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Exploring Pathways to Enhance College Students' Psychological Resilience and Well-Being Using Large Language Mode

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Abstract: In response to the challenges that college students currently face in improving their resilience and well-being and the limitations of traditional support models, this study uses literature analysis and theoretical deduction methods to systematically construct an intelligent and personalized support path framework, aiming to use large-scale language models to promote college students' resilience and well being. The framework is student-centered and relies on personalized interactive accounts and dynamic learning personal knowledge bases to design core support paths covering cognitive behavioral adjustment, positive resource cultivation, psychological skills training, and multimodal emotional insight and crisis warning. The study also explores the key guarantee conditions required for the implementation of this framework, including core technology, scientific content, ethical safety, and application promotion, and emphasizes that through responsible design, adherence to the principles of ethics first and human-computer collaboration, large-scale language models are expected to become an effective auxiliary tool for improving college students' mental health and well-being, and contribute to the cultivation of a more adaptable next generation.

Keywords: Large Language Model; College Students; Psychological Resilience; Happiness; Intelligent Psychological Intervention

1. Introduction

In recent years, the mental health of college students in China has been thought-provoking and has become an important issue affecting the quality of higher education and social harmony and stability. A large amount of survey data shows that the incidence of psychological problems such as depression and anxiety among contemporary college students continues to be at a high level. The "2022 National Mental Health Report" shows that the detection rate of depression risk among college students is about 21.48%. The results of the "2022 College Students' Mental Health Survey Report" show that half of college students have anxiety problems in their lives, and only 54.72% of college students have no anxiety risk. In addition, researchers used the 90-item symptom checklist (SCL-90) to measure 500 college students and found that college students had obvious symptoms of anxiety, depression, inferiority, social withdrawal, sensitivity, and fragility. Most students are on the verge of psychological disorders and have psychological risks, which require further observation and effective prevention. At the same time, 2.86% of students already have more serious psychological disorders and need to seek professional treatment in time. Psychological distress not only seriously affects students' individual growth, academic achievement and social adaptation, but in extreme cases may even lead to tragic events such as self-harm and suicide [1], which will cause a heavy blow to individuals, families and even society. Therefore, how to effectively respond to the challenges of college students' mental health and improve their psychological resilience and happiness has become a key issue that needs to be solved urgently.

Faced with the increasingly severe situation of students' mental health and the limitations of traditional psychological counseling models in terms of resources, accessibility, and willingness to seek help, artificial intelligence technology represented by large language models has brought innovative opportunities to the field of mental health services. This study adopts the methods of literature analysis and theoretical deduction to explore and construct a systematic path to improve college students' psychological resilience and happiness using large language models. By deeply analyzing the technical characteristics of Large Language Models（LLMs） and combining them with the psychological development needs of college students, an intervention framework integrating advanced functions such as personalized interaction, dynamic knowledge base support, long-text comprehension,

multimodal perception, and intelligent early warning is proposed. The significance of this study is to provide innovative ideas and solutions for college mental health work, make up for the shortcomings of the existing support system, and give full play to the potential of cutting-edge technologies in promoting the positive psychological development of the younger generation, so as to more effectively maintain and improve the overall mental health level of college students.

2. Literature Review

2.1 Psychological Resilience and Happiness of College Students

Psychological resilience is usually defined as the ability of an individual to effectively adapt, actively cope, recover, and even grow in the face of adversity, trauma, tragedy, threats, or other major stressors. It is not a rare trait, but a dynamic process that individuals can develop through learning and experience, which includes positive cognitive, emotional, and behavioral strategies [2]. The components of psychological resilience usually include optimism, cognitive flexibility, emotional regulation ability, self-efficacy, and an effective social support system [1]. For college students, at this stage, they often face pressure from academic competition, interpersonal relationship adjustment, career development planning, independent life adaptation, etc. (Zhou Nina et al., 2025)[3]. Therefore, good psychological resilience is a key protective factor for college students to successfully cope with challenges, maintain physical and mental health, and realize their personal potential. Students with high psychological resilience are more able to learn from setbacks, maintain a positive attitude, and seek constructive solutions, thereby promoting their overall happiness and academic achievement [4].

College students' happiness is a multidimensional positive psychological state, covering students' overall evaluation of life satisfaction, the frequency and intensity of positive emotions, and the perception of personal potential realization and life meaning [5]. There are many factors that affect college students' happiness, including personality traits, cognitive style, coping style, psychological resilience at the individual level, and social support, campus atmosphere, academic pressure and life events at the environmental level. Therefore, college students' happiness not only refers to the lack of negative emotions, but also emphasizes the presence and vigorous development of positive psychological qualities. Studies have shown that college students' happiness is closely related to their academic investment, innovation ability, physical and mental health, and career development and social contribution after graduation [6]. Improving college students' happiness will not only help them spend their college years smoothly, but also lay a solid foundation for their future all-round development and positive life.

2.2 Large Language Models and Their Potential for Application in Mental Health

Large language models are a breakthrough technology in the field of artificial intelligence, specifically deep learning models that are pre-trained on massive amounts of text data and have powerful natural language understanding, generation, and interaction capabilities. These models have significant capabilities in language understanding and generation, and contextual learning and other methods are key technologies to further promote social development[7]. Through fine-tuning, they can even perform a certain degree of reasoning and emotional simulation. It is these core capabilities that make LLMs show great application potential in the field of mental health, which is highly dependent on language communication.

Compared with traditional mental health services, LLMs, as a technological tool, have some significant potential advantages. Studies have shown that traditional psychological counseling has a low degree of counseling fit, including style mismatch, difficulty for clients to open up, and clients' aversion to counselors. Some psychological counseling is also limited by the counselor's competence, resulting in negative experiences. For example, clients cannot recognize the counselor's ability and experience, attitude, and organizational management of counseling, which leads to adverse effects, as well as clients' disappointment with counseling or stopping counseling [8]. LLMs can provide instant services around the clock, breaking through the counselor's time and space and competence limitations, solving the problem of counseling mismatch between interviewees and clients, and greatly improving the accessibility of psychological support [9]. In addition, LLMs

can provide users with an anonymous communication environment, which helps to alleviate the concerns of not seeking help due to concerns about privacy leakage or social stigma, thereby increasing the willingness to seek help [10]. Thirdly, LLMs are highly scalable and can theoretically serve a large number of users at the same time, which can help alleviate the contradiction between the shortage of professional psychological service resources and the growing demand [9]. In addition, standardized LLM services can ensure the consistency of information transmission, avoid the professional level differences that may exist in manual services [11], and may show cost-effectiveness advantages in long-term operations [9]. These advantages make LLMs an important part of the universal mental health support system.

With the rapid development of information technology, digital mental health interventions have emerged. They provide more accessible and cost-effective new ways to cultivate resilience and improve well-being through websites, mobile applications [12]. In this wave, large language models, with their unique interactivity and personalization potential, have begun to be seen as an emerging force in empowering resilience and well-being, and even broader mental health services. Researchers are actively exploring the use of LLMs to design and provide a variety of intelligent intervention programs.

In terms of systematic skill development, LLMs have the potential to be designed as interactive training modules, especially for improving psychological resilience and well-being. These modules can guide users to learn and practice stress management skills, emotion recognition and regulation strategies, and ways to build resilience, such as cultivating an optimistic mindset and enhancing self-efficacy [9]. For example, some applications that integrate LLM or similar AI technologies already include practice modules for resilience building. In terms of delivering positive psychology interventions, LLMs can guide users to practice exercises such as gratitude journaling, identifying and applying personal strengths, and setting positive life goals, which are all proven strategies that can effectively improve individual happiness and life satisfaction [9].

At the cognitive level, LLMs are also used to promote users' cognitive reconstruction. Through cognitive techniques such as Socratic questioning, LLMs can assist users in deep self-reflection and challenge maladaptive beliefs, thereby promoting more constructive coping styles and the development of positive self-cognition, which is essential for the core of psychological resilience, namely cognitive flexibility [13].

In addition, LLMs also show potential in a wider range of mental health applications. In terms of mental health education, LLMs can serve as an interactive knowledge base that can popularize mental health knowledge, stress management skills and coping strategies to the public in real time, and improve the public's psychological literacy [12] which lays the foundation for individualized psychological resilience and happiness. In terms of early screening and identification, researchers have tried to use LLMs to analyze individual text expressions or conversation content to identify early signs of depression, anxiety, and even suicide risk. Many studies are dedicated to developing LLMs-based chatbots to provide preliminary therapeutic conversations and intervention support. These tools often draw on the principles and techniques of evidence-based psychotherapy to guide users to identify and adjust negative thinking patterns and conduct behavioral activation exercises. Tools such as Woebot and XiaoE have shown initial results in reducing users' depression and anxiety symptoms [11]. LLMs are also used to provide immediate emotional support and companionship, and attempt to provide initial crisis identification and referral guidance when users express a serious crisis, although the latter still faces challenges in terms of reliability[14].

2.3 Research Review

In summary, the psychological resilience and happiness of college students are of fundamental significance to their individual development and social adaptation. Improving these two positive psychological qualities is the top priority of current college mental health work. Large language models have shown broad application prospects in the field of mental health due to their unique advantages in natural language processing, emotional interaction, personalized services, and wide accessibility. They have also conducted a series of beneficial explorations in psychological problem screening, mental health education, initial counseling intervention, and

positive psychological construction. Existing research has confirmed the potential of LLMs in providing standardized information, executing specific treatment techniques, and assisting users in skill learning and positive psychological practice.

However, through the review of existing literature, this study also identified the following gaps that deserve further exploration:

First, there is a lack of a systematic and integrated pathway framework. Although existing studies have verified the effectiveness of certain single-point functions of LLMs in mental health support, few studies have systematically explored how to integrate these functions and the various technical characteristics of LLMs to form a multi-dimensional, full-process intervention and development pathway specifically for improving college students' psychological resilience and well-being.

Second, there is insufficient exploration of the application of advanced technical features of LLMs. The LLM functions used in most current studies are relatively basic. As for how to fully utilize and integrate the more advanced features of LLMs , such as building and using a personalized student dynamic knowledge base (including student status information, interaction history, key personal information, etc.), leveraging long-context memory capabilities to ensure deep and coherent interactions, carefully introducing multimodal interactions such as voice and even video to more comprehensively understand student status, guiding constructive dialogues through careful prompt word engineering, deeply fine-tuning the model for psychological counseling and construction field knowledge to enhance professionalism, and establishing a reliable automatic crisis warning mechanism, etc., the specific paths and methods for improving intervention effects and user experience need to be further studied.

Third, the customization and refinement of the intervention for college students needs to be improved. As a specific group, college students have their own particularities in psychological needs, cognitive characteristics, and life situations. At present, there is still a lack of detailed research on how to design LLM intervention programs that are more developmentally appropriate and can better meet their specific needs in terms of psychological resilience and happiness.

Based on the above research gaps, the core goal of this study is to focus on the college student group on the basis of previous research, and to deeply deduce and construct a set of intelligent and personalized support path frameworks that can fully tap the potential of large-scale language models and aim to systematically improve their psychological resilience and well-being. It also explores the key elements and guarantee conditions for its implementation, in order to provide useful references for future theoretical research and practical applications in related fields.

3. Construction of a Large Language Model to Improve College Students' Psychological Resilience and Happiness

Based on the literature review above, this paper proposes an intelligent and personalized path framework that integrates the advanced technical features of large language models. The framework focuses on the application of specific intervention technologies, emphasizes student-centeredness, and realizes the personalized, dynamic and intelligent support process through technology empowerment.

3.1 Building Interactive Accounts and Dynamic Knowledge Base

The first prerequisite for achieving intelligent and personalized psychological support is to establish an underlying infrastructure that can comprehensively and dynamically record and understand individual student information. This architecture mainly includes the following two core components:

The first is personalized student interaction accounts. Set up a dedicated and secure LLM interaction account for each college student user. This account not only serves as the only entry point for students to interact with the LLM system, but also integrates students' basic student information and continuously records their interaction history with LLM, preference settings, and key feedback. These structured and unstructured data together form the basis for understanding students' individual backgrounds and needs.

The second is a dynamic learning personal knowledge base. On the basis of personalized accounts, a dynamically updated personal knowledge base is built for each student. The core function of this knowledge base is to use

the natural language understanding and information extraction capabilities of LLM to automatically learn, identify and store key information or important life events from the interactive dialogue between students and the system , such as the stressors, emotional fluctuations, coping methods, personal strengths, important goals, etc. mentioned by students recently. This knowledge base is different from static archives. It can be continuously enriched and evolved with the use of students. LLM can call on this information in subsequent interactions, thereby providing feedback and support that is more context-aware and more in line with the individual situation of students. For example, when a student mentions a similar problem again, LLM can review his historical coping strategies and effects to provide more in-depth guidance.

This infrastructure provides data and technical support for the personalized implementation of subsequent specific support paths through refined management and dynamic learning of students' individual information. It is the key to achieving the transition from "universal" to "individualized" psychological support.

3.2 Cognitive Reconstruction and Behavioral Activation to Improve Resilience

The core of psychological resilience lies in the cognitive flexibility and positive action of individuals when facing difficulties. This path aims to use LLM to assist college students in effective cognitive reconstruction and behavioral activation. Its key features are deep personalization and continuous interaction:

The first is the personalized cognitive behavioral intervention module. Based on the student's personal knowledge base, LLM can more accurately identify their unique maladaptive thinking patterns and behavioral inhibition problems. The system can guide students to conduct personalized cognitive behavioral therapy exercises, such as thought recording, evidence testing, and developing coping thinking. Using long context (such as millions of characters) processing can ensure that LLM maintains its focus on students' core issues in multiple consecutive conversations, understands the ins and outs of complex emotions and events, and avoids fragmentation of conversations, thereby conducting deeper and more coherent cognitive challenges and reshaping work.

The second is guided Socratic questioning and reflection. Drawing on the Socratic questioning method [13]. LLM can guide students to deeply explore and reflect on their own beliefs, assumptions, and values through a series of carefully designed heuristic questions. Combined with students' past experiences and coping patterns recorded in their personal knowledge base, LLM's questions can be more targeted, helping students to discover contradictions and clarify vague cognitions on their own, and ultimately achieve cognitive adjustment and understanding, enhance psychological cognitive flexibility, and thus improve students' psychological resilience.

Finally, there is behavioral activation and goal management. For behavioral withdrawal caused by depression, anxiety and other emotions, LLM can help students develop specific and actionable behavioral activation plans. Through continuous tracking and positive reinforcement, students are encouraged to gradually resume their normal learning and life rhythms, and actively guided to maintain a positive mental state. At the same time, information such as interests and strengths recorded in the personal knowledge base can provide a reference for the personalized customization of the behavioral activation plan.

3.3 Cultivating Positive Psychological Resources and Enhancing Happiness

Improving happiness is not only about reducing negative emotions, but also about cultivating positive psychological resources. This path is committed to using LLM to create personalized positive experiences and sow the seeds of happiness:

First, customized positive psychology exercises. Based on the student’s personal knowledge base and current emotional state, LLM can push or guide students to conduct various positive psychology exercises in a personalized manner, such as gratitude journaling, strengths identification and application, hope exercises, meaning exploration, self-care exercises, etc[9]. If a student records his interest in art in his knowledge base, LLM can guide him to experience flow and express positive emotions through artistic creation.

Second, the arousal and expansion of positive emotions. LLM can help students arouse and expand positive emotions by sharing relevant positive stories, inspiring quotes, or guiding

students to recall and describe past positive experiences in detail. Exploring the use of multimodal interactions such as pictures, voice, and video is expected to further enhance the immersion and effect of positive emotional experience.

Third, support for building a sense of meaning and value. Through in-depth dialogue, LLM can help students explore their personal values, life goals, and the meaning of life. Combined with their academic information, interests and specialties, it guides students to think about how to combine personal pursuits with social contributions, and gain a deeper sense of satisfaction and happiness.

3.4 Path to Improving Comprehensive Quality through Psychological Skills Training

Mastering the necessary skills is an important guarantee for maintaining mental health and improving psychological resilience [15]. This path makes LLM an adaptive psychological skills coach:

First, personalized skill learning modules. Provide a series of psychological skill training modules including stress management, emotion regulation, interpersonal communication, problem solving and decision-making ability. For example, LLM can recommend appropriate learning content based on the weak links reflected in the student's personal knowledge base or the learning needs actively proposed.

Secondly, adaptive training and feedback. LLM's interactive capabilities can be used to design the skill training process to be more interactive and participatory. For example, students can practice the skills they have learned in a near-real situation through role-playing and scenario simulation. LLM can provide instant feedback based on students' performance and dynamically adjust the difficulty and focus of subsequent training to achieve true adaptive learning. The use of long context can support more complex and multi-round skill practice scenarios.

Finally, learning transfer and application support. LLM not only teaches skills, but also emphasizes the application of skills in real life. It can encourage students to record their attempts and results in skill application, and review and discuss them in subsequent exchanges, helping students consolidate what they have learned and realize the transformation from knowledge to ability.

3.5 Emotional Insight and Real-Time Warning Guardian Path

While providing developmental support, timely identification and intervention of potential psychological crises is the key to protecting students' safety. This path aims to build a sensitive "emotional radar" and an efficient "early warning system":

The first is multimodal emotional state perception. In addition to the main text interaction, AI multimodal technologies such as voice intonation analysis and even facial micro-expression recognition in videos can be carefully explored to capture students' true emotional state and psychological needs more comprehensively and accurately. This will help LLMs provide more empathetic responses and discover the deep-seated problems that may be hidden behind language expression as early as possible.

The second is intelligent crisis tendency identification. Through in-depth semantic analysis and risk assessment of students' language patterns, emotional expressions, and specific topics mentioned during interactions, the LLM system will continuously monitor students' psychological crisis tendencies.

Ultimately, a real-time early warning and graded intervention linkage mechanism is realized. When the LLM system determines that a student has a high or extremely high risk of serious psychological problems based on a preset algorithm, the system will automatically trigger the early warning mechanism. According to the risk level, the early warning information will be automatically sent to the class counselor or crisis intervention team as soon as possible. After receiving the early warning, the counselor needs to immediately start the manual intervention procedure to provide professional assessment and support for the student. This closed-loop mechanism is designed to minimize tragic events caused by failure to detect in time.

In summary, the ultimate concept proposed in this study is to build an adaptive, multimodal, full-cycle LLM psychological support ecosystem. First of all , adaptability means that the system can dynamically adjust support strategies, content push and interaction methods based on students' personal knowledge base, interactive feedback and performance in different path modules, so as to truly "teach

students in accordance with their aptitude" ; secondly , multimodality , on the premise of ensuring ethics and effectiveness, gradually integrate multiple interactive modes such as text, voice, and images to provide a richer, more natural and more insightful user experience. Finally, full-cycle, services cover the entire process from mental health promotion, early warning, mild problem support, skill training, to serious problem identification and professional referral, forming a continuous, spiraling mental health support closed loop. Students can find corresponding support modules in this ecosystem at different stages of life and when facing different psychological needs.

4. Key Elements and Guarantee Conditions

The successful implementation of the above-mentioned path does not rely solely on conceptual design, but also requires detailed planning on a series of key elements and the establishment of sound guarantee conditions. Next, the guarantee conditions are explained from four dimensions: core technology support, intervention content design, ethical norms system, and application support system.

Core technology support and model optimization In order to effectively support the aforementioned intelligent and personalized paths, the LLM system not only needs to have the current leading natural language understanding, generation and dialogue management capabilities, but also needs to be specially constructed and optimized at the following core technical levels.

First, deep fine-tuning of domain knowledge is crucial. Although general LLMs have extensive knowledge, they still lack the depth of understanding and accuracy of expression in the professional field of psychological counseling and construction. Therefore, it is necessary to select a suitable base model and use high-quality, strictly screened psychological counseling theories, psychological construction techniques, real (anonymized, desensitized) consultation cases, and corpus related to common psychological distress of college students for deep fine-tuning. This will help the model better understand the specific expressions and emotional needs of college students, and generate more professional, empathetic and constructive responses.

Secondly, strong long-context processing capabilities are essential. As mentioned in the previous paths, whether it is deep cognitive reconstruction, complex skill training or continuous emotional companionship, LLM needs to have strong long-context memory and processing capabilities. This can ensure the coherence of the conversation, enable LLM to integrate the information provided by students in multiple and multi-round interactions, understand the complete context of events and the dynamic changes of emotions, thereby avoiding superficial and fragmented communication and improving the depth and durability of intervention.

Urthermore, the careful integration of multimodal interaction technologies should also be considered. On the basis of text interaction, in order to more comprehensively grasp the status of students, we can carefully explore the integration of AI multimodal technologies such as voice and intonation analysis, and even facial expression recognition under strict ethical approval. These technologies help capture non-verbal cues and improve the accuracy of emotion recognition.

At the same time, intelligent prompt word engineering plays a decisive role in improving the quality of LLM output. Professional efforts are needed to carefully design system-level and user-level prompt word strategies for different intervention paths, interactive scenarios and treatment goals. This includes preset guiding questioning frameworks, follow-up questioning mechanisms to clarify ambiguous expressions, and structured prompt templates in specific psychological technology applications to ensure that LLM behavior meets expectations and can effectively guide students to think positively and change.

Finally, the basis for achieving personalized paths lies in personalized account and dynamic knowledge base management technology. This requires strong background technology support, including a secure user account management system, efficient data encryption and storage solutions, and LLM's ability to extract information from unstructured text, build knowledge graphs, and dynamically update. Ensuring the accuracy, relevance, and real-time nature of the knowledge base is the key to achieving truly personalized support.

4.1 Scientific Design and Dynamic Adjustment of Intervention Content

Technology is the carrier, and content is the

core. The psychological support content provided by LLM must follow the principles of scientificity, evidence-basedness, and adaptability.

Evidence-based and professional content is a fundamental requirement. All psychoeducational information, skill training modules, and various intervention exercises provided through LLM must be based on recognized psychological theories and clinically proven effective intervention programs [11]. The development and review of content should be led by a team of experts in psychology, psychiatry, and related fields to ensure its scientificity, accuracy, and safety.

Targeted content customization and cultural adaptation are necessary. The intervention content needs to fully consider the cognitive characteristics, development needs, cultural background and common stressors of Chinese college students. For example, when designing a stress management module, it should be combined with the unique stress situations of college students in terms of academic, employment, and interpersonal relationships. At the same time, language style, case selection, and interaction methods should also be localized and adjusted for development suitability.

Finally, we should give full play to the interactivity and dynamic adaptability of content presentation. Taking advantage of the interactive advantages of LLM, we should present the intervention content in a more attractive, easier to understand and accept way. The system should be able to dynamically adjust the content push rhythm, presentation method, and difficulty level of exercises based on students' interactive feedback and information in their personal knowledge base, so as to achieve the transformation from “standardization” to “personalized adaptation”.

4.2 Comprehensive Ethical Standards and Safety Assurance System

When using LLMs to provide psychological support, ethical considerations and security assurance are the bottom line that cannot be crossed. The constant explicit and implicit data collection brought about by the large language model has the risk of infringing personal privacy and data rights , and it is necessary to carefully consider the protection of data rights and data security[16]. A targeted and efficient normative and assurance system must be built. The core lies in strict data privacy and security protection. The personal information generated by students when using the LLM system, including student information, interaction records, emotional data, personal knowledge base content, and even potential multimodal data, are highly sensitive information and must be protected most strictly. Detailed data encryption, storage, access and use specifications should be formulated to comply with national laws and regulations on personal information protection, and ensure technical leakage and abuse prevention capabilities.

At the same time, intelligent crisis identification and efficient early warning intervention are key lines of defense to ensure student safety. It is crucial to establish a reliable intelligent crisis identification model and an efficient real-time early warning mechanism. Therefore, it is necessary to clarify the threshold and standard of early warning to ensure that early warning information can be accurately and promptly delivered to the designated counselor or crisis intervention responsible person. At the same time, a clear follow-up manual intervention process and division of responsibilities must be formulated to ensure rapid response and professional handling after receiving the early warning. The accuracy and reliability of the early warning system need to be continuously optimized and verified.

4.3 Construction of Application Promotion and Support System

The successful application of a new technology is inseparable from a detailed promotion strategy and a complete support system.

First, a prudent pilot promotion and iterative optimization strategy should be adopted. Before formal large-scale application, it is strongly recommended to select qualified universities or colleges to conduct small-scale pilot projects. Through the pilot, the effectiveness, security, user acceptance, technical stability and problems in the actual operation of the LLM psychological support system can be comprehensively evaluated, feedback from users and professionals can be collected, and continuous iterative optimization can be carried out.

Secondly, it emphasizes deep integration with the existing campus psychological service system. The LLM psychological support system should not exist in isolation, but should be an

organic part of the existing mental health service system of colleges and universities, forming a hybrid service model of "human-machine collaboration" with the school psychological counseling center and department counselors. For example, LLM can undertake tasks such as preliminary screening, psychological science popularization, and basic skills training, and refer identified high-risk or complex cases to professional manual services in a timely and seamless manner.

Finally, we must pay attention to the training and empowerment of professional teams. College psychological counselors, student work teams and other relevant personnel are the key to the effective operation of the LLM system, especially crisis warning response and human-machine collaboration. They must be provided with sufficient special training to understand the functional boundaries, operating procedures, and ethical requirements of LLM, and master how to interpret warning information, how to handle LLM referral cases, and how to improve work efficiency with the assistance of LLM.

5. Discussion and Conclusion

This study focuses on the outstanding challenges of college students' mental health and the technical potential of large language models. Through systematic literature analysis and theoretical deduction, a set of intelligent and personalized path frameworks are constructed to use LLMs to improve college students' psychological resilience and happiness. The core of this framework is to be student-centered and deeply integrate advanced LLM technical features including personalized dynamic knowledge base, long context processing, multimodal interaction, precise prompt word engineering, domain knowledge fine-tuning and intelligent crisis warning. It is concretized into four core support paths: cognitive reconstruction and behavioral activation, positive psychological resource cultivation, psychological skills training, and emotional insight and protection, and ultimately leads to an adaptive, multimodal, full-cycle LLM psychological support ecological concept. The study also clarified the key technologies, scientific content, ethical safety and application support necessary to achieve these paths.

Through careful design and responsible application, large language models have the potential to become "intelligent partners" and "guardian angels" for college students' mental health, providing strong support for the innovation and efficiency improvement of college mental health service systems. However, the application of technology is by no means a smooth road, and opportunities and challenges coexist. While embracing its huge potential, we must always adhere to ethics first, ensure data security and user privacy, emphasize human-computer collaboration rather than simple replacement, and continue to optimize and move forward prudently in practice. The road ahead requires interdisciplinary cooperation, rigorous scientific verification, and responsible social co-construction. Only in this way can large language models truly contribute positively to promoting the mental health and well-being of the younger generation.

5.1 Research Contributions

The main contributions of this study are reflected in the following aspects:

First, at the theoretical level, this study systematically connects the technical potential of LLMs with the psychological mechanisms of improving college students' psychological resilience and well-being, providing a new perspective for the study of human-computer interaction in the field of promoting positive mental health. The proposed multi-path, integrated support framework provides a theoretical model for designing more complex AI mental health intervention systems that goes beyond the discussion of single functions, and provides theoretical references on key elements, design principles, and ethical guarantees for building responsible AI mental health applications.

Secondly, at the practical level, this study provides decision-making references and planning ideas for university administrators and mental health workers to explore LLM-assisted psychological support systems, which is helpful for innovating service models and improving service efficiency. At the same time, it also clarifies the technical characteristics that need to be optimized and the design principles that should be followed in mental health application scenarios for LLM technology developers, and reminds education policy makers to pay attention to and support the standardized application of emerging technologies in promoting youth mental health.

Finally, in terms of innovation, this study

proposed a relatively complete and systematic LLM application path framework, emphasizing the deep integration of LLM's advanced technical characteristics and forward-looking application concepts, focusing on the specific needs of college students, and conducting a relatively comprehensive consideration of implementation guarantees, reflecting strong targetedness and potential practicality.

5.2 Research Limitations and Prospects

Despite the positive theoretical exploration of this study, there are some limitations and indicate future research directions:

The main limitations of this study include: First, the research results are mainly theoretical deductions, and the actual effects and user acceptance of the proposed path framework and technical concepts lack empirical testing. Second, LLM technology is rapidly iterating, and its capability boundaries and ethical risks continue to evolve, which may make some specific technical paths proposed in this study face uncertainty. Third, the implementation complexity and resource requirements of the envisioned LLM psychological support ecosystem are high, and actual implementation faces challenges. Fourth, in-depth discussions on ethical risks, especially in the deep application of personalized data and multimodal information processing, still need to be deepened.

In view of the above limitations, future research prospects may include: First, vigorously carry out prototype system development and empirical evaluation, and test the effectiveness, usability and security of the path framework through methods such as randomized controlled trials. Second, carry out special research and optimization on key technical modules such as personalized knowledge base construction, long context management, multimodal emotion recognition, and crisis warning reliability. Third, deeply explore the human-computer collaborative working mode between LLM and professional counselors, and clarify referral standards and information sharing mechanisms. Fourth, conduct long-term follow-up studies to evaluate the long-term effects of LLM psychological support services. Fifth, continue to pay attention to and study new ethical issues and governance strategies in the application of LLMs. Sixth, conduct cross-cultural applicability research to test and adapt the effectiveness of this framework in different cultural contexts.

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