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The Interactive Influence Between Mental Health and Professional Development of Pre-Service Biology Teachers: A Survey Based on Stressors, Emotional Regulation, and Support Needs

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Abstract: This study examines the relationship between mental health and employment development among pre-service biology teachers, conducting a three-month longitudinal survey of 259 undergraduates across grade levels, yielding 771 valid questionnaire responses. Assessments encompassed emotional profiles, stressor types, interpersonal dynamics, emotion regulation strategies, sleep quality, and support requirements. Results revealed a complex yet predominantly stable and positive overall psychological state among participants. Primary stressors included future uncertainty (intensifying with academic progression) and academic pressure (diminishing across grades). Over half of the students reported moderate sleep quality, characterized by occasional insomnia or frequent dreaming, with sleep quality showing a significant correlation with emotional states. Emotion regulation strategies were diverse, featuring coexisting adaptive and maladaptive approaches with distinct grade-based variations. Interpersonal relationships were generally satisfactory, though support needs varied by grade, peaking in the junior year and declining in the senior year. Key contradictions emerged: high self-evaluation coexisted with stress and low help-seeking tendencies; maladaptive emotion regulation correlated with poor sleep quality; and senior students' future planning stress was linked to both sleep disturbances and emotional distress. In light of these findings, the study proposes implementing a multidimensional mental health intervention framework, enhancing the integration of employment guidance and academic education, and refining career development systems to comprehensively safeguard students' mental well-being and facilitate their employment progression.

Keywords: Biological sciences; Pre-service teachers; Mental health; Employment development; Stressors; Emotion regulation; Support needs

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1. Introduction

In 2024, China saw 11.6068 million new college enrollments [1] alongside 12.22 million graduates, intensifying societal competition to an unprecedented degree. Warnings of university "involution" and "high school-ification" have grown

ubiquitous. Amidst this overwhelming competitive strain, mental health crises among college students have surged, emerging as a critical social issue demanding immediate redress. Against this backdrop, this study conducted a three-month longitudinal survey involving approximately 259 students across five classes—spanning freshmen to seniors—in the Biological Sciences (Teacher Education) program. A total of 771 valid questionnaires were collected, assessing multiple mental health dimensions: emotional profiles, stress triggers, interpersonal dynamics, negative emotion management strategies, sleep quality, and holistic development needs. This comprehensive scope ensures representativeness, with the aim of elucidating the interplay between students' stressors, career development, and employment prospects to inform targeted mental health interventions for college students.

2. Survey results

2.1. Overall psychological state

The psychological profile of the surveyed college students is characterized by complexity, yet remains generally stable and positive. This complexity stems from their position within a critical transitional phase of physical and psychological development, during which their cognitive frameworks and emotional regulatory capacities are still evolving. Consequently, they are susceptible to the confluence of diverse influences—academic pressures, interpersonal relationships, and future-oriented anxieties—resulting in naturally varied emotional expressions and psychological experiences. Among the 771 valid questionnaires, emotional states ranged from "calm and stable" to "low mood"; psychological state scores spanned 1 to 10; and high-frequency life descriptors included positive terms such as "fulfilling" and "growing," neutral terms like "busy" and "ordinary," and negative terms such as "tired" and "anxious." This distribution aligns with the typical trajectory of youth psychological development: while they nurture aspirations for the future, actively strive for self-actualization, and report positive experiences of "fulfillment" and "growth," they also contend with negative emotions like "fatigue" and "anxiety" arising from tangible challenges such as academic competition, internships, and job searches. The prevalence of "busy" and "ordinary" reflects the quotidian rhythm of academic life. The questionnaire's comprehensive coverage across emotional states, self-rated scores, and life descriptions underscores the intricate psychological landscape of students in this major—an intricacy that is not chaotic but rather an inevitable product of individual-environment interactions during a distinct developmental stage.

Despite this complexity, the data underscores that the prevailing trend in students' psychological well-being remains positive and stable. A cross-grade analysis reveals that among senior students (fourth-year), the combined proportion of "calm/stable" and "positive" emotional states exceeded 70% in a consecutive three-month survey. This phenomenon may be attributed to their refined understanding of academic and career trajectories following over three years of collegiate experience; while confronting graduation-related pressures, most seniors have transitioned into substantive phases of job seeking or further education, with clear objectives fostering a measurable sense of psychological equilibrium. For juniors (third-year), these two emotional categories collectively surpassed 80%. Having typically acclimated to the academic rhythm of university life, juniors witness the gradual consolidation of their professional knowledge systems while engaging in research initiatives or social practices. Enhanced competencies and an augmented sense of future agency contribute to their elevated incidence of positive affect. Sophomores (second-year) demonstrated approximately 50% "calm/stable" emotions, accompanied by a substantial proportion of "positive/pleasant" states. As they enter the intensive phase of professional studies, sophomores experience a waning of initial collegiate novelty counterbalanced by strengthening professional identity, resulting in relatively steady emotional profiles. Freshmen (first-year) also reported over 80% combined "calm/stable" and "positive/pleasant" emotions. Driven by curiosity and anticipation upon entering university, new students generally sustain an optimistic outlook toward campus life, notwithstanding challenges in adapting to the novel environment.

Self-assessment scores and daily life descriptions further confirm this positive trend. Over 80% of seniors rated their psychological well-being at 7+ points, showing general satisfaction. Among juniors, over 80% scored 8+points, with

a third giving the maximum 10—reflecting dominant positive emotions and high self-contentment. Sophomores and freshmen showed similar self-evaluation patterns, indicating strong self-affirmation. Life descriptions used mostly positive/neutral terms: "growing," "fulfilling," "happy," "ordinary," with little negative language. "Growing" and "fulfilling" denote accomplishment in knowledge, skills, and personal growth; "happy" directly expresses positive emotions; "ordinary" suggests a stable, healthy daily life despite lacking constant excitement. A few negative terms imply isolated negative experiences don't define overall psychology. Thus, the major's students maintain a positive psychological state, stemming from their resilience, proactive coping, and the university's mental health education, academic guidance, and support services—collectively building a solid foundation for healthy development.

2.2. Primary stressors

First-year university students, as fledgling entrants to higher education, predominantly grapple with stress rooted in "academics," accounting for approximately 80% of their reported pressures. This phenomenon exhibits distinct stage-specific characteristics. The transition from high school to university represents not merely a change in learning environment but a fundamental paradigm shift in pedagogical approaches and evaluation frameworks. University courses prioritize autonomous learning, critical thinking, and applied knowledge—markedly diverging from the standardized, exam-centric methodologies of secondary education. Amidst this adaptation, freshmen frequently confront challenges such as a sudden escalation in course difficulty, misalignment with new learning modalities, and nebulous professional identity formation. This academic "weaning period" directly precipitates a concentrated surge in stress levels. Compounding this, the freshman year typically precedes specialized curricular subdivisions and concrete career planning, with future uncertainties remaining abstract rather than manifesting as immediate practical pressures—rendering academic adaptation the inevitable focal point of concern.

The stressors across different grade levels exhibit a distinct grade-related pattern: as students progress toward graduation, "future planning" gradually emerges as the dominant stressor, while the proportion of students identifying academic stress as their primary concern declines annually. This evolutionary trajectory aligns closely with the developmental logic of university life: in lower grades, the core focus lies in knowledge acquisition and capability cultivation, where academic performance directly influences the solidification of professional foundations and future opportunities, thus placing academic stress at the forefront. Upon entering higher grades, human capital investment nears the threshold of yielding returns. Converging factors such as labor market signaling, the costs associated with career path decisions, and familial and societal expectations collectively drive the steady ascent of "future planning" in terms of priority. Fundamentally, this shift in stressors represents an inevitable consequence of the individual's transition from "input-oriented development" to "output-oriented development"—a pivot from the "accumulation" of knowledge and skills to the "application" of resource transformation, with the nature of stress evolving from "pressure for capability enhancement" to "pressure for value realization."

Other stressors mentioned by the surveyed university students include interpersonal relationships, financial status, and romantic issues, which account for a smaller proportion. This result not only reflects the mainstream characteristics of the stress structure among contemporary university students but also suggests potential group homogeneity within the research sample. Within a collectivist cultural context, university students generally regard academic achievement and career prospects as core indicators of personal value realization, making these related stressors more readily perceived and expressed as priorities. In contrast, stressors such as interpersonal relationships and financial status are often viewed as "personal" or "stage-specific" issues, with relatively limited scope and intensity of impact. Notably, these "secondary stresses" can potentially transform into primary stressors under specific circumstances—for instance, students facing financial difficulties may experience heightened anxiety regarding future planning due to tuition and living expense concerns, while students with weaker social skills may see their academic performance affected by interpersonal barriers. Therefore, caution must be exercised to avoid simply dismissing them as "secondary" and neglecting their potential additive effects.

2.3. Physical and mental quality status

New social environments bring uncertainty and insecurity, inducing emotional volatility that impairs sleep quality. A specific analysis shows a significant bidirectional correlation between sleep quality and emotional states among college students. For example, an October survey of freshmen found 73.08% with good sleep scored 8–10 (high level) in psychological state, and 65.38% reported "calm and stable" emotions. Positive psychology and emotional stability facilitate regular sleep patterns, enhancing efficiency and depth. Conversely, quality sleep restores cognitive function, strengthens emotional regulation, and maintains a steady mood. Anxiety, depression, or emotional swings cause hyperactivity in emotion-related brain regions like the amygdala, suppressing sleep center function, leading to insomnia or fragmented sleep. Interviewed students mainly use "sports, music, and recreational activities" and "seeking support from relatives and friends" as positive emotional regulation strategies. Exercise releases endorphins to alleviate stress; music relaxes by modulating neural rhythms; conversations provide emotional sustenance and problem-solving insights. However, "internalizing emotions alone" and "seeking relief through gaming or mindless phone scrolling" are also common, showing the coexistence of adaptive and maladaptive strategies. Improper "silent internalization" may suppress and accumulate negative emotions, causing long-term psychological issues. Excessive gaming or phone use offers a temporary distraction but represents an escape from real problems; screen blue light and information overload may worsen emotional exhaustion and sleep disturbances.

Grade-level disparities in emotional regulation methods align with core tasks and psychological stages. Freshmen prioritize "verbal communication" to meet social connection and emotional support needs in new environments, using dialogue to foster security. Many seniors choose "internalizing emotions alone" due to job hunting or postgraduate exam pressures, seeing communication as ineffective, or avoiding burdening others. These differences highlight the need for tailored mental health education and support services for distinct student cohorts.

2.4. Psychological support needs

The interpersonal communication patterns of college students exhibit a distinct intermediate characteristic: over half of the respondents described their relationships as "relatively uneventful yet conflict-free." This dynamic reflects contemporary undergraduates' preference for a "comfortable social distance"—sustaining basic interpersonal harmony while evading excessive emotional entanglement. The finding that 30% of students reported "harmonious and enjoyable" relationships underscores the presence of a stable cohort engaged in positive interactions within the campus social ecosystem; these individuals typically forge close-knit networks through extracurricular clubs and dormitory life. Notably, the challenges faced by minority groups reporting "occasional loneliness or integration difficulties" and "existing interpersonal conflicts" may arise from dual factors: first, the digital native generation's unfamiliarity with offline socialization; second, the underdevelopment of empathy stemming from single-child upbringing. If such latent social barriers accumulate over time, they risk impairing mental health and personality formation.

The divergent support activity preferences across academic grades essentially mirror the developmental tasks inherent in college students' lifecycle stages. Over 70% of seniors selected "no need for activities," a choice not indicative of diminished social needs but rather a rational response to practical pressures like thesis completion and job interviews—during this period, individuals tend to seek support through established social networks rather than structured events. In stark contrast, juniors' 90% demand for stress management workshops and 75% willingness to participate in team-building outbound activities reveal this stage's unique developmental anxieties: academic strain from advanced coursework, future uncertainty amid career planning ambiguities, and peer tension arising from postgraduate recommendation and entrance exam competition collectively fuel an urgent need for stress-relief interventions. Sophomores' over 50% interest in outbound activities reflects the persistence of social needs during the transition from adaptation to stability; having acclimated to college life, students begin proactively cultivating high-quality social connections. Freshmen's divergent needs are particularly noteworthy: some strive to overcome unfamiliarity through outbound games, while others opt for solitude due to post-college-entrance-exam psychological decompression or social anxiety. This polarization highlights

variability in freshmen's psychological adjustment during identity transition, necessitating more personalized adaptive support programs from institutions.

3. Analysis and discussion

The moderate levels of stress and psychological distress identified in the questionnaire starkly contrast with students' high self-perceived mental well-being and low utilization of psychological support, representing the study's first pivotal finding. This disparity may stem from students prioritizing academic excellence and future aspirations at the expense of mental health, internalizing stress to the point of normalization, or encountering psychological barriers such as social reticence that inhibit help-seeking behaviors [2]. To address these underlying causes, further in-depth, multidimensional explorations of students' psychological states are imperative to facilitate targeted, timely interventions.

Concerning emotion regulation strategies, the substantial proportion of students reporting "silent emotional suppression" and "excessive smartphone scrolling" underscores the prevalence of passive coping mechanisms, which exhibit a strong correlation with compromised sleep quality [3]. Notably, such passive strategies not only demonstrate limited efficacy but also engender long-term risks to physical and mental well-being. Consequently, university administrators should adopt a proactive stance to guide students toward more adaptive emotion regulation techniques.

The term "ordinary" emerged as the most frequently cited descriptor of interpersonal relationships, reflecting distinct psychological traits among college students in the "post-pandemic era" [4]. Given the increasing societal emphasis on individual growth and self-actualization, a cautious, observant approach—rather than immediate intervention—is advisable for this phenomenon.

For senior-year students, stress arising from future uncertainty constitutes their primary stressor, significantly exacerbating sleep disturbances and emotional distress. This interconnected nexus of challenges transcends isolated psychological issues, encompassing intricate interactions between social determinants and individual developmental trajectories. In response, universities should actively encourage seniors to articulate their needs, mobilize institutional resources, and deliver comprehensive support services—including psychological counseling, career guidance, and further education advisory—to address practical hurdles while mitigating psychological strain [5].

4. Countermeasures

Based on the mental health status of undergraduate biology majors as indicated by psychological well-being assessments, we advocate for the establishment of a three-dimensional, multi-tiered framework for mental health monitoring and intervention among college students. Concurrently, we emphasize the need to enhance career-oriented guidance to address the root causes of student stress, thereby comprehensively safeguarding their psychological well-being. To this end, we propose the following specific measures:

Firstly, elevate the effectiveness of specialized programs that seamlessly integrate mental health awareness with career-focused education. Establish a collaborative "psychology-employment" policy support framework. Educational authorities should incorporate mental health education and career guidance into university evaluation criteria while introducing targeted policies to incentivize institutions to develop integrated "psychology-employment" curricula. For example, implement mutual credit recognition between career planning and mental health courses, mandate universities to organize at least two high-quality developmental activities that incorporate vocational experiences each semester, ensure sustained resource allocation at the policy level, and promote the standardization and professionalization of such initiatives. Collaborate with enterprises—including educational institutions and biotechnology firms—to establish "vocational experience laboratories," providing students with immersive job simulation opportunities. For instance, arrange sophomores to participate in teaching assistant internships for middle school biology lab courses, mitigating anxiety arising

from "inadequate teacher training" through hands-on teaching experiences. Simultaneously, enterprise mentors can deliver "occupational stress management" lectures rooted in industry realities, employing concrete case studies rather than abstract rhetoric to enhance students' psychological resilience.

Secondly, refine career education to ease future planning anxiety. Develop a "full-cycle career education" framework via "Guidelines for College Students' Career Education," structuring trajectories as "freshman enlightenment–sophomore exploration–junior orientation–senior acceleration." Require freshmen to take "Vocational Cognition and Mental Health" as a compulsory course, sophomores to engage in industry internships, juniors to undergo vocational skill certification training, and seniors to receive one-on-one job-seeking psychological counseling, balancing policy and institutional autonomy. Introduce an AI career planning system generating dynamic reports using students' academic performance, interest assessments, and psychological metrics. For example, recommend "postgraduate study + experimental skill enhancement" for research-interested students with employment anxiety, connecting them with mentors; for aspiring teachers anxious about demos, deploy "VR simulated classroom" modules to reduce anxiety through virtual desensitization. Collaborate with universities, local education authorities, and enterprises to build an "employment demand forecasting model," analyzing 3–5 year trends like teaching vacancies and subject competition to tailor education. If regional junior high school biology experimental teaching positions surge, create an "experimental teaching design workshop" to boost competitiveness, turning "blind anxiety" into "targeted preparation." Establish a "home-school collaboration" network via "parent career education workshops," guiding parents beyond "stability" or "salary" mindsets to support individualized development. Organize parents to visit labs and observe simulated teaching, helping them recognize students' capabilities and potential, reducing familial pressure, and fostering "institutional guidance–parental support–student autonomy" interaction.

Disclosure statement

The author declares no conflict of interest.

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