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Research Report on the Immersive Aviation and Aerospace Red Culture Education Model in Vocational Colleges

Xinyue Xu ^{1,*}, Wei Zhang ² and Siyi Chen ²¹ School of Aviation Engineering, Beijing Polytechnic University, Beijing, China² Beijing Polytechnic University, Beijing, China

* Correspondence: Xinyue Xu, School of Aviation Engineering, Beijing Polytechnic University, Beijing, China

Abstract: This study explores the development of an immersive education model that integrates aviation and aerospace red culture into vocational colleges in China. Aligned with national strategies for talent cultivation and cultural confidence, the paper examines current educational practices and identifies key challenges, including limited resource integration, insufficient curriculum integration, and the absence of effective collaborative mechanisms. To address these issues, the study proposes a comprehensive framework aimed at enhancing students' ideological awareness and professional competence. Drawing on mixed-methods research conducted across 12 aerospace-focused vocational institutions, the findings underscore the transformative potential of scenario-based learning, dual-qualified faculty, and multisectoral collaboration in cultivating technically skilled and value-driven aerospace professionals. The results offer practical guidance for vocational education reform and the effective incorporation of red cultural resources into technical training systems.

Keywords: aerospace red culture; vocational education; immersive learning model

1. Introduction

China's aerospace development has cultivated a rich cultural tradition, marked by resilience, innovation, and collective dedication. Over the decades, countless scientists and workers have overcome immense challenges and achieved significant milestones in areas such as satellite development, manned spaceflight, lunar exploration, and global navigation systems. The values embodied in these efforts — commonly referred to as the "Two Bombs, One Satellite" spirit, the spirit of manned missions, the lunar exploration ethos, and the Beidou spirit — have become important cultural assets that reflect national pride and scientific ambition. These cultural resources hold great potential for value-oriented education, particularly in vocational institutions focused on aerospace and engineering. This study aims to construct an immersive learning ecosystem by integrating aerospace-related cultural elements into vocational training. By aligning educational content with industrial demands, and enhancing training through scenario-based learning, value-driven instruction, integrated quality development, and multi-stakeholder collaboration, the goal is to establish a distinctive vocational education model that combines technical skill development with cultural literacy.

1.1. Research Background

From a national strategic perspective, fostering morality and talent is the fundamental mission of building a strong nation. Education, technology, and talent as foundational strategic pillars. Vocational colleges bear the critical responsibility of nurturing high-quality technical professionals — "great national craftsmen" — to advance the core competencies of the aerospace sector. The deep integration of aerospace red culture, characterized

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by loyalty, innovation, perseverance, and selflessness, into talent development is essential for sustainable national progress [1].

On the global stage, cultural soft power competition is intensifying. Aerospace culture, embodying scientific spirit, courage, and patriotism, transcends borders and resonates with universal values. China's aerospace history, shaped by a tradition of self-reliance under the strategic guidance of national leadership, has forged a valuable spiritual legacy that aligns with broader human ideals [2]. Leveraging aerospace red culture to communicate China's technological self-reliance can enhance international cultural influence and help cultivate a favorable external environment.

Educational reform requires deeper content and higher quality. Despite its significance, red culture education faces several challenges:

- 1) Generational gaps hinder resonance with digitally native learners.
- 2) Traditional delivery methods lack immersive appeal.
- 3) Emotional identification remains shallow, limiting internalization.
- 4) Evaluation systems for educational outcomes are underdeveloped.

An immersive education model is thus necessary to transform red culture learning from superficial exposure to deep cognitive and emotional engagement.

Building such a model requires a collaborative ecosystem integrating diverse stakeholders and resources. However, several obstacles persist, including fragmented resource distribution, weak cross-sector cooperation, limited funding and professional capacity, and a lack of opportunities for authentic immersive experiences. Overcoming these challenges is essential to institutionalize and scale immersive red culture education.

1.2. Research Process

This study employed a mixed-methods approach, incorporating field research, extensive surveys, in-depth interviews, and policy analysis. The research sample included 2,140 participants from 12 aerospace vocational colleges, comprising 1,820 students and 320 educators. The data focused on levels of awareness regarding red culture integration, participation in related initiatives, resource utilization, and perceived institutional challenges. In-depth interviews revealed common obstacles, such as the lack of mechanisms for converting confidential materials into accessible educational content. Additionally, a comparative analysis of national vocational education policies and international immersive training models informed the design of the proposed educational framework.

2. Current Situation

Student engagement with aerospace red culture remains inconsistent. Approximately 68.2% of students have encountered related content through ideological courses, public lectures, or media, but only 34.7% have experienced it through specialized courses or internships, while 12.3% reported being largely unaware. Activities such as model aircraft practice and thematic lectures help enhance cultural awareness and learning motivation [3]. However, participation is often hindered by scheduling conflicts or the limited appeal of outdated formats.

Course integration remains limited. Only 45.6% of students notice red culture elements in their professional courses, and fewer than 20% find such content engaging. While ideological courses dominate cultural education, professional curricula lack systematic integration of red culture. Existing practical training platforms tend to emphasize passive observation over interactive, immersive learning experiences. As a result, student engagement with on-campus red culture facilities is limited compared to their higher engagement in enterprise internships and museum visits [4,5].

Efforts to cultivate the spirit of craftsmanship show promise. Over 70% of students report experiencing such values during skills training, with the strongest influences stemming from aerospace heroes and enterprise mentors. Programs that feature role models

in classroom settings effectively translate abstract values into tangible motivation and professional pride [6]. However, collaborative mechanisms among schools, enterprises, and communities remain underdeveloped. Fragmented resources and weak institutional engagement continue to hinder the sustained impact of red culture education.

3. Problem Analysis

Cultural outreach suffers from uneven coverage. Only 18.1% of students participate through professional courses and 10.9% through internships, while 17.9% have never joined any red culture-related activities, often due to time conflicts, unengaging formats, or poor information dissemination. Initial exposure to red culture is often superficial and fragmented, resulting in divided engagement [7].

Curricular ideological integration remains fragmented, with nearly half of the students perceiving red culture content as rigid or unnoticeable, mostly confined to mandatory ideological courses rather than embedded within core professional subjects. Educators report insufficient red culture literacy and a lack of instructional resources, often relying on individual initiative in the absence of systemic institutional support.

Practical platforms are underutilized. Nearly half of the students have never accessed on-campus red culture facilities, showing greater preference for authentic off-campus experiences, such as enterprise internships or museum visits [8]. Digital content limitations and low enterprise engagement further weaken the continuity and vitality of immersive platforms.

Role model mechanisms are underdeveloped. Although most students report some perception of the craftsmanship spirit, only about one-third are deeply inspired by aerospace heroes. Traditional promotional methods lack immersive continuity, failing to bridge the gap between inspiration and practice. A significant minority of students show no noticeable change in attitudes [9].

Collaborative systems remain underdeveloped. More than two-thirds of educators cite issues such as dispersed resource distribution and limited enterprise engagement. Stable cooperation frameworks are scarce, with disconnected information and resource flows hampering the formation of an integrated educational ecosystem. Gaps in teacher competence, passive student participation, and the absence of comprehensive evaluation frameworks continue to constrain systemic progress [10].

4. Recommendations

To establish a distinctive aerospace red culture education system in vocational colleges, the following strategies are proposed:

1) Curate High-Quality Aerospace Red Culture Resources

Systematically catalog diverse heritage sites, artifacts, events, and exemplary figures centered around "objects, events, people, and spirit". Develop resource-sharing platforms and mobile exhibitions through inter-school collaborations and forums to facilitate knowledge exchange and expand access.

2) Integrate Educational and Industrial Chains

Embed aerospace spirit metrics into talent development plans, construct ideological-professional course maps, and translate historical and technical cases into teaching materials [11]. Develop modular resource packages reflecting cognitive, skill, and cultural levels. These packages should be supported by joint school-enterprise collaborations and a dynamic sharing platform. Foster diversified role model systems through interactive storytelling, which enhances students' identification with and engagement in cultural values.

3) Empower Dual-Qualified Teaching Teams

Implement a phased teacher training scheme encompassing red culture literacy, pedagogical transformation, and industry immersion. Form joint instructional teams combining school faculty and enterprise craftsmen, with coordinated lesson preparation, delivery, and evaluation. Integrate the outcomes of cultural education into faculty performance

evaluations and career advancement criteria, ensuring measurable impacts on teaching effectiveness.

4) Adopt Progressive Three-Tiered Teaching Implementation

Design a pedagogical path that progresses from value guidance and skill shaping to habitual behavior. Use historical cases for emotional resonance in theory courses; apply real workplace projects to embed craftsmanship standards in core subjects; and integrate cultural literacy into practical assessments within authentic production environments, ensuring continuous cultivation throughout training cycles.

5) Focus on Skill Excellence and Spirit Cultivation

Develop professional cultural identity through visual systems and themed activities to strengthen belonging. Establish a comprehensive role model mechanism identifying and promoting exemplary students across growth stages. Create authentic, scenario-based skill training aligned with aerospace standards, emphasizing quality management and meticulous work ethic.

6) Create Multidimensional Cultural Immersion Scenarios and Collaborative Platforms

Design classroom strategies integrating ethics and quality culture; enhance campus environments with aerospace cultural symbols and interactive exhibits; standardize skill training with rigorous evaluation and behavioral norms; and institutionalize craftsmanship through regulations and student self-governance. Promote the holistic development of students, encompassing ideological, technical, physical, aesthetic, and labor education dimensions [12,13]. Establish coordinated governance among government, schools, enterprises, museums, communities, and science parks or innovation hubs to ensure resource sharing, joint projects, and sustainable evaluation mechanisms.

5. Conclusion

This study explores the integration of aerospace red culture into vocational education, emphasizing the critical role it plays in shaping skilled professionals who are not only technically proficient but also ideologically grounded. By examining current practices, challenges, and opportunities, we have identified several key areas where improvements can be made to better integrate red culture into both curricula and extracurricular activities.

The findings highlight the importance of developing high-quality red culture resources and fostering a collaborative ecosystem that connects schools, enterprises, and other cultural institutions. Through the strategic curation of cultural content and the creation of immersive learning environments, vocational colleges can ensure that students are not only exposed to aerospace history but are also deeply engaged with its values. Moreover, empowering dual-qualified teaching teams and enhancing practical training platforms will facilitate a more holistic and immersive educational experience.

Moving forward, a progressive, three-tiered teaching approach that combines theoretical knowledge, practical skills, and value-oriented behavior is essential to ensure that students internalize the aerospace spirit. By focusing on both skill excellence and the cultivation of craftsmanship, vocational education institutions can foster a strong cultural identity, enabling students to contribute to the long-term development of China's aerospace sector.

In conclusion, the deep integration of aerospace red culture into vocational education represents an invaluable opportunity to cultivate both technical and moral excellence in the next generation of professionals. To achieve this vision, it is imperative that educational reforms continue to prioritize the integration of red culture, with an emphasis on practical, immersive learning experiences, and sustained collaboration across sectors. By doing so, vocational colleges can play a pivotal role in advancing China's aerospace development while nurturing the future leaders of the industry.

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