

Evaluation of the Effect of Integrating the Craftsman Spirit into Mechanical Professional Courses: A Follow-Up Study for One Academic Year

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Abstract: With the accelerating process of transformation and upgrading of China's manufacturing industry, employers' requirements for the professional qualities and skills of technical workers are increasing day by day. As the core value to promote high-quality development, the craftsman spirit has become an important part of vocational education. Taking the Mechanical Foundation course of the mechanical major in a technician college as an example, this study tracked and analyzed the teaching effect of integrating the craftsman spirit into the course for one academic year. By comparing the performance of students before and after integrating the craftsman spirit into daily teaching, it explored its influence on students' professional skills, innovation ability, and professional qualities. The study collected data through questionnaires, classroom observations, etc., providing a practical basis for the promotion of the craftsman spirit in vocational education and curriculum reform in the future.

Keywords: Craftsman spirit; Mechanical professional teaching; Vocational education

Online publication: May 28, 2025

1. Introduction

In recent years, the craftsman spirit has received more and more extensive attention. It emphasizes the ultimate pursuit of craftsmanship and strict requirements for quality, as well as personal responsibility, concentration, innovation, and the unrelenting pursuit of excellence. Scholars at home and abroad have conducted extensive research on the craftsman spirit. Xue put forward two core connotations of "valuing skills" and "upholding morality" ^[1]. Deng *et al.* further refined the contemporary connotation of the craftsman spirit into "craftsman's heart," "craftsman's action," and "craftsman's quality" ^[2]. Although the importance of integrating the craftsman spirit into daily teaching has been widely recognized, there are still many problems in the actual teaching process. A sampling survey of vocational schools in the Yangtze River Delta region by Gao and Deng found

that the recognition of the craftsman spirit among teachers and students has increased, but there is still a lack of a systematic plan for cultivating the craftsman spirit ^[3]. Through a questionnaire survey, Du pointed out that the cultivation of the craftsman spirit in teaching is separated from students' learning of knowledge and skills, and there is also a lack of in-depth guidance on the craftsman spirit during the internship and training stage ^[4].

Based on the above theoretical discussion of the craftsmanship spirit and existing research results, this paper will conduct an in-depth study on the integration effect of the "craftsmanship spirit" in mechanical professional courses. Through a one-year follow-up survey and data analysis of two classes, it will evaluate the specific impact of the integration of the craftsmanship spirit on students' professional skills, professional qualities, and comprehensive qualities.

2. Theoretical basis: Developmental research evaluation theory

This study will adopt the developmental evaluation theory as the main theoretical support to evaluate the integration effect of the craftsmanship spirit in mechanical professional courses. The developmental evaluation theory emphasizes the dynamic changes in the educational process, especially focusing on the long-term growth and improvement of learners' comprehensive abilities. Within this framework, evaluation not only focuses on students' current knowledge mastery but also emphasizes their continuous progress, behavioral changes, and skill development ^[5].

A longitudinal design tracked students across two semesters, evaluating three dimensions:

- (1) Cognition: Evolving understanding from technical skills to professional ethics.
- (2) Emotion: Value identification with excellence and innovation.
- (3) Behavior: Practical application in tasks and quality standards.

The study employed a longitudinal design where baseline measurements (questionnaires and academic performance) were collected during Semester 1's traditional instruction, followed by systematic craftsman spirit integration in Semester 2 with repeated assessments, enabling analysis of both the temporal development of professional competencies and the relationship between spiritual cultivation and technical skill acquisition.

3. Research materials: Questionnaire survey and grade analysis

The study tracked two classes (2023 Industrial Robot and Electronic Technology Application majors) for one year to assess craftsman spirit integration in mechanical courses. Data collection included: (1) a self-developed questionnaire measuring cognition, emotion, and behavior, administered at each semester's start and end; (2) analysis of "Fundamentals of Machinery" final exam scores; and (3) implementation of craftsman spirit-integrated teaching with practical activities in Semester 2.

3.1. Strategies for integrating the craftsmanship spirit

The study implemented a comparative approach across two semesters in the "Fundamentals of Machinery" course. During the first semester, conventional teaching methods were employed without explicit integration of craftsman spirit elements. In the second semester, instructors systematically incorporated craftsman spirit concepts using Tang's curriculum design framework ^[6], developing chapter-specific teaching plans that blended technical content with relevant case studies and practical activities. For instance, in the "Gear Transmission" unit, students engaged with precision engineering applications while developing professional values through hands-on design tasks and case analyses, effectively merging technical skill development with craftsman

spirit cultivation. **Table 1** shows the teaching case design for integrating the craftsmanship spirit into the gear transmission chapter.

Table 1. Curriculum content design under the concept of craftsmanship spirit

Course content	Cultivation points of craftsmanship spirit	Practical activities
Overview of gear transmission	Dedication and love for work: Understand the application and importance of gear transmission and cultivate a love for the mechanical major	Consult information and make a PPT presentation on gear transmission application cases
Geometric parameters and calculation of gears	Striving for excellence: Accurately calculate gear parameters to ensure design accuracy	Manually calculate parameters such as the module and number of teeth of gears and compare them with the standard answers
Design of gear transmission system	Innovative thinking: Design a gear transmission system to optimize transmission efficiency	Design a small-scale gear transmission system and conduct simulation analysis
Optimization of gear transmission system	Continuous improvement: Optimize the design	Optimize the designed gear transmission system

3.2. Research results: Evaluation of the cultivation effect of craftsman spirit

The study assessed students' performance across four key dimensions of craftsman spirit development: cognitive understanding, emotional engagement, behavioral application, and overall composite scores. These measurements were obtained through pre- and post-intervention questionnaires, with statistical analysis comparing mean values, standard deviations, and significance levels between the two testing periods. The results demonstrated measurable changes in all dimensions following the educational intervention.

As can be seen from **Table 2**, the comparative analysis revealed consistent improvements across all measured dimensions. Cognitive scores showed the most significant increase (16.72 to 19.74), demonstrating the intervention's effectiveness in enhancing understanding of craftsmanship principles. Emotional engagement scores rose moderately (18.88 to 19.97), while behavioral application showed modest gains (18.96 to 19.94). The composite score increased from 56.74 to 60.50 ($P < 0.05$), confirming the overall positive impact of the pedagogical approach on craftsmanship spirit cultivation.

Table 2. Data table comparing the mean values of each dimension in two surveys on the cognition of the craftsman spirit

	First-time average	First-time standard deviation	Second-time average	Second-time standard deviation	<i>t</i> statistic (<i>t</i> -stat)	<i>P</i> value (<i>P</i> -val)
Cognition	16.72	4.06	19.74	5.38	-4.478	1.27×10^{-5}
Emotion	18.88	4.61	19.97	4.11	-1.77	5.10×10^{-5}
Behavior	18.96	5.01	19.94	4.06	-1.52	2.43×10^{-5}
Total score	56.74	8.60	60.50	7.59	-3.28	2.82×10^{-5}

The analysis of final exam results revealed significant academic improvements following the teaching intervention (**Table 3**). The average score increased substantially from 57.44 to 66.66 ($P < 0.001$), while the median rose from 59.55 to 66.65, demonstrating widespread gains across the student cohort. Although maximum scores showed more modest improvement (78.77 to 88.8) and the standard deviation remained stable (10.13 to 10.30), these patterns collectively confirm the intervention's effectiveness while suggesting potential

variations in impact across different achievement levels that merit further investigation.

Table 3. Data analysis table of the two final exam results

	Average	Median	Maximum	Standard deviation	<i>t</i> statistic (<i>t</i> -stat)	<i>P</i> value (<i>P</i> -val)
Final exam of the first semester	57.44	59.55	78.77	10.13	-	-
Final exam of the second semester	66.66	66.65	88.8	10.30	-6.75	1.04×10^{-9}

To better understand these differential effects, the study employed Pearson correlation analysis to examine the relative contributions of cognitive, emotional, and behavioral dimensions to craftsmanship development, as shown in **Table 4** ^[7]. This methodological approach provided empirical evidence for optimizing teaching strategies by identifying which aspects of craftsmanship spirit cultivation most strongly influenced academic outcomes.

Table 4. Pearson coefficient table of the correlation between final exam results and the three dimensions of craftsmanship spirit

	Cognition	Emotion	Behavior
Score of the first final exam	0.314	0.529	0.468
Score of the second final exam	0.229	0.595	0.448

Pearson correlation analysis revealed distinct patterns in how cognitive, emotional, and behavioral dimensions influenced exam performance. The emotional dimension showed the strongest association with academic achievement, with coefficients increasing from 0.529 to 0.595 after the intervention, suggesting enhanced motivational effects. Cognitive correlations decreased slightly (0.314 to 0.229), possibly reflecting a shift toward more comprehensive skill application. Behavioral impacts remained stable (0.468 to 0.448), indicating consistent but gradual skill internalization. These findings demonstrate that while emotional engagement became the primary academic driver post-intervention, all three dimensions contributed uniquely to craftsmanship development, with cognitive understanding providing foundational knowledge and behavioral practice enabling long-term skill mastery.

4. Conclusion and outlook

This study demonstrated that integrating craftsmanship spirit into mechanical courses significantly enhanced students' cognitive understanding and emotional engagement. The emotional dimension showed the strongest correlation with academic performance ($r = 0.595$), highlighting the importance of motivation and participation. While cognitive improvements primarily strengthened knowledge foundations, behavioral changes exhibited gradual but sustained development. These findings validate craftsmanship education's dual role in enhancing both professional competencies and vocational qualities. Future research should examine the model's applicability across disciplines and its long-term effects, as these results position craftsmanship spirit as a vital component in cultivating high-quality technical professionals.

Funding

This paper is the research result of the project “Research on the Integration and Implementation Strategy of the ‘Craftsman Spirit of a Great Nation’ in the Mechanical Professional Courses of Vocational Colleges: Taking a Technician College as an Example” of the Social Science Federation of Pingxiang City, Jiangxi Province (2024PXSK81).

Disclosure statement

The authors declare no conflict of interest.

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