

Research on Cultivation System of Engineering Students' Psychological Resilience Based on Integrated Engineering Practical Psychological Activities

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Abstract: Against the backdrop of high-quality development of engineering education, undergraduate students majoring in vehicle and mechanical engineering are exposed to heavy burdens including intensive theoretical derivation, experimental training, and fierce competition for postgraduate admission and employment. Restricted social interaction channels and restrained emotional expression easily trigger persistent academic anxiety and social isolation. Conventional mental health education relying on theoretical lectures and one-on-one counseling has limited coverage and fails to match the practical-oriented cognitive characteristics of engineering students, leading to obvious deficiencies in preventive psychological cultivation. Taking over one thousand engineering students from the School of Automotive Engineering as research subjects, this study constructs a three-dimensional cultivation framework based on positive psychology theories: improving students' frustration tolerance, popularizing operable psychological adjustment skills, and establishing a multi-level early warning and assistance network. Five immersive intervention activities are designed by integrating engineering collaboration, waste recycling, natural mindfulness, and projective psychological techniques, forming a targeted practical psychological education system for science and engineering universities. One-year longitudinal intervention data indicate that 90% of participants reported improved frustration coping ability; the number of counseling visits for academic anxiety decreased by 40% year-on-year; the scale of peer psychological support teams expanded significantly; and no severe psychological crises such as self-harm or suicide occurred throughout the academic year. The results verify that cross-border integration of engineering professional thinking, expressive psychological intervention and natural healing can effectively activate internal psychological resources of engineering undergraduates, providing replicable and operable practical paradigms for mental health education in science and engineering institutions.

Keywords: engineering undergraduates; psychological resilience; immersive practical intervention; integrated mental health education in engineering universities; peer early warning system .

1. INTRODUCTION

With the continuous deepening reform of higher engineering education, engineering students face overlapping assessment pressures from complex coursework, graduation design, discipline competitions, and postgraduate job hunting, which lower their psychological stress tolerance threshold. Compared with liberal arts students, engineering undergraduates mainly shuttle between classrooms and laboratories with narrow social circles. When suffering negative emotions, they tend to avoid communication and suppress inner feelings, gradually developing self-doubt and passive pessimism, with hidden risks of extreme psychological incidents rising year by year.

Most science and engineering universities still adopt traditional mental health modes dominated by centralized lectures and individual counseling, which contain two prominent defects. First, theoretical lectures focus on knowledge indoctrination and fit the learning habits of liberal arts students, resulting in low participation and superficial educational effects among engineering students. Second, the shortage of professional psychological counselors can only cover a small number of students with obvious psychological abnormalities, leaving a gap in regular preventive mental cultivation for all students.

Engineering education emphasizes project collaboration, failure review, and waste material recycling, which provides

cross-disciplinary integration entry points for innovating mental health education. The School of Automotive Engineering of Zibo Polytechnic University launched the special education project "Practice Empowers Psychological Growth" in 2024 based on the thinking characteristics of engineering students, breaking the barrier between mental health education and engineering training, natural science, and artistic expression. A series of immersive practical activities were carried out to deliver universal psychological nourishment. This paper systematically sorts out the project's implementation logic, hierarchical intervention paths, quantitative educational effects and promotion implications, offering empirical references for student mental health work in science and engineering universities nationwide.

2. PSYCHOLOGICAL RISK CHARACTERISTICS OF ENGINEERING STUDENTS AND DESIGN LOGIC OF PRACTICAL INTERVENTION SYSTEM

2.1 Typical Psychological Dilemmas of Engineering Undergraduates

Comprehensive analysis of annual psychological survey records, regular counselor communication logs, and counseling reception data reveals two typical evolutionary characteristics of psychological distress among engineering students. First, academic assessment pressure induces chronic

anxiety. Engineering disciplines feature low fault tolerance in formula deduction, precision experimental operation, and vehicle design. Negative outcomes such as course failure, competition loss, and postgraduate admission failure easily collapse students' self-efficacy and trigger continuous anxiety. Second, weak social support networks lead to social isolation. Long-term laboratory isolation and fixed same-gender social circles deprive students of stable emotional confidants. Some high-risk groups deliberately avoid collective activities, and long-term suppression of negative emotions breeds extreme thoughts including self-injury and suicide. Traditional mental health approaches cannot meet the demands of engineering students. Classroom theoretical lectures lack attraction and attract low attendance and engagement; scarce one-on-one counseling resources cannot realize regular universal psychological nourishment, leaving obvious loopholes in early crisis intervention.

2.2 Three-Dimensional Goals of Practical Psychological Cultivation

Combining positive psychology and engineering practice education theories, this project establishes progressive educational objectives covering crisis intervention and positive psychological quality shaping.

2.2.1 Improve students' frustration tolerance

Challenging team tasks guide participants to objectively view practical failures and build a virtuous psychological cycle of "stress perception-active adjustment-review and optimization", enhancing psychological recovery capacity.

2.2.2 Popularize standardized psychological adjustment skills

Diversified carriers including group interaction, manual creation and outdoor mindfulness teach self-operable psychological regulation methods such as emotion recognition, rational catharsis, interpersonal communication and short-term mindfulness relaxation.

2.2.3 Build a multi-level collaborative early warning mechanism

Form a three-level assistance chain consisting of dormitory psychological observers, class psychological committee members, counselors and full-time psychological teachers, covering the whole process of early identification, hierarchical intervention and continuous tracking of psychological problems.

2.3 Integrated Framework of Themed Practical Activities

Targeting over one thousand engineering undergraduates in the school, five differentiated immersive intervention activities are developed by integrating five theoretical tools: engineering project collaboration, waste resource recycling, projective psychological evaluation, artistic emotional expression, and environmental mindfulness therapy. The system balances universal collective participation and in-depth individual counseling to achieve full-coverage and stratified psychological nourishment.

3. IMPLEMENTATION PATH OF ENGINEERING-INTEGRATED IMMERSIVE PSYCHOLOGICAL INTERVENTION ACTIVITIES

3.1 Team Collaborative Expansion Training: Enhancing Frustration

Resistance via Project Review Thinking

Team expansion activities replicate the collaborative operation logic of engineering projects, setting competitive flag racing, synchronous support, pipeline ball transmission and other collaborative tasks. Students are required to complete scheme planning, task allocation and obstacle breaking, matching the practical thinking mode of engineering majors. A dedicated practice review module is set to simulate repeated failures in engineering experiments, guiding participants to decompose task errors and adjust collaboration plans, so as to establish the rational cognition that failure is an inevitable optimization link. During activities, introverted students who avoid group interaction are assigned rational-thinking posts including data recording and route planning to gradually build their team value recognition. Many socially reserved students stated in sharing sessions that task division brought them a sense of group belonging and effectively relieved loneliness and internal friction caused by isolation. This activity transfers engineering project review methodology to psychological frustration education, enabling students to view negative emotions from an objective and rational perspective.

3.2 OH Projective Card Group Exploration: In-Depth Self-Regulation Based on Subconscious Tools

OH projective cards are internationally standardized projective psychological tools composed of 88 abstract image cards and matching text cards. Relying on free association mechanisms, the tools bypass individual psychological defense and intuitively display hidden emotional conflicts and cognitive biases, which fit engineering students who are poor at oral expression and accustomed to rational thinking and reduce resistance to didactic counseling.

In group counseling, full-time psychological teachers guide students to interpret card metaphors targeting high-frequency psychological pain points of engineering students such as academic setbacks, postgraduate anxiety and excessive family expectations. Participants learn to distinguish objective reality from subjective catastrophic imagination and break perfectionist cognitive deviations. Most students realize that negative feelings such as anxiety and confusion are not character defects but normal psychological signals in the growth process, eliminating the stereotype that psychological distress equals weakness.

3.3 Waste Material Reconstruction Art Workshop: Emotional Transformation Therapy Based on Resource Recycling Concepts

Combining professional knowledge of waste component recovery and resource recycling in vehicle engineering, the "Waste Rebirth" creative workshop integrates engineering circular manufacturing thinking with expressive art therapy. Students release accumulated negative emotions through

disassembling and reconstructing waste materials to create artistic works.

Many students experiencing relationship breakdown or major academic failures complete psychological reconstruction during creation: disassembling waste materials represents the release of negative emotions, while reconstructed artworks symbolize the rebuilding of self-state. A sense of achievement from hands-on creation quickly repairs damaged self-worth, subtly conveying the positive cognition that predicaments can be transformed and broken states can be reconstructed, realizing two-way integration of psychological counseling and professional knowledge infiltration.

3.4 Emotion Visualization Balloon Creation Activities: Reducing Confiding Threshold via Concrete Emotional Expression

Based on the psychological principle of emotion visualization, balloon-themed intervention activities guide students to write and draw negative perceptions including anxiety, regret and pressure on balloon carriers, and complete concrete emotional catharsis by releasing or popping balloons. Meanwhile, participants record personal expectations and positive self-suggestions to balance positive and negative emotional perceptions.

A one-week emotional tracking assignment is arranged to help students observe regular emotional fluctuations and summarize normalized adjustment methods suitable for individuals. This activity features low operation barriers and relaxed participation forms, making up for engineering students' weakness in verbal emotional expression, establishing regular emotional awareness and mastering simple self-catharsis methods.

3.5 20-Minute Campus Natural Mindfulness Stress Reduction Practice: Relieving Mental Internal Friction Based

Combining attention restoration theory and short-term mindfulness intervention methods, daily 20-minute outdoor natural stress reduction practice is promoted. Students are encouraged to temporarily break away from closed environments such as laboratories and electronic devices, observe natural scenery via five-sense perception, and carry out simple outdoor mindfulness breathing training to relieve mental tension, insomnia and anxiety caused by long-term high-intensity mental labor.

For engineering students with severe mobile phone dependence and persistent worries about postgraduate admission and employment, natural environments effectively divert excessive rumination, help individuals build the ability to "focus on the present", and provide low-cost, sustainable regular psychological relaxation channels.

4. QUANTITATIVE AND QUALITATIVE EFFECT ANALYSIS OF ONE-YEAR INTERVENTION PRACTICE

4.1 Significantly Improved Psychological Recovery Capacity

Anonymous questionnaire statistics show that 90% of participating students reported more stable mental states when facing academic and life setbacks; the annual number of

counseling visits for academic anxiety decreased by 40% year-on-year, reflecting substantial improvement in students' stress adaptation capacity.

4.2 Comprehensive Popularization Of Practical Psychological Adjustment Skills

85% of surveyed students can proficiently apply at least three independent psychological regulation methods including deep breathing adjustment, positive self-talk and outdoor mindfulness relaxation, transforming theoretical mental health knowledge into daily operable practical capabilities.

4.3 Full Expansion Of Multi-Level Psychological Early Warning Teams

The number of class psychological committee members and dormitory psychological observers expanded from an initial 30 to more than 200, realizing full coverage of peer psychological early warning at the dormitory level and smooth operation of the mechanism for early identification and intervention of psychological risks.

4.4 Zero Severe Psychological Crises

All high-risk students identified through annual psychological screening returned to normal study and life rhythms after receiving a combination of immersive practical activities and one-on-one professional assistance, with no extreme malignant incidents such as self-harm or suicide recorded.

From a qualitative perspective, multiple students with severe negative tendencies achieved psychological transformation and voluntarily signed up as volunteers for psychological practical activities, realizing the conversion of assisted groups into supporting forces and forming a sustainable positive cycle of psychological support. Student feedback indicates that immersive practical activities integrating engineering majors, natural science and manual creation are more consistent with the thinking habits of engineering students and deliver significantly higher acceptance and participation compared with traditional psychology courses.

5. OPTIMIZATION PATH AND PROMOTION IMPLICATIONS OF PSYCHOLOGICAL PRACTICE EDUCATION IN SCIENCE AND ENGINEERING UNIVERSITIES

Summarizing one year of practical experience from the School of Automotive Engineering, three universally applicable implementation ideas for mental health education are proposed for universities focusing on science and engineering education.

5.1 Prioritize Immersive Experiential Education to Adapt to Cognitive Logic of Engineering Students

Science and engineering students receive experimental, project-based and practical professional teaching for a long time and show low acceptance of one-way theoretical lectures. Transforming mental health education into operable, participatory and reviewable practical tasks realizes internalization of psychological cognition through personal experience, bringing far better educational effects than classroom preaching. Psychological work in science and engineering universities should continuously reduce pure theoretical indoctrination and focus on developing scenario-

based, operable immersive psychological intervention carriers.

5.2 Fully Tap the Value of Peer Support and Improve the Hierarchical Early Warning and Intervention Chain

The limited staffing of university counselors and full-time psychological teachers cannot cover dynamic psychological monitoring of all students. A multi-level support network built by peer psychological backbones from classes and dormitories realizes early identification of psychological risks relying on empathy advantages brought by identical majors and equivalent pressure backgrounds. Peer backbones are simultaneously absorbed into the organization and planning of psychological practical activities to radiate all students and expand the coverage of mental health education.

5.3 Promote Cross-Border Integration of Mental Health Education with Engineering, Nature and Art Fields

Break the isolated development dilemma of mental health education and deeply connect with the characteristics of science and engineering majors. Design themed activities by integrating engineering thinking such as project collaboration and waste recycling manufacturing, together with environmental psychology, short-term mindfulness and expressive art therapy, realizing two-way coordination between professional ability cultivation and psychological quality shaping. A unique mental health education system with exclusive marks of science and engineering universities is constructed to raise students' willingness of active participation.

6. CONCLUSION

The core goal of engineering education in the new era is not only to cultivate professional practitioners mastering advanced science and technology, but also to shape high-quality engineering talents with stable mental state, frustration resilience and positive perception of life. Traditional mental health education modes fail to match the group characteristics of science and engineering students. The characteristic psychological intervention system integrating engineering practice and immersive experience can comprehensively nourish students' inner state from three dimensions: emotional catharsis, frustration tolerance and social support.

One-year psychological practice project from the School of Automotive Engineering empirically proves that taking practice-oriented psychological cultivation as the core starting

point and breaking the integration path between engineering professional education and mental health education can resolve various psychological risks of engineering students in advance and awaken individual internal growth motivation. Student affairs departments in science and engineering universities should further deepen the integrated education mode of "engineering practice + psychological nourishment", continuously enrich psychological practical carriers including natural mindfulness, creative handcraft and group collaboration, and build a normalized, full-coverage and professional psychological cultivation system. Every engineering student can construct a stable and healthy psychological core alongside professional ability growth, achieving coordinated physical and mental development with balanced all-round progress.

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