively, indicating the timeliness and continuity of educational feedback. In the process of life view education for medical students, the implementation, feedback, and effect evaluation of ideological and political education as the core content will adopt quantitative analysis methods (QAM), conduct data processing through SPSS software, and verify the effectiveness of the hypothesis model through regression analysis [11,12]. In the data analysis, an appropriate significance level ($p < 0.05$) was set to ensure the statistical significance and practicability of the research results.

2.3. Boundary conditions and experimental design

The content of education is adjusted according to students learning progress and subject characteristics, but the overall educational goals and core concepts remain stable. All relevant educational activities and assessment criteria were considered fixed and would not change during the course of the study.

In order to simulate different educational effects, three types of educational contents were selected for experimental design, namely basic theory education, intermediate applied education, and advanced practice education. To enrich the study's methodology, biomarker monitoring and functional imaging techniques have been integrated into the research design. These include the collection of blood and saliva samples to measure key physiological indicators, as well as the use of advanced brain imaging methods like Positron Emission Tomography (PET) and functional Magnetic Resonance Imaging (fMRI). Blood and saliva samples will be collected at two points during the study: before the ideological and political education intervention (baseline) and after its completion (post-intervention). The collection of these samples will focus on measuring cortisol levels as a primary stress hormone, as well as other relevant biomarkers such as serotonin and dopamine, which are linked to emotional regulation and decision-making processes. These biological samples will be analyzed

to quantify changes in hormone levels, helping to correlate physiological changes with shifts in life concept cognition and behavioral outcomes. fMRI will be employed to measure the activity in specific brain regions, such as the prefrontal cortex and amygdala, which are associated with decision-making and emotional processing, before and after the ideological and political education intervention. fMRI scans will be conducted at the same two points (pre- and post-intervention) to monitor changes in neural activation patterns. PET scans could also be used for more precise localization of brain activity, allowing for further examination of functional connectivity and metabolic changes in relation to educational interventions. Additionally, the levels of stress hormones, particularly cortisol, will be quantified and correlated with brain activity findings to assess their relationship with changes in life concept cognition and behavioral outcomes, providing objective biomechanical data to support the study's findings.

The basic theory education includes the analysis of core ideas, history and present situation of ideological and political education, focusing on cultivating the students' basic values. The content focuses on establishing foundational ideological concepts, such as social justice, equality, and personal responsibility, which form the basis of the students' life philosophy. Intermediate applied education covers medical ethics, professional ethics, and social responsibility, helping students combine theory with practice and enhance their ethical judgment ability. In this stage, students will learn how to apply ethical principles in practical settings, such as understanding how ethical dilemmas emerge in medical practice and how to navigate them in a professional context. This education will involve case studies, role-playing exercises, and discussions on ethical challenges in the medical field. Advanced practice education is focused on clinical practice and experiential learning, where students use ethical knowledge in real-world situations to enhance their humanistic care consciousness and social responsibility. The course emphasizes hands-on clinical experience, where students interact with patients, work in healthcare teams, and confront real-world ethical decisions. This stage aims to deepen students' understanding of the impact of their decisions on both individuals and society at large.

In particular, the study emphasized the diversification of educational methods, using a combination of multiple educational methods, including classroom teaching, interactive discussion, social practice and clinical case analysis, in order to comprehensively evaluate its regulatory role in the life view education of medical students. These methods aim to create a dynamic learning environment where students not only absorb knowledge but also actively engage with it and apply it in practice. For the experimental group, students will receive a comprehensive intervention that includes all three levels of educational content—basic theory, intermediate applied education, and advanced practice education. This group will participate in classroom sessions, workshops, seminars, and clinical practice that integrate ideological and political education across the three levels. The intervention will be designed to help students gradually internalize these concepts at increasing levels of complexity, from theoretical understanding to practical application. For the control group, students will follow the standard medical curriculum, which focuses primarily on the medical sciences without integrating specific ideological and political education content. This

group will not receive the additional ethical education or life view shaping activities that are part of the experimental intervention.

2.4. Research samples and data collection

A sample of 300 medical students will be recruited for this study, including participants from different geographical regions (East, Central, and West China) and different educational levels (basic and advanced stages of their medical education). The selection of students will aim to ensure a diverse representation, covering students from both undergraduate (basic education) and postgraduate (advanced education) stages, as well as students from various regions to account for regional differences in educational exposure and life concept formation. Students participating in this study were voluntary and gave informed consent. The students will be grouped according to different educational patterns. Specifically, students will be assigned to one of the experimental groups based on their educational level (undergraduate vs. postgraduate) and geographical location (Eastern, Central, or Western China). This stratified sampling method will help ensure that different backgrounds and educational stages are adequately represented, which may influence their responses to ideological and political education. Participants will receive different educational interventions depending on their group assignment. These interventions will be tailored to their respective educational levels and regional context to ensure the relevance and applicability of the intervention. The intervention will be designed to be adaptable to the learning progress and subject characteristics of the students, with the overall goal of shaping their life concepts, professional ethics, and social responsibility. The questionnaire will be used as the main data collection tool for this study, mainly investigating student changes in life outlook, professional ethics and social responsibility before and after receiving ideological and political education [13]. The questionnaire design refers to the Likert five-point scale, involving the concept of life, professional ethics awareness and social responsibility. Before data collection, all participating students filled in the questionnaire to assess their initial status; One month after the educational intervention, the questionnaire was given again to assess the impact of ideological and political education on students cognition and attitudes.

The internal consistency of the questionnaire was also assessed using Cronbachs α coefficient, ensuring that the questionnaire reliability was higher than 0.7. The validity of the questionnaire was tested by the expert review method, and the questionnaire was revised by the pre-experiment method to ensure that it can truly reflect the students cognitive changes in the view of life, professional ethics and social responsibility. In addition, additional measures, such as semi-structured interviews or focus group discussions, may be conducted with a subset of participants to further explore qualitative changes in their perceptions and to triangulate the quantitative data.

2.5. Data analysis

Quantitative analysis (QAM) and regression analysis were used for data processing and validation. All data will be analyzed by statistical software such as SPSS with a significance level ($P < 0.05$) set to ensure the reliability of the results. The analysis will focus on understanding the changes in students' life outlook and

professional ethics under different educational modes. Regression analysis will specifically explore the relationship between students' life outlook and professional ethics across various educational interventions. In addition to the quantitative data, qualitative interviews will be conducted to gain insights into the potential mechanisms through which ideological and political education shapes students' behavior, values, and overall worldview. In terms of biomarker and brain imaging data analysis, functional magnetic resonance imaging (fMRI) will be employed to track changes in the brain's neural activity, particularly in regions such as the prefrontal cortex and amygdala, which are associated with decision-making, emotional regulation, and ethical reasoning, before and after the educational intervention [14,15]. The prefrontal cortex and amygdala—regions of the brain linked to decision-making, emotional regulation, and ethical reasoning—will be the primary focus. These brain regions are crucial for understanding how students internalize and apply the ethical principles introduced during the ideological and political education. The salivary cortisol levels of participants will be measured as a biomarker to assess the impact of the educational intervention on stress responses. Salivary cortisol is a reliable indicator of physiological stress, and it will be measured pre- and post-intervention to explore the role of stress regulation in students' behavioral and cognitive changes. These hormone levels will be analyzed in relation to changes in students' life outlook cognition and their emotional responses to the education. This will help establish a link between physiological stress regulation and the effectiveness of ideological and political education in shaping students' values. Data on neural activity and cortisol levels will be integrated with the stress response model, which accounts for the influence of family background and social environment. By analyzing how these factors interact with ideological and political education, we can better understand how external factors influence the effectiveness of the educational intervention. A detailed analysis will examine the correlation between changes in cortisol levels and students' cognitive and behavioral outcomes. This will provide an empirical basis for exploring the neurobiological mechanisms underlying the educational intervention's impact on students' life concepts and professional ethics.

Additionally, neuroplasticity will be examined by analyzing changes in brain activity in regions associated with ethical decision-making and emotional regulation. These neural changes will be compared to cognitive shifts in students' life outlooks, focusing on how educational interventions can enhance students' moral reasoning and emotional maturity.

3. Results and discussion

3.1. Sample collection

This study investigated the life outlook education of medical students in three medical universities in Beijing, including medical students in Peking Union Medical College Hospital, Capital Medical University and Peking University School of medicine. The study randomly distributed 500 questionnaires, covering medical students in different schools and grades. In the process of questionnaire screening, invalid questionnaires were eliminated according to the following three criteria: first, missing or incomplete answers to the contents of the questionnaire; Second, the

answers are inconsistent; Third, the questionnaire was filled out too hastily or casually. 300 valid questionnaires were recovered, and the effective recovery rate of questionnaires was 98.45%. In order to ensure the authenticity of the data, this study also combined open-ended questionnaires and case interviews. The demographic information table is shown in **Table 1**.

Table 1. Demographic information table.

Demographic Variable	Statistic	Sample Size	Percentage (%)
Gender	Male	150	50.00%
	Female	150	50.00%
Place of Birth	Urban	180	60.00%
	Rural	120	40.00%
Only Child	Yes	180	60.00%
	No	120	40.00%
Living Situation	Urban Resident	200	66.67%
	Rural Resident	100	33.33%
Family Relationship	Harmonious	250	83.33%
	Average	40	13.33%
	Tense	10	3.34%
Father's Education Level	High School or Below	50	16.67%
	Associate's Degree/Bachelor's	150	50.00%
	Master's Degree or Above	100	33.33%
Mother's Education Level	High School or Below	70	23.33%
	Associate's Degree/Bachelor's	160	53.33%
	Master's Degree or Above	70	23.34%
Family Economic Status	Good	180	60.00%
	Average	100	33.33%
	Poor	20	6.67%
Consumption Status	Moderate	220	73.33%
	High	60	20.00%
	Low	20	6.67%

3.2. Evaluation of the survey results of Ideological and political education in medical students' outlook on life education

This section shows a detailed analysis of the current situation of medical students' Outlook on life. The analysis covers the descriptive statistics (mean and standard deviation) of all dimensions of the outlook on life, and tests the differences based on different social, family and personal background factors (such as gender, age, family upbringing style, parental education level, economic status, etc.).

From a biomechanical perspective, family economic status and gender differences emerged as the two main determinants of students' life perception and life existence scores. Medical students' life perception scores (mean = 3.614, standard deviation = 0.818) showed significant gender differences. Male students (mean = 3.611, standard deviation = 0.813) tended to have slightly lower life perception scores

than female students (mean = 3.410, standard deviation = 0.668) (t = 5.522, p = 0.000). This difference may be influenced by neurobiological factors such as amygdala volume and propensity for logical analysis in males. On the other hand, females have higher grey matter density in the hippocampus and prefrontal cortex and may show more balanced cognition. These findings are consistent with neuroplasticity theory, suggesting that gender differences in brain structure may contribute to how individuals process and internalise life-related concepts. The prefrontal cortex plays a role in reflective thinking and decision-making, which may account for the higher cognitive flexibility of females. Life presence scores (mean = 4.108, standard deviation = 0.791) were significantly influenced by family economic status. Students from low-income families tended to score lower on life presence due to increased cortisol secretion and impaired prefrontal cortex function as a result of stress. This is consistent with the hormonal regulation theory that stress hormones such as cortisol affect mood regulation and neural connectivity, ultimately shaping students' sense of presence.

Other factors affecting attitude towards life and life values include attitude towards life and life values, which scored consistently high among medical students (mean = 4.319, standard deviation = 0.523) with no significant gender difference. Male (mean = 4.302, standard deviation = 0.585) and female (mean = 4.356, standard deviation = 0.456) students had similar scores (t = −0.704, p = 0.482). This finding supports emotion regulation theory, which states that the positive influence of social support and emotion regulation mechanisms leads to more consistent attitudes toward life among students of different genders. The Value of Life score (mean = 4.010, standard deviation = 0.631) showed slight differences between genders, but family background seemed to play a more prominent role. This is consistent with long-term memory reinforcement theory, which suggests that emotional support plays a crucial role in the long-term neural consolidation of values and life goals.

Students' total life perspective scores (mean = 16.051, standard deviation = 2.129) did not differ significantly (t = 1.167, p = 0.244) between male (mean = 16.054, standard deviation = 2.043) and female students (mean = 15.838, standard deviation = 1.636). This suggests that the formation of outlook on life is influenced not only by gender, but also by the economic situation of the family and social support. This reflects the synergistic effect of biomechanical mechanisms whereby brain structure, hormonal regulation and external support systems work together to shape an individual's worldview. The mean and standard deviation of medical students' views on life divided by dimensions, as well as the test results of gender differences in medical students' views on life, are shown in **Tables 2** and **3**, respectively.

Table 2. Mean and standard deviation ($\bar{X}$ ± SD) of medical students' view of life by dimension.

Dimension	Mean (±SD)	Biomechanical Relevance
Life Cognition	3.614 ± 0.818	Impact of neuroplasticity on emotional cognition
Life Existence	4.108 ± 0.791	Hormonal regulation (e.g., oxytocin) and its relationship to social identity
Life Attitude	4.319 ± 0.523	Emotional regulation and enhanced neural connectivity in decision-making areas
Life Value	4.010 ± 0.631	Formation of values and the role of emotional support in long-term memory strengthening
Total Score	16.051 ± 2.129	Synergistic effect of biomechanical mechanisms in overall cognition and emotional improvement

Table 3. Test results for gender differences in medical students' view of life.

Life View Dimension	Male ($\bar{X}$ ± SD)	Female ($\bar{X}$ ± SD)	*t*	*p*
Life Cognition	3.611 ± 0.813	3.410 ± 0.668	5.522	0.000
Life Existence	4.113 ± 0.808	4.104 ± 0.724	0.095	0.924
Life Attitude	4.302 ± 0.585	4.356 ± 0.456	−0.704	0.482
Life Value	4.027 ± 0.658	3.968 ± 0.569	1.284	0.200
Total Score	16.054 ± 2.043	15.838 ± 1.636	1.167	0.244

Note: *, $P < 0.05$; **, $P < 0.01$.

1) Differences in Life Perceptions and Place of Residence.

On the life cognition dimension, urban residents scored significantly higher than rural residents ($t = 3.254$, $p = 0.002$). This difference suggests that urban residents may benefit from more educational resources and cognitive stimulation in their cognitive development, which may contribute to the activation of the prefrontal cortex of the brain, thus improving abstract thinking skills. This result is consistent with the theory of neuroplasticity, suggesting that the external environment may promote cognitive ability by influencing the structure and function of neural networks.

2) Differences in Value of Life and Place of Residence.

The value of life dimension showed significant differences, with urban residents scoring significantly higher than rural residents ($t = 2.226$, $p = 0.026$). This finding may be related to the fact that urban dwellers are exposed to more diverse life experiences and cultural influences that can play a positive role in shaping life values. This can be explained by the socio-cultural theory that urban environments usually provide more cultural diversity and help individuals find their place in a diverse value system.

3) Differences in Life Presence and Place of Residence.

The difference in scores between urban and rural residents on the life presence dimension was not significant ($t = 0.529$, $p = 0.597$). This suggests that life presence is influenced more by social support and emotional networks than by the environment itself. This phenomenon supports the affect regulation theory that family and social support networks play a more important role in shaping an individual's sense of life presence.

4) Differences in Life Attitudes and Place of Residence.

This result further suggests that the formation of life attitude is not only influenced by environmental factors, but also closely related to personal experiences and emotional states.

This result further suggests that the formation of life attitudes is not only influenced by environmental factors, but also closely related to personal experiences and emotional states.

5) Comparison of Overall Scores.

For the overall score, urban residents were slightly higher than rural residents, but the difference was not significant ($t = 1.332$, $p = 0.183$). This suggests that although there are some differences between urban and rural residents on various dimensions, the difference in the overall outlook on life scores is relatively small. This suggests that while environmental factors are important in the multifactorial role of life view

formation, there are many other internal and external factors that may work together to influence the final life view. The test results of the differences in place of residence in medical students' outlook on life are shown in **Table 4**.

Table 4. Test results for place of residence differences in medical students' view of life.

Life View Dimension	Urban Residents ($\bar{X}$ ± SD)	Rural Residents ($\bar{X}$ ± SD)	*t*	*p*
Life Cognition	3.650 ± 0.791	3.470 ± 0.722	3.254	0.002
Life Value	4.100 ± 0.610	3.930 ± 0.641	2.226	0.026
Total Score	16.220 ± 2.060	15.740 ± 2.086	1.332	0.183

Note: *, $P < 0.05$; **, $P < 0.01$.

1) Family Economic Status and Life Cognition: A Significant Influence.

The most significant finding in this analysis is the impact of family economic status on medical students' life cognition. Students from families with better economic conditions scored 3.750 ± 0.775, significantly higher than students from average (3.530 ± 0.755) and poor (3.460 ± 0.706) backgrounds ($F = 4.825$, $p = 0.009$). This suggests that students with better economic conditions likely have access to more educational resources and psychological support, which may stimulate the development of their prefrontal cortex and enhance abstract thinking abilities. According to neuroplasticity theory, richer environmental stimuli are conducive to brain development, particularly in cognitive functions.

2) Family Economic Status and Other Life Dimensions: Minimal Impact.

While family economic status showed a significant effect on life cognition, it had a minimal impact on life existence, life attitude, and life value. The scores for these dimensions were not significantly different across economic status groups, indicating that these aspects of life view are more influenced by emotional support and social interaction than by economic conditions. For example, the life existence dimension showed no significant difference ($F = 0.252$, $p = 0.778$), and similarly, the life attitude and life value dimensions also showed non-significant results ($F = 1.229$, $p = 0.295$ and $F = 1.506$, $p = 0.222$, respectively). This aligns with social interaction theory, which suggests that emotional support and interpersonal relationships are key drivers in shaping life perspectives in these areas.

3) Total Life Outlook Scores: Limited Economic Impact.

When considering the total score, students from families with good economic status had a slightly higher total score (16.400 ± 2.120) compared to the average (15.810 ± 2.102) and poor (15.630 ± 2.067) groups, but the difference was not statistically significant ($F = 1.866$, $p = 0.157$). This suggests that while economic status might influence cognitive development, it has a limited effect on the overall life outlook, likely because other factors such as emotional well-being and social support are more dominant in shaping this broader perspective.

4) Biomechanical Perspective on Family Economic Status.

From a biomechanical perspective, family economic status affects the development of both the brain's nervous system and endocrine system, which are influenced by living environments and psychological stress levels. Economic pressure in economically disadvantaged groups may cause higher levels of stress, which can

affect neurodevelopment and emotional regulation, thereby influencing their worldviews. In contrast, students from wealthier families, exposed to fewer stressors, may develop more robust cognitive and emotional systems. The results of the analysis of variance on the differences in family economic status in medical students' outlook on life are shown in **Table 5**.

Table 5. Anova results for family economic status differences in medical students' view of life.

Life View Dimension	Good ($\bar{X}$ ± SD)	Average ($\bar{X}$ ± SD)	Poor ($\bar{X}$ ± SD)	*F*	*p*
Life Cognition	3.750 ± 0.775	3.530 ± 0.755	3.460 ± 0.706	4.825	0.009
Total Score	16.400 ± 2.120	15.810 ± 2.102	15.630 ± 2.067	1.866	0.157

Note: *, $P < 0.05$; **, $P < 0.01$.

1) Father's Educational Level and Life Cognition: Significant Influence.

The father's educational level has a significant impact on medical students' life cognition. Students whose fathers have higher education levels (university or above) scored higher in life cognition compared to those whose fathers had high school education or below. Specifically, students with fathers having a high school education or below scored 3.460 ± 0.732, significantly lower than those with fathers holding university degrees (3.750 ± 0.788) or master's degrees and above (3.800 ± 0.741) ($F = 6.390$, $p = 0.003$). This suggests that fathers with higher educational backgrounds are likely to provide better cognitive support, fostering the development of brain regions such as the prefrontal cortex, which are crucial for abstract thinking and cognitive functions. This finding aligns with neuroplasticity theory, which posits that intellectual stimulation from caregivers can positively influence cognitive development.

2) Father's Educational Level and Other Life Dimensions: Minimal Influence.

In contrast to the significant effect on life cognition, there were no significant differences in other dimensions such as life existence, life attitude, and life value across different father education levels ($p > 0.05$). Specifically, the life existence dimension ($F = 0.297$, $p = 0.744$), life attitude ($F = 1.282$, $p = 0.282$), and life value ($F = 1.976$, $p = 0.143$) showed no notable differences. This suggests that these aspects of life perspective are likely more influenced by emotional support and social relationships rather than by cognitive stimulation. These findings are consistent with attachment theory, which emphasizes the role of emotional bonds and support in shaping students' broader worldview.

3) Total Life Outlook Scores: Influence of Father's Education Level.

When considering the overall life outlook score, students whose fathers had higher educational levels (master's degree or above) scored 16.500 ± 2.124, significantly higher than those whose fathers had lower educational levels (15.670 ± 2.076) ($F = 3.283$, $p = 0.040$). This result suggests that father's education plays a positive role in the overall formation of life philosophy, which may reflect the influence of higher education levels on shaping broader cognitive and philosophical perspectives.

4) Biomechanical Perspective on Father's Education Level.

From a biomechanical perspective, a father's educational level can influence the development of a student's brain and nervous system, particularly in areas related to

cognitive processing. The positive influence of a father's higher educational background may enhance cognitive development, thereby influencing a student's life view. This could be related to neuroplasticity and the capacity for brain development stimulated by cognitive enrichment. Moreover, the endocrine system may also be influenced by social and environmental factors, with higher education potentially providing a more stimulating environment for emotional and psychological development. The results of the analysis of variance on the differences in father's educational level in medical students' outlook on life are shown in **Table 6**.

Table 6. Anova results for father's educational level differences in medical students' view of life.

Life View Dimension	High School or Below ($\bar{X}$ ± SD)	College or Bachelor's ($\bar{X}$ ± SD)	Master's or Above ($\bar{X}$ ± SD)	*F*	*p*
Life Cognition	3.460 ± 0.732	3.750 ± 0.788	3.800 ± 0.741	6.390	0.003
Life Existence	4.080 ± 0.761	4.130 ± 0.748	4.170 ± 0.735	0.297	0.744
Life Attitude	4.210 ± 0.545	4.350 ± 0.499	4.380 ± 0.520	1.282	0.282
Life Value	3.920 ± 0.629	4.120 ± 0.609	4.150 ± 0.600	1.976	0.143
Total Score	15.670 ± 2.076	16.350 ± 2.107	16.500 ± 2.124	3.283	0.040

Note: *, $P < 0.05$; **, $P < 0.01$.

1) Mother's Educational Level and Life Cognition: Significant Influence.

The mother's educational level has a significant impact on medical students' life cognition. Specifically, students whose mothers have lower education levels (high school or below) scored 3.480 ± 0.735, significantly lower than those whose mothers hold university degrees (3.740 ± 0.758) or master's degrees and above (3.760 ± 0.764) ($F = 5.670$, $p = 0.019$). This finding is consistent with the idea that mothers with higher educational backgrounds can provide greater cognitive support, which facilitates the development of critical brain areas, such as the prefrontal cortex, crucial for advanced cognitive abilities. This aligns with the neuroplasticity theory, which suggests that cognitive development can be enhanced by intellectual stimulation from caregivers.

2) Mother's Educational Level and Other Life Dimensions: Minimal Influence.

In contrast to the significant effect on life cognition, the mother's educational level did not show significant differences in other dimensions such as life existence, life attitude, and life value ($p > 0.05$). Specifically, the life existence dimension ($F = 0.175$, $p = 0.839$), life attitude ($F = 2.120$, $p = 0.125$), and life value ($F = 1.645$, $p = 0.196$) showed no notable differences. This suggests that these dimensions of life perspective are more strongly influenced by emotional support and social relationships rather than by maternal education alone. This finding is in line with attachment theory, which emphasizes the importance of emotional bonding and social support in shaping one's worldview.

3) Overall Life Outlook Scores: Minimal Effect of Mother's Educational Level.

When considering the overall life outlook score, students whose mothers had higher education levels (master's degree or above) scored 16.420 ± 2.126, slightly higher than those whose mothers had lower education levels (15.720 ± 2.115) ($F = 2.358$, $p = 0.099$). Although the difference is not statistically significant at the conventional level ($p > 0.05$), this result suggests that maternal education may still have a positive impact on the overall formation of life philosophy, albeit to a lesser degree compared to father's education level. This supports the notion that higher

education can enhance cognitive and emotional development, which influences life perspectives.

4) Biomechanical Perspective on Maternal Education Level.

From a biomechanical perspective, a mother's educational level could influence the development of a student's brain function and nervous system, particularly those areas related to cognitive processing. The findings indicate that higher maternal education may foster a more stimulating environment for cognitive growth, enhancing students' life cognition abilities. Additionally, the influence of social and emotional support from the mother plays a significant role in shaping the student's broader worldview and emotional well-being. The analysis results of the variance analysis on the differences in maternal education level in medical students' outlook on life are shown in **Table 7**.

Table 7. Anova results for mother's educational level differences in medical students' view of life.

Life View Dimension	High School or Below ($\bar{X}$ ± SD)	College or Bachelor's ($\bar{X}$ ± SD)	Master's or Above ($\bar{X}$ ± SD)	*F*	*p*
Life Cognition	3.480 ± 0.735	3.740 ± 0.758	3.760 ± 0.764	5.670	0.019
Total Score	15.720 ± 2.115	16.230 ± 2.112	16.420 ± 2.126	2.358	0.099

Note: *, $P < 0.05$; **, $P < 0.01$.

1) Family Relationships and Life Cognition: Significant Influence.

The impact of family relationships on medical students' outlook on life is most pronounced in the dimension of life cognition. Specifically, students from harmonious family environments scored 3.740 ± 0.768, significantly higher than those from average (3.540 ± 0.798) and tense family environments (3.460 ± 0.710) ($F = 9.032$, $p = 0.001$). This indicates that a harmonious family environment reduces psychological stress and promotes cognitive development. This finding aligns with the stress reduction theory, which suggests that lower psychological stress improves cognitive functions.

2) Family Relationships and Other Life Dimensions: Minimal Influence.

In contrast, family relationships did not have significant effects on other dimensions such as life existence, life attitude, and life value ($p > 0.05$). Specifically, the life existence dimension ($F = 0.154$, $p = 0.858$), life attitude ($F = 0.876$, $p = 0.419$), and life value ($F = 2.404$, $p = 0.093$) showed no notable differences. This suggests that these dimensions are influenced more by individual emotional regulation and personal experiences rather than family relationships alone. This finding is consistent with attachment theory, emphasizing the role of emotional bonding and social support in shaping life perspectives.

3) Overall Life Outlook Scores: Positive Effect of Harmonious Family Relationships.

When considering the overall life outlook score, students from harmonious family relationships scored 16.380 ± 2.035, higher than those from average (15.860 ± 2.108) and tense family relationships (15.680 ± 2.087) ($F = 3.142$, $p = 0.049$). Although the difference is modest, it indicates that good family relationships contribute positively to the overall formation of life perspectives. This supports the notion that a supportive family environment fosters emotional regulation and social support, which are crucial for comprehensive worldview formation.

4) Biomechanical Perspective on Family Relationships.

From a biomechanical perspective, harmonious family relationships contribute to the development of emotional regulation mechanisms and provide social support, promoting brain development and endocrine balance. This positive family environment aids in reducing stress hormones, which in turn facilitates cognitive and emotional development, aligning with theories of neuroplasticity and hormonal regulation. The results of the indifference analysis on the differences in life philosophy and family relationships among some medical students are shown in **Table 8**.

Table 8. Anova results for family relationship differences in medical students' view of life (continued).

Life View Dimension	Harmonious ($\bar{X}$ ± SD)	Average ($\bar{X}$ ± SD)	Tense ($\bar{X}$ ± SD)	*F*	*p*
Life Cognition	3.740 ± 0.768	3.540 ± 0.798	3.460 ± 0.710	9.032	0.001
Life Existence	4.150 ± 0.732	4.100 ± 0.799	4.070 ± 0.745	0.154	0.858
Life Attitude	4.370 ± 0.508	4.270 ± 0.567	4.230 ± 0.550	0.876	0.419
Life Value	4.120 ± 0.605	3.950 ± 0.642	3.920 ± 0.633	2.404	0.093
Total Score	16.380 ± 2.035	15.860 ± 2.108	15.680 ± 2.087	3.142	0.049

Note: *, $P < 0.05$; **, $P < 0.01$.

In **Figure 2**, a survey on the question "When facing life-related issues, who do you consult first?" shows that 40.92% of medical students choose their "parents", 28.15% choose "friends", 19.85% choose "doctors", 5.27% choose "classmates", and only 6.01% choose "teachers". This data indicates that the role of teachers in educating medical students about life awareness is still insufficient, leading to a lack of adequate scientific guidance and risk management advice when students face life-related challenges. Therefore, in the process of educating medical students about their outlook on life, higher education institutions should enhance teacher training in life education, improving their theoretical knowledge and practical skills in this area. This will ensure that teachers can effectively provide life education and contribute to the development of a professional, experienced teaching team.

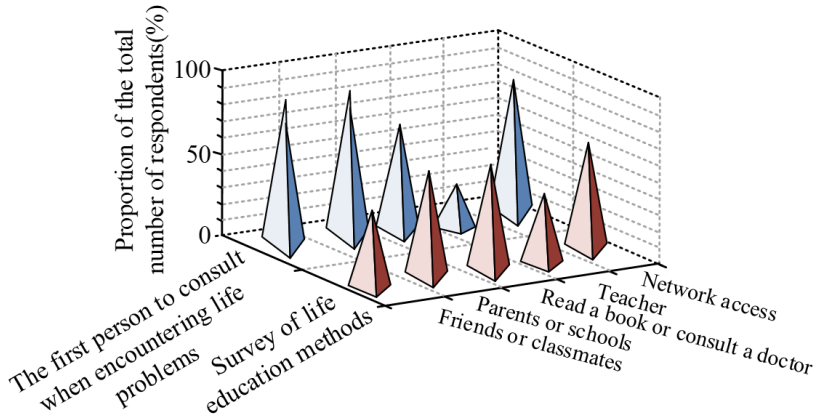

Figure 2. Investigation and analysis of the current situation of medical students' outlook on life education.

Regarding the question "Through which channels have you received life education?" 25.95% of medical students reported receiving life education through "school", 20.77% through "family", 19.88% through "reading books", 18.88%

through “online resources”, and 14.52% through “classmates or friends”. This suggests that the majority of medical students rely primarily on their school for life education. Therefore, schools should place more emphasis on offering diverse and engaging activities to promote life education. By leveraging campus cultural activities and student organizations, schools can create an environment imbued with the meaning of life, making the education more integrated into students’ daily lives. At the same time, providing platforms for communication can help students alleviate academic and personal pressures, subtly guiding them toward forming a correct outlook on life.

3.3. Research on the practical path of Ideological and political education in the education of medical students’ outlook on life

Building an effective path for the education of medical students’ outlook on life requires a comprehensive approach, involving the enrichment of educational content, the enhancement of emotional and intellectual guidance, the integration of teaching resources, the diversification of practical platforms, and the improvement of the overall educational environment.

1) Integrating Philosophical, Ethical, and Humanistic Content into Medical Education.

The content of life education should not only cover traditional medical knowledge but also incorporate multidimensional education in philosophy, ethics, and humanistic care. By introducing theories on life and values into the curriculum, medical students can be exposed to diverse perspectives on life, including concepts of health, the meaning of life, and issues such as death. This will help them gain a comprehensive understanding of the profound impact their future profession will have on their own lives and society. These insights are aligned with neuroplasticity, where exposure to new perspectives and challenges facilitates cognitive adaptation and mental growth.

Through integrating medical ethics, case analysis, and moral dilemmas into the curriculum, students will be encouraged to think critically and explore real-life issues, thus enhancing their ability to solve practical problems. This approach activates cognitive processes that involve moral reasoning and empathy, which are key to fostering professional ethics and decision-making.

2) The Role of Ideological and Political Education in Shaping Life Values.

The role of ideological and political education is not only to transmit knowledge but also to guide emotions and shape values. Medical students, when facing challenges related to life, disease, and death, often require a deep sense of the meaning of life and a strong sense of responsibility. This can be achieved through subtle and immersive educational methods. By incorporating classroom teaching, teacher-student interactions, and the power of role models, the values of humanistic care, social responsibility, and the benevolence of medical professionals can be transmitted to students, helping them develop a correct outlook on life.

This approach influences biopsychosocial mechanisms, where positive emotional regulation and a sense of purpose are formed through hormonal balance and neuroplastic changes in response to empathetic and value-driven teaching methods.

3) Interdisciplinary Collaboration in Life Education.

Moreover, interdisciplinary collaboration is crucial for life education. For instance, the integration of medical courses with philosophy, ethics, psychology, and other fields allows students to understand the value and meaning of life from multiple perspectives. Schools should encourage cooperation among faculty members, sharing teaching resources and organizing interdisciplinary lectures and seminars. This would foster the organic integration of ideological education with medical education, thereby enhancing the overall effectiveness of life education.

This integration also promotes cross-disciplinary cognitive flexibility, which enhances students' ability to think critically and adapt to complex life and career challenges. Neuroplasticity plays a role in this, as students' brains adapt to new interdisciplinary knowledge, which strengthens their problem-solving skills and broadens their worldview.

4) Practical Activities and Real-Life Experiences: Enhancing Emotional Regulation.

Medical students' education on life should not be confined to theoretical classroom teaching; practical activities are essential to deepen their understanding. By organizing volunteer services, community healthcare, clinical internships, and other hands-on experiences, students can personally witness the fragility and value of life while interacting with patients and serving society. This process helps to strengthen their sense of responsibility and mission, and contributes to their emotional and psychological development.

The practical experience of interacting with patients in real-life settings can lead to biomechanical changes, such as improved heart rate variability (HRV), reflecting better autonomic nervous system balance. This connection underscores how practical life education enhances emotional regulation and physiological responses, thus strengthening the mind-body connection in the context of medical practice.

5) Biofeedback and Long-Term Tracking Systems: Optimizing Emotional Regulation.

To further enhance the practical effectiveness of life education, this study also incorporates advanced techniques such as biofeedback training and long-term tracking systems. To help students better manage their emotions and internalize educational content, heart rate variability (HRV) monitoring devices will be used to track their physiological and emotional states in real time during activities such as case discussions and role-playing in ideological and political education.

This biofeedback approach allows students to observe changes in their HRV, which reflects autonomic nervous system balance, and learn techniques such as controlled breathing and muscle relaxation. These skills will not only improve students' emotional regulation but also enhance their self-awareness, thus promoting the internalization of the educational content and encouraging the development of a positive outlook on life and professional ethics.

From a biomechanical perspective, emotional regulation and the balancing of stress hormones through biofeedback may stimulate brain areas associated with empathy and decision-making, thus enhancing students' capacity to navigate emotionally challenging situations, such as those they will face in their medical careers.

6) Optimizing the Campus Cultural Environment.

Finally, schools should optimize the campus cultural environment to create a space that values and respects life, providing students with a positive and supportive environment for growth. Through life education lectures, life culture walls, and thematic activities, the influence of life education can be further deepened, allowing students to absorb these values in subtle and unconscious ways.

A positive campus culture can influence students' brain chemistry and emotional regulation by fostering a sense of community, belonging, and shared values. This aligns with the concept of social support, which has been shown to promote neurobiological resilience and improve students' ability to cope with stressors, thereby enhancing their emotional and psychological well-being.

4. Conclusion

This study comprehensively discusses the role of Ideological and political education in the education of medical students' Outlook on life and its practical path. Through the investigation and analysis of medical students in three medical colleges in Beijing, it was found that medical students demonstrated a medium to high level of life outlook education across four key dimensions: life cognition, life existence, life attitude, and life value. Among these, the dimension of life attitude scored the highest (mean = 4.319), while life cognition and life value scored relatively lower (mean = 3.614 and 4.010, respectively). These findings indicate that medical students still face challenges in fully developing their life cognition and life value systems.

The results have significant implications for both medical education and the broader field of ideological and political education. They suggest that life outlook education within medical curricula should focus not only on fostering positive life attitudes but also on strengthening students' understanding of life cognition and value systems. The relatively lower scores in life cognition and life value underscore the need for integrating more comprehensive content related to philosophical thinking, ethical reflection, and humanistic values into medical education. This integration could involve enhancing curriculum design, adopting innovative teaching methods, and offering students more opportunities for self-reflection and interdisciplinary learning, aimed at bridging these educational gaps.

Furthermore, the study highlights the critical role of educators in guiding students through life-related challenges. Given that only 6.01% of students sought guidance from teachers on life issues, there is a clear need to enhance teachers' professional skills and more effectively incorporate ideological and political education into the curriculum. Teacher training programs focused on life education could help equip educators with the tools to foster critical thinking, emotional intelligence, and personal development among students. Additionally, incorporating peer-to-peer learning and role models within the curriculum could also provide valuable support for addressing the emotional and ethical needs of medical students.

While this study offers valuable insights, several limitations should be acknowledged. The sample was limited to medical students from three colleges in Beijing, which may not fully represent the diversity of medical students across the country. Future research could expand the sample size and include medical students from different regions and types of institutions. Further studies could explore the long-

term impact of life outlook education on medical students' professional practice, particularly in relation to their ethical decision-making and patient care.

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