

To cite this article: Hao Li, Jiaoyu Zhang, Yancheng Zheng, Fuchang Shu (2026). PRELIMINARY EXPLORATION ON THE CONSTRUCTION EFFECT OF IDEOLOGICAL AND POLITICAL EDUCATION IN ADVANCED INDUSTRIAL CATALYSIS COURSE, International Journal of Education and Social Science Research (IJESSR) 9 (2): 43-53 Article No. 1205, Sub Id 1861

PRELIMINARY EXPLORATION ON THE CONSTRUCTION EFFECT OF IDEOLOGICAL AND POLITICAL EDUCATION IN ADVANCED INDUSTRIAL CATALYSIS COURSE

Hao Li*, Jiaoyu Zhang, Yancheng Zheng, Fuchang Shu

College of Chemistry and Environmental Engineering, Yangtze University,
No.1 Xueyuan Road, Jingzhou 434023, P. R. China
haoli@yangtzeu.edu.cn

DOI: <https://doi.org/10.37500/IJESSR.2026.9204>

ABSTRACT

Course-based ideological and political education serves as the core pathway for higher education to fulfill the fundamental mission of fostering virtue and cultivating talent in the new era. It is also a crucial lever for synergistically advancing graduate professional education and value guidance. Drawing upon the author's year-long experience in developing and teaching course-based ideological and political education in the field of advanced industrial catalysis, this study systematically investigates the effectiveness of its implementation through a questionnaire survey. The results indicate that the implementation of ideological and political education within the course has achieved remarkable outcomes. Students demonstrate a high level of awareness regarding the concept of course-based ideological and political education and a strong recognition of its significance. The integration of ideological and political education into the course is highly effective, teaching methods are well-implemented, and educational outcomes are outstanding. This approach has achieved a deep integration of professional education with ideological and political education, fulfilling the collaborative educational goal of 'knowledge transmission + competency development + value guidance'.

KEYWORDS: Advanced industrial catalysis, Course-based ideological and political education, Questionnaire survey, Effectiveness evaluation

1. INTRODUCTION

As China's higher education continues to advance through quality-driven development, 'fostering virtue and cultivating talent' has become the fundamental mission of graduate education [1]. As the core cohort for cultivating high-level innovative talents, graduate students require not only solid professional theoretical foundations and strong scientific research capabilities, but also unwavering ideals and convictions, profound patriotic sentiments, and a strong sense of social responsibility [2]. Advanced industrial catalysis serves as a core professional course for graduate students majoring in

chemical engineering, industrial catalysis, and materials chemistry at our university. This course integrates theoretical depth, practical application, and innovative thinking. The course content encompasses catalytic principles, industrial catalytic technologies, and related cutting-edge advancements, closely aligning with national strategic demands in energy, environmental protection, and new materials. It embodies rich ideological and political value and spiritual significance: from the journey of independent innovation in catalytic technology to scientists' dedication to serving the nation through research, and from the industrial value of catalytic processes to the era's mission of green development, all of which provide a natural carrier for exploring and integrating ideological and political elements into the course [3].

To overcome the disconnect between 'professional instruction' and 'value-based guidance', and to fully leverage the educational potential of ideological and political education within the course, we undertook a year-long practice of building and reforming ideological and political education within the course. In routine classroom instruction, we centered on the tripartite teaching objectives of 'knowledge transmission, competency development, and value guidance' [4], deeply integrating ideological and political elements identified within the curriculum with specialized knowledge while optimizing teaching content and methodologies. To scientifically evaluate the effectiveness of ideological and political education within the course, accurately gauge student needs, and further refine the teaching model, we designed a survey questionnaire after the course concluded and conducted research through 'Wenjuanxing'. Based on student feedback regarding their understanding of the course-based ideological and political education concept, evaluation of its integration level, teaching method preferences, implementation effectiveness, and influencing factors, we comprehensively analyzed the achievements and areas for improvement in its implementation. This lays a solid foundation for promoting the organic integration of professional knowledge transmission and ideological and political education within the course, thereby achieving the educational objectives of 'catalyzing' the mind, shaping character, and empowering professional development.

2. Overview of the course-based ideological and political education practice

The ideological and political education in the curriculum of advanced industrial catalysis is based on the characteristics of graduate students, who have a solid foundation in their major, a clear orientation towards scientific research, and strong autonomous learning abilities. Adhering to the principles of 'professional expertise as the foundation, ideological and political education as the core, practical relevance, and subtle influence', reforms were implemented across three dimensions: teaching content, teaching methods, and teaching activities. This approach builds a comprehensive, multi-tiered system for cultivating students through course-based ideological and political education. In terms of teaching content, based on nearly 9 years of experience in teaching graduate course on advanced industrial catalysis, as well as relevant reports from literature [5-8], we have thoroughly explored and refined the ideological and political cases hidden in the 8 chapters of the course. These cases were then appropriately presented, discussed, and integrated into the classroom teaching process. In the brief history of industrial catalysis development covered in Chapter 1, ideological and political cases such

as ‘Wu Yunchu and the Buddha's Hand Brand MSG’, and ‘Hou Debang and the Hou's Soda Process’ were integrated. These cases helped graduate students establish correct values, enhance cultural confidence, cultivate an exploratory spirit, innovative mindset, and patriotic sentiment, inspiring them to contribute their efforts toward building a technologically strong nation [5]. In Chapter 2, by combining the advantages of solid acid catalysts such as low corrosivity and ease of separation, the concept of green development was integrated to cultivate the awareness of harmonious coexistence between humans and nature. In Chapter 3, the research and academic contributions of Academician Min Enze, known as the ‘Father of Catalysts in China’, in the field of molecular sieve catalysts were introduced to inspire the patriotic sentiments and sense of national mission of graduate students. In Chapter 4, by combining the arduous journey of scientists developing molten iron catalysts for ammonia synthesis, the perseverance and tireless scientific spirit was learned. In Chapter 5, the frontier hotspot of synthesizing starch using ZnO-ZrO₂ as a catalyst and CO₂ as a raw material, developed by Chinese scholars, was introduced to cultivate academic passion and scholarly interests. In Chapter 6, the key performance metrics and comparative advantages/limitations of catalytic cracking catalysts were introduced to cultivate green development principles and safety/environmental awareness. In Chapter 7, by combining the ‘low water consumption’ synthesis gas-to-olefins catalyst designed by Academician Bao Xinhe's team, patriotism and national mission were inspired. In Chapter 8, by combining the application of iron-based catalysts in the 4 million tons/year indirect coal liquefaction of Shenhua Ningxia Coal Industry Group, the recognition and resonance with the coal chemical industry were cultivated.

In teaching methodology, we moved beyond the single-dimensional ‘lecture-based’ approach by adopting diverse instructional methods such as case studies, classroom discussions, video presentations, and quotations from notable figures. This facilitated the seamless integration of ideological and political elements with specialized knowledge, avoiding rigid didacticism. In instructional activities, we established blended online-offline teaching platforms supplemented with supplementary resources like industry updates and research case studies. This approach guided students toward independent inquiry while encouraging them to explore the connection between catalytic technology and societal development through research practice, thereby reinforcing the unity of knowledge and action.

To comprehensively evaluate the effectiveness of this course's ideological and political education implementation, an online survey was conducted via the ‘Wenjuanxing’ survey platform targeting 34 graduate students enrolled in the course. A total of 34 questionnaires were distributed, with 34 valid responses collected. The survey achieved 100% participation among respondents, yielding authentic and reliable data that fully reflects the outcomes of the course's ideological and political education implementation.

3. Research analysis on the effectiveness of ideological and political education in the course

This survey focused on seven core dimensions: basic information of research subjects, awareness and acceptance of course-based ideological and political education, integration level of course-based ideological and political education, evaluation of teaching methods, implementation effectiveness, influencing factors, and improvement suggestions. Through data statistics and visual chart analysis, the effectiveness of course-based ideological and political education development was comprehensively evaluated.

3.1 Analysis of basic information of survey participants

The gender and professional distribution of survey participants directly impact the representativeness and relevance of research data. Survey results indicated 18 male graduate students (52.9%) and 16 female graduate students (47.1%), with a gender gap of less than 6%. This balanced distribution minimized the influence of single-gender perspectives on findings. Among the survey participants, there were 21 graduate students majoring in chemical engineering, accounting for 61.8%, and 13 graduate students majoring in materials engineering, accounting for 38.2%. This distribution revealed a dominant presence of chemical engineering majors supplemented by materials and chemical engineering majors. This pattern aligned closely with the primary majors of students enrolled in the advanced industrial catalysis course, ensuring the survey accurately reflects the target group's perceptions and evaluations of course-based ideological and political education.

3.2 Analysis of awareness and acceptance of course-based ideological and political education

Figure 1 presents the results regarding graduate students' understanding of the course-based ideological and political education concept. As shown in the figure, 61.8% of graduate students report being 'very familiar' with the concept, while 32.4% indicate being 'quite familiar'. Together, these two groups account for 94.1% of respondents. Only 5.9% state they are 'generally familiar', and no one selects the options 'not very familiar' or 'completely unfamiliar'. These findings indicate that after one year of course-based ideological and political education development, graduate students have fully grasped its core concepts and implications.

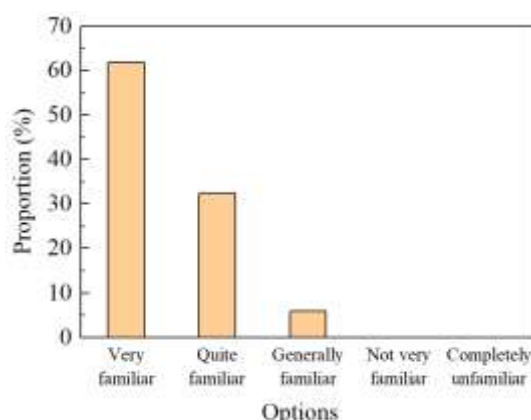


Figure 1: Graduate students' understanding of the concept of ideological and political

education in the course.

Figure 2 shows the evaluation results of graduate students regarding the importance of course-based ideological and political education. As shown in the figure, 82.4% of graduate students consider course-based ideological and political education ‘very important’, while 14.7% believe it ‘relatively important’, with both categories accounting for 97.1% of the total. Only 2.9% of graduate students view it as ‘somewhat important’, and no one selects ‘generally important’ or ‘completely unimportant’. These findings indicate that graduate students have developed a profound understanding of the significance of ideological and political education within the course for both their professional studies and personal growth, and they hold a positive and supportive attitude toward its implementation.

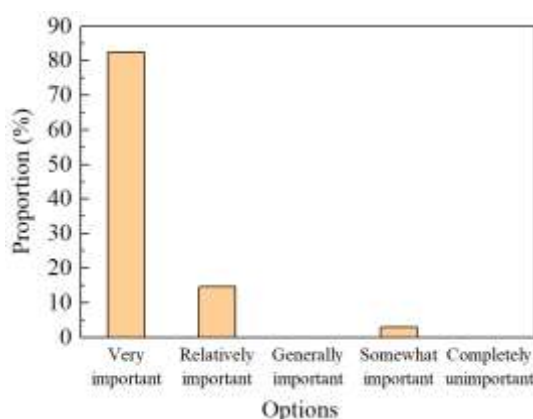


Figure 2: Evaluation results of graduate students on the importance of ideological and political education in the course.

Students' understanding of the concept of ideological and political education in the course and their recognition of its importance form the foundation for the effectiveness of its implementation. The results in Figures 1 and 2 indicate that graduate students demonstrate high awareness and strong identification of this concept, laying a solid groundwork for its further advancement.

3.3 Evaluation of course-based ideological and political education integration and teaching methods

Figure 3 presents the evaluation results of graduate students on the integration degree of ideological and political education into the course. As depicted, 88.2% of graduate students believe that ideological and political education is ‘fully integrated, with elements clearly interwoven throughout all course components alongside professional knowledge’. 11.8% perceive it as ‘partially integrated, evident in certain chapters or knowledge points but not comprehensively applied’. No respondents select the options ‘not integrated’, ‘not clear’, or ‘other’. These findings indicate that the construction of ideological and political education into the curriculum over the past year has achieved a deep integration of ideological and political elements with the professional knowledge of advanced industrial catalysis, and the integration method is natural, without any stiff preaching.

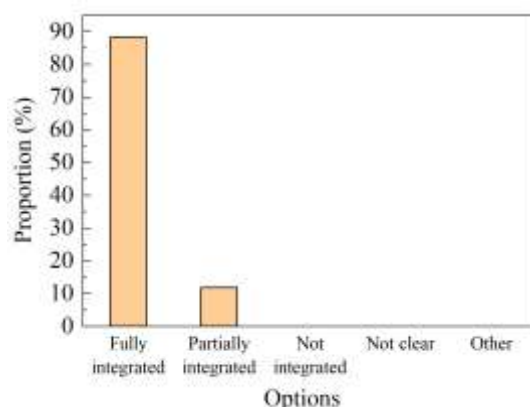


Figure 3: Evaluation results of graduate students on the integration degree of ideological and political education into the course.

Using a multiple-choice format, the graduate students' preferences for integrating ideological and political education into the course were examined, with results shown in Table 1. As can be seen from the table, 85.3% of graduate students prefer the integration method of 'The historical, cultural, and social context integrated with professional knowledge'. Additionally, 79.4% favor the approach of 'Guide attention to current affairs hot spots (such as catalytic technology and national strategy)', while 61.8% are receptive to the integration method of 'Integrating ideological and political elements through case analysis'. Moreover, a minority of students (35.3%) favor the approach of 'Invite industry experts to give lectures to interpret industry development and ideological and political connotation', while none select the 'Other methods' option. These results show that graduate students have a clear tendency to choose the way of integration, and prefer the way of integration that is closely integrated with their major and flexible in form.

Table 1: Graduate students' preferences for methods of integrating ideological and political education into the course (multiple choice)

<i>Integration method</i>	<i>Number of participants (Persons)</i>	<i>Proportion (%)</i>
The historical, cultural, and social context integrated with professional	29	85.3
Guide attention to current affairs hot spots (such as catalytic	27	79.4
Integrating ideological and political elements through case analysis	21	61.8
Invite industry experts to give lectures to interpret industry	12	35.3
Other methods	0	0

During the course, four primary teaching methods were employed: illustrating key concepts with examples, facilitating classroom discussions, showing relevant videos, and citing case studies or notable quotations. The questionnaire investigated the evaluation of the teaching effect of these four

teaching methods by graduate students, and the results are shown in Table 2. As shown in the table, over 85.3% of graduate students think that the teaching effects of the four teaching methods are 'excellent', indicating that the four teaching methods have been highly recognized by graduate students and there is no negative evaluation.

Table 2: Graduate students' evaluation of the teaching effectiveness of specific teaching methods.

<i>Teaching methods</i>	<i>Excellent (%)</i>	<i>Better (%)</i>	<i>Average (%)</i>	<i>Poor (%)</i>
Illustrate ideological and political elements through	91.2	8.8	0	0
Organize classroom discussions to guide ideological	85.3	14.7	0	0
Integrate ideological and political elements by	85.3	14.7	0	0
Illustrate ideological and political viewpoints by	94.1	5.9	0	0

The integration level of ideological and political education within courses and the rationality of teaching methods directly impact the effectiveness of such implementation. Results from Figure 3, Table 1, and Table 2 indicate that the current integration level of ideological and political education is high, and the diverse teaching methods have gained broad recognition among graduate students, aligning well with their learning needs.

3.4 Analysis of the implementation effect of course-based ideological and political education

Figure 4 illustrates the impact of course-based ideological and political education on graduate students' professional course learning. As can be seen from the figure, 76.5% of graduate students report it was 'very helpful', while 23.5% find it 'somewhat helpful', with both responses totaling 100%. None report it as 'not helpful', 'negative impact', or 'Minimal impact'. These findings indicate that integrating ideological and political education into the course not only fails to hinder professional studies but effectively enhances graduate students' comprehension and mastery of specialized knowledge, achieving the goal of 'empowering professional studies through ideological and political education'.

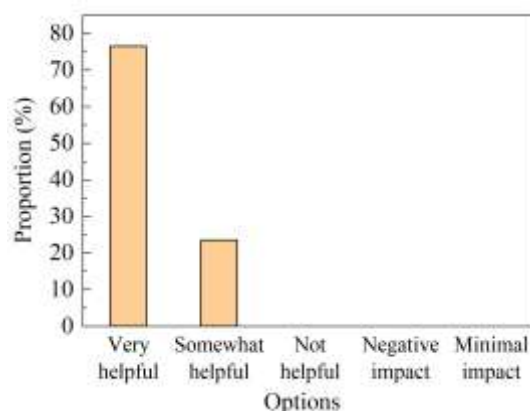


Figure 4: The impact of course-based ideological and political education on graduate students' professional course learning.

Table 3 presents the impact of course-based ideological and political education on the ideological perspectives of graduate students. As shown in the table, 94.1% of graduate students believe that course-based ideological and political education 'Enhanced national consciousness and ethnic pride', 94.1% feel it 'Strengthened sense of social responsibility and mission', 79.4% report that it 'Cultivated correct worldview, outlook on life, and values', 70.6% of graduate students feel it 'Deepened understanding of professional knowledge', and none report 'no significant impact'. These findings demonstrate that course-based ideological and political education exerts multifaceted positive guidance on the ideological perspectives of graduate students, effectively achieving the core objective of 'value-driven leadership'.

Table 3: Impact of ideological and political education in the course on the ideological perspectives of graduate students (Multiple choice).

<i>Impact on ideological concepts</i>	<i>Number of participants (Persons)</i>	<i>Proportion (%)</i>
Enhanced national consciousness and ethnic	32	94.1
Strengthened sense of social responsibility and	32	94.1
Cultivated correct worldview, outlook on life,	27	79.4
Deepened understanding of professional	24	70.6
No significant impact	0	0

Professional identity is an important driving force for graduate students to devote themselves to professional learning and scientific research. Therefore, the impact of course-based ideological and political education on graduate students' professional identity was investigated, with results presented in Table 4. As can be seen from the table, 82.4% of graduate students indicate that course-based ideological and political education deepens their sense of professional identity and pride, further

solidifying their resolve to pursue careers within their field. Additionally, 17.6% of graduate students report that it has had some positive impact, though it is not the primary factor. Furthermore, no one indicate 'No noticeable impact' or 'Causes aversion and diminishes professional passion'. These findings demonstrate that by integrating professional values and societal significance, course-based ideological and political education effectively stimulates graduate students' love for their major and enhances their professional identity.

Table 4: Impact of ideological and political education in the course on graduate students' professional identity.

<i>Impact on professional identity</i>	<i>Number of participants (Persons)</i>	<i>Proportion (%)</i>
Significantly promotes professional development and	28	82.4
Provides some promotion but is not a primary factor	6	17.6
No noticeable impact	0	0
Causes aversion and diminishes professional passion	0	0

The core objective of course-based ideological and political education is to achieve the synergistic advancement of 'value guidance' and 'professional empowerment'. The results presented in Figure 4, Table 3, and Table 4 demonstrate that this initiative has yielded significant outcomes in guiding ideological perspectives, enhancing professional learning, and strengthening professional identity, thereby fulfilling its anticipated educational goals.

3.5 Factors affecting the implementation effect of ideological and political education in the course

Table 5 presents the key factors influencing the effectiveness of ideological and political education in the course. As shown in the table, graduate students rank the importance of these factors in descending order as follows: teaching attitude and methods of instructors (85.3%), selection of course content (76.5%), student engagement (73.5%), and campus cultural atmosphere (47.1%). Additionally, no one select 'Other factors'. These findings indicate that teacher factors are central to the effectiveness of course-based ideological and political education, followed by course content and student engagement. This result provides a basis for the continuous optimization of course-based ideological and political education development.

Table 5: Factors influencing the implementation effect of ideological and political education in the course (Multiple Choice).

<i>Influencing Factors</i>	<i>Number of participants (Persons)</i>	<i>Proportion (%)</i>
Teachers' teaching attitudes and methods (positive guidance,	29	85.3
Course content selection (integration of ideological and political	26	76.5
Students' own engagement (proactive thinking, active	25	73.5
Campus cultural atmosphere (environment for ideological and	16	47.1
Other factors	0	0

3.4 Analysis of improvement suggestions

In the questionnaire survey, graduate students were invited to provide suggestions for improving course-based ideological and political education through fill in the blank questions. The feedback received was carefully analyzed and organized. The improvement suggestions primarily focused on the teaching content: increasing the application cases of industrial catalysis in actual industrial fields (such as energy catalysis, environmental protection catalysis, and material synthesis), combining typical projects, technological breakthroughs, or industry development history to demonstrate the practical value and social significance of course knowledge in the industry. Moving forward, we will incorporate these valuable suggestions to dynamically refine the content and methods of ideological and political education within the curriculum, continuously enhancing its educational effectiveness.

4. CONCLUSIONS

Based on a year of course-based ideological and political education construction and reform practices in the graduate course of advanced industrial catalysis, the effectiveness of its implementation was systematically evaluated through a questionnaire survey method. The results indicated that: (1) High awareness and recognition of course-based ideological and political education: 94.1% of graduate students understood the concept, with 97.1% acknowledging its importance, demonstrating widespread support for the construction of course-based ideological and political education. (2) Deep integration and recognized teaching methods: 88.2% of graduate students perceived full integration of course-based ideological and political education with professional knowledge. Teaching methods such as case studies, classroom discussions, and video presentations gained widespread recognition. (3) Significant implementation outcomes. In ideological guidance, it effectively strengthened postgraduates' national consciousness, ethnic pride, and social responsibility, and cultivated the correct three views. Regarding professional empowerment, 100% of postgraduates believed course-based ideological and political education aided their academic studies, broadened their knowledge horizons, enhanced learning interest, and significantly increased their professional identity. (4) Teacher factors are the core influence. 85.3% of graduate students identified instructors' teaching attitudes and methodologies as the primary factor affecting the effect of course-based ideological and political

education, followed by course content selection and student engagement. This provided a clear direction for optimizing future course-based ideological and political education construction. In summary, the ideological and political education integration in the course had effectively achieved the tripartite teaching objectives of 'value guidance, knowledge transmission, and competency development'. It had overcome the disconnect between professional instruction and value guidance, providing replicable and scalable practical experience for advancing ideological and political education integration in science and engineering graduate courses at our university.

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