

Current Situation and Improvement Path of College Students' Understanding of the Spirit of Scientists

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Abstract: As a core element driving technological progress and cultivating innovative talents, the spirit of scientists holds irreplaceable value in ideological and political education and scientific literacy development for contemporary universities. Through literature analysis and current situation assessment, this study systematically investigates the understanding and dissemination characteristics of the scientific spirit among college students. It identifies existing challenges including monotonous communication formats, insufficient content depth, weak international outreach, and low student engagement. The paper proposes targeted improvement strategies across four dimensions: innovating communication methods, enriching content, enhancing international communication, and boosting student participation. These findings provide valuable references for universities to strengthen the educational function of the scientific spirit and nurture scientific talents capable of undertaking the great mission of national rejuvenation.

Keywords: College students; Scientific spirit; Cognitive status; Communication path; Ideological and political education.

1. Introduction

In this new era of intensifying global technological competition, the spirit of scientists embodies not only the moral character forged through decades of research but also serves as both the driving force for national innovation and the cultural bedrock of national rejuvenation. President Xi Jinping has repeatedly emphasized the need to promote this spirit across society, inspiring scientific professionals to pursue truth and scale new heights. As future architects of technological advancement, college students' depth of understanding and commitment to this ethos directly determine the quality of innovative talent cultivation and the sustainable development of China's scientific endeavors.

Current academic research on integrating the spirit of scientists into higher education has yielded notable achievements. For instance, WANG Changming (2023) highlighted its significant empowering role in ideological and political education for college students [1], while CUI Mingfang et al. (2023) explored its value implications in this context [2]. However, systematic analysis of contemporary college students' understanding of the spirit of scientists remains underdeveloped [3]. Drawing on existing research and practical observations, this paper examines three dimensions—awareness levels, existing challenges, and improvement pathways—to clearly map students' current understanding of the spirit of scientists [4]. The findings aim to provide empirical references and theoretical support for optimizing communication strategies and enhancing educational effectiveness.

2. The Degree of Contemporary College Students' Understanding of the Spirit of Scientists

2.1. Superficial Understanding Is Widespread, But Deep Understanding Needs to Be Improved

From an overall cognitive perspective, contemporary college students exhibit a "widespread awareness but superficial understanding" of the spirit of scientists [5, 6]. On one hand, thanks to the advancement of ideological and political education in universities and social science popularization efforts [7], most students can form a basic understanding of the spirit of scientists, associating it with keywords like "diligence," "daring to explore," and "innovative breakthroughs." On the other hand, students' comprehension of the spirit of scientists remains superficial, lacking a deep grasp of its essential connotations and systematic composition [8]. A questionnaire survey conducted by a university among 2,000 students revealed that only 30% could accurately and comprehensively articulate the six dimensions encompassed by the spirit of scientists: "patriotism, innovation, pragmatism, dedication, collaboration, and education." Most students exhibit cognitive biases of "emphasizing traits over systems" and "prioritizing individuals over groups [9, 10]."

2.2. Classroom Teaching as The Main Guide, Multiple Channels to Supplement

From the perspective of communication channels, the channels for college students to understand the spirit of scientists are characterized by "classroom dominance and multi-dimensional collaboration [11]", which can be divided into three categories:

(1) Classroom Teaching: As the primary channel for disseminating scientific ethos, its limited formats constrain effectiveness. This remains the main avenue for college

students to engage with scientific spirit. Educators integrate it into teaching through specialized courses, thematic lectures in ideological-political education, and case studies in current affairs and policy courses. For example, STEM courses explaining concepts [12] like "quantum mechanics" or "artificial intelligence" often highlight the research journeys and ethical values of scientists such as Einstein and Turing. However, traditional classrooms predominantly rely on "teacher-led lectures plus case presentations," with minimal interactivity, which hampers the dissemination's impact.

(2) Campus Cultural Activities: Limited Coverage as Practical Experiential Platforms [13]. These initiatives serve as valuable supplements to classroom instruction, offering students immersive experiences of scientific ethos through science lectures, tech competitions, and innovation clubs. A prime example is Tsinghua University's [14, 15] "Scientist Spirit Forum," which annually invites academicians from the Chinese Academy of Sciences and Chinese Academy of Engineering to share research insights, attracting thousands of students. However, such events predominantly occur in STEM-focused institutions or elite universities, with venue and scheduling constraints limiting regular participation to merely 30% of students. The current reach and impact of these activities require substantial expansion.

(3) New media platforms: convenient channels for dissemination, but with uneven content quality; with the development of new media technology, platforms such as Weibo, WeChat official accounts, and TikTok have become important avenues for college students to access content related to the spirit of scientists. According to statistics [16], 68% of students reported reading stories about scientists or watching science videos through popular science accounts, which meet students' fragmented learning needs in a "short, flat, and fast" format. However, new media dissemination also faces the issue of uneven content quality. Some accounts, in pursuit of traffic, excessively entertain by interpreting scientists' experiences or simplifying the essence of the spirit of scientists, leading students to form one-sided perceptions, such as attributing "scientists' success to talent rather than perseverance," thereby weakening the educational value of the spirit of scientists.

3. Problems in the Understanding of the Spirit of Scientists by Contemporary College Students

Monotonous Communication Formats: Lack of Interactivity and Engagement. The dissemination of scientific spirit currently relies heavily on "one-way indoctrination" through rigid, uninnovative formats that fail to align with modern college students' cognitive patterns and learning needs. Traditional classroom teaching and lectures predominantly adopt a "teacher lectures, students listen" model, lacking contextualized and experiential designs that prevent deep student participation. While new media platforms offer diverse formats, their innovation remains limited. Most science communication accounts still rely on "text + images" and "short video explanations," lacking immersive and interactive content. Compared to the application of VR and AR technologies in education, the adoption of new technologies in scientific spirit dissemination lags significantly [17]. Only a few universities have attempted to develop "virtual scientist laboratories," but due to high technical costs and limited scalability, these initiatives have

failed to create widespread impact, resulting in communication formats that struggle to engage students actively.

Content Depth Deficiency [18]: Lack of Contemporary Relevance and Systematic Analysis. The superficiality and fragmentation of educational content constitute core barriers to students' comprehensive understanding of the scientific spirit, manifesting in two key aspects. First, content interpretation lacks depth, failing to explore the philosophical essence and modern significance of the scientific spirit, which impedes students' grasp of its profound value. Second, the content framework lacks systematic coherence, with insufficient integration of social hotspots and technological frontiers. [19] Current materials predominantly focus on "individual scientist case studies" rather than establishing a complete framework encompassing "historical legacy, contemporary practice, and future development." Moreover, there is limited incorporation of current technological hotspots (e.g., AI ethics, carbon neutrality technology R&D) and social issues, making it challenging for students to perceive the timeliness and practical relevance of the scientific spirit.

Low Student Engagement: Cognitive Biases and Inadequate Incentives. The cognitive biases among students and the lack of effective incentive mechanisms in schools have resulted in generally low participation in cultivating the spirit of scientists. On one hand, some students hold the cognitive bias that "the spirit of scientists is irrelevant to them." Surveys [20] show that 40% of students believe "the spirit of scientists is an exclusive trait of scientists, difficult for ordinary students to possess," viewing it as "an unattainable moral standard" rather than "a behavioral guideline that can be learned and practiced." On the other hand, [21] schools lack effective incentive mechanisms and evaluation systems. Currently, universities primarily assess students based on academic performance and research competition awards, with no clear incentives for behaviors related to learning and practicing the spirit of scientists (such as participating in science popularization volunteer activities or writing research reports on the spirit of scientists).

4. Ways to Improve the Understanding of the Spirit of Scientists among Contemporary College Students

Innovative communication methods: Relying on new technologies to create immersive experiences; adopting a "student-centered" approach, combining new technologies and new carriers to innovate communication forms and enhance interactivity and appeal. First, promote the integration of "technology + education" to develop immersive communication content. Utilize VR and AR technologies to create "virtual science museums" and "immersive research scenarios," allowing students to experience the research environment and work processes of scientists firsthand. Second, innovate new media communication forms to build interactive content matrices. Launch content such as "interactive Q&A on the spirit of scientists" and "research simulation mini-games" on platforms like WeChat and TikTok, enabling students to experience the spirit of "seeking truth and innovation" in practice;

Enriching Communication Content: Establishing a systematic and contemporary content framework. Centered on "in-depth interpretation + contemporary relevance," we

will diversify content delivery to enhance scientific rigor and relevance. First, deepen content analysis by exploring the profound essence of the scientific spirit. Systematically interpret the scientific spirit through four dimensions: "scientific attitude, scientific methodology, scientific ethics, and social responsibility." Second, align with current hot topics to build a "history-contemporary-future" content system. On one hand, trace the historical evolution of the scientific spirit—from Xu Guangqi's translation of Euclid's *Elements* to modern researchers' innovative practices—highlighting its continuity. On the other hand, integrate the scientific spirit with cutting-edge technologies and social issues, systematically combining case studies, theories, and practical methods to provide students with comprehensive learning resources.

Enhancing Student Engagement: Addressing Cognitive Biases and Refining Incentive Systems. By implementing dual strategies of "cognitive guidance" and "systemic support," we aim to ignite students' enthusiasm for active participation and deepen their resonance with the spirit of scientists. First, we will strengthen cognitive guidance to dispel the misconception that "the spirit of scientists is irrelevant to me." Through interdisciplinary integration and hands-on experiences, students will recognize the universal applicability of this ethos. Second, we will refine incentive mechanisms and evaluation frameworks. The learning and practice of the spirit of scientists will be incorporated into university comprehensive quality assessment systems, with clear evaluation criteria and bonus points for activities such as "volunteering in science outreach," "compiling research reports on the spirit of scientists," and "organizing themed events."

5. Conclusion

The current understanding of the scientific spirit among contemporary college students reflects both the effectiveness of university education and the shortcomings in its dissemination and teaching. In the new era, enhancing students' awareness and recognition of the scientific spirit requires not only innovative communication methods and enriched content, but also the establishment of a collaborative education framework that integrates schools, society, and the international community. This approach will ensure the scientific spirit is truly embedded in students' academic and daily lives.

As the main arena for nurturing talents, universities should fully leverage the synergistic effects of classroom teaching, campus culture, and practical platforms, deeply integrating the spirit of scientists with professional education and ideological and political education. At the societal level, efforts should be made to strengthen the integration of science popularization resources and expand the reach of communication through new media and technologies. On the international level, more communication platforms should be established to enhance the global influence of the spirit of Chinese scientists. Only in this way can the spirit of scientists become a spiritual driving force for the growth and development of college students, laying a solid foundation for cultivating new-era talents with patriotic sentiments, innovative capabilities, and scientific literacy.

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