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Integrated Practice of Cultivating Innovative Ability and Ideological Education for Graduate Students of Materials Science Major

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Abstract: Aiming at the problem of weak integration of innovation ability and ideological education of postgraduates in materials major, this paper explores postgraduates' cultivation work under the support of Liaocheng University. It is found that the cultivation of the innovation ability of postgraduates in materials can be the realization path and sublimation carrier of ideological education, ideological education can provide spiritual support and methodological guidance for the former, and the organic integration of the two is feasible. Constructing the fit relationship between innovation ability and ideological education, institutionalizing tutor guidance, establishing tutor + counselor + professional teacher communication mechanism, and taking disciplinary competitions as a handhold can achieve the integration of innovation ability cultivation and ideological education of graduate students in materials major.

Keywords: Postgraduate education; Innovation ability; Ideological education; Materials major

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1. Introduction

Postgraduate training is an important component of higher education and bears the mission of cultivating top talents for the country. High-level graduate students should be both physically and mentally healthy, as well as morally and academically qualified [1]; only in this way can graduate students lead the direction of China's scientific and technological cultural development in the future. Postgraduate training and ideological and scientific research education are two sides of the same coin, ideological education and innovation ability training are equally important, cannot be ignored, and should be closely linked. However, in postgraduate education, professional teachers or tutors mainly teach innovative methods and are rarely involved in innovation motivation, while ideological teachers or counselors are difficult to combine with professional practice to cultivate students' innovative consciousness [2-4]; when graduate students engage in research, there is often a lack of ideological education, and it tends to be marginalized in the process of cultivating students' innovative abilities [5-8], this situation is especially obvious in the field of materials, and it is of great significance to integrate the cultivation of innovation ability and ideological education of postgraduates in materials.

2. Status quo and problems

At present, the work of postgraduate innovation ability [9-11] and ideological education is usually carried out separately. There are two main strategies for the cultivation of innovation ability: (1) Constructing a system for the cultivation of graduate students' innovation ability. For example, we can set up a scientific teaching system, carry out inquiry teaching and inspirational education, strengthen the construction of practical links, improve the scientific research level of tutors through further training and academic exchanges, strengthen the construction of the tutor team, establish a tutor team model and tutor group joint cultivation system, and strengthen the system of academic seminars, and improve the assessment mechanism. (2) Creating an innovative learning environment and strengthening the role of scientific research platforms and process management. The university and colleges actively build some innovative practice platforms, set up postgraduate innovation fund projects, make full use of the scientific research platform for postgraduates to implement the diversified cultivation of laboratory rotation; pay attention to postgraduates' dissertation topics, strictly control the accuracy of the experimental data, and control the quality of the dissertation. In terms of ideological education, the main measures are as follows. Firstly, attaching importance to the education of ideals and beliefs, strengthening the education of moral quality and mental health through thematic activities, refining the work of postgraduates' party building, adjusting the content of postgraduates' party building scientifically and reasonably according to the actual situation, and promoting the effective integration of party building and ideological and political education. Secondly, the dual tutor system is implemented, with on-campus tutors being responsible for the education of postgraduates in academic norms and ethics, and off-campus tutors strengthening the cultivation of their professional ethics and frustration ability; the tutors have a comprehensive understanding of postgraduates' ideology and study and life, and endeavor to cultivate their sense of responsibility and commitment. Thirdly, we need to improve the management organization of ideological and political education of postgraduates and strengthen the construction of the management team; improve the system of postgraduate associations, build an elite team of postgraduates, and promote the self-education of postgraduates. Fourthly, we can make use of the advantages of the Internet in breaking through space and rapid dissemination, spreading ideological and political information, expanding the scope of ideological education, creating a learning atmosphere, and improving the effectiveness of ideological education.

The above initiatives can improve the quality of postgraduate training, but they have not achieved the expected results due to insufficient attention to the integration of postgraduate innovation ability and ideological education. There are problems to be solved: (1) Insufficient efforts to carry out ideological education in practice; (2) Lack of synergy among supervisors, professional teachers, and counselors (moral education supervisors) in the cultivation of postgraduates; (3) Lack of institutionalization of supervisors' guidance, exemplary effect, and evaluation of the effect. These problems have become constraints affecting the further improvement of the quality of postgraduate students, and they are related to whether the cultivation of students' innovative ability and ideological education can be truly integrated.

3. Feasibility of the integration of postgraduate innovation ability training and ideological education

3.1. Convenient integration into materials major

In the field of materials major, postgraduates' scientific research activities are essentially the process of adopting scientific methods to investigate the nature of the reaction of material composition and the changing law of material shaping and organizational structure/properties in accordance with the environment, from which they can cultivate their ability of data collection, information processing, experimental manipulation, interaction, thesis writing, and innovation ability. Among these scientific research abilities, innovation ability

is the materialization and externalization of ideological elements such as innovation consciousness, innovation thinking, innovation spirit, and innovation motivation stimulation; and it is the high-level comprehensive ability of postgraduates to discover and solve problems in experimental and theoretical research, including students' ability to generalize the current situation of the materials discipline, their ability to conceptualize experimental design, and their ability to perceive and grasp the research frontiers. The cultivation of scientific research and innovation ability requires the instructor's superior art of education and the students' faith in truth, which involves many points of view in the concept of material history and materialism, such as "consciousness and matter, phenomenon and essence, the concept of truth, the theory of contradiction, the universality of linkage, the relationship between accidental and inevitable, the dialectical relationship between theory and practice, and development and innovation" and so on. The process of cultivation of scientific research and innovation ability of postgraduate students of materials contains a large number of philosophical elements that can be used for ideological education, and these philosophical elements and ideas are the methodological basis for the development of students' innovation ability. Usually, the scientific research work of materials majors is a long-term and continuous trial and error process, engaging in scientific research is also a test of graduate students' emotional intelligence, and non-intellectual factors (perseverance, resistance to frustration, personal sentiment) play an important role in the cultivation of graduate students' innovation ability, and they need to be fed by ideological education. It can be seen that the cultivation of innovative ability of postgraduates in materials can become the realization path and sublimation carrier of ideological education, and ideological education can provide spiritual support and methodological guide for the former, and the organic integration of the two is necessary and feasible.

3.2. Easy integration of teaching subjects

In the training of postgraduates, the main body of education includes tutors, professional theory teachers, and counselors, of which the tutors are the primary responsible persons. Tutors are responsible for both the cultivation of postgraduate innovation ability and the ideological education of students, which is convenient for the integration of the cultivation of innovation ability and ideological education of postgraduate students of materials majors. In addition, the implementation of an "all-member, all-process, all-round" education policy in colleges and universities means that tutors, counselors, and professional teachers can work together to improve students' innovation ability and ideological level and implement innovation ability and ideological education simultaneously.

4. Teaching practice

4.1. Sorting out and integrating the topics to build the relationship between innovation ability and ideological education

Based on the fact that the cultivation process of the innovation ability of postgraduates in materials majors not only contains philosophical thoughts, but also needs spiritual nourishment and methodological guidance, we extract philosophical elements and materials applicable to postgraduates' ideological education from the links of "professional theoretical study, literature reading, experimental design, experiment execution, result verification, data analysis, dissertation writing, and modification," and collate and summarize philosophical elements and materials that can enhance students' patriotism in the frontier research of materials disciplines. We extract the philosophical elements and materials applicable to the ideological education of postgraduates from the "literature reading, experimental design, experimental verification, data analysis, thesis writing, and revision," collate and summarize the materials of cutting-edge research in material disciplines that can enhance the patriotism of students, and sort out the ideological education topics required for the cultivation of innovation ability based on

the integrity of scientific research, methodology and resistance to frustration. Taking advantage of the dialectical relationship between innovation ability and ideological education of postgraduates, combined with the ideological dynamics and characteristics of postgraduates in the era of self-media, the nutrients of ideological education are melted into the four modules of "innovation motivation, innovation awareness, innovation ideas, and innovation methods," so as to put philosophical colors on the lines of cultivating innovation ability.

Ideology belongs to the field of consciousness, subtle influence is the effective education to achieve the effectiveness of ideological education, which requires that ideological education for graduate students be implemented in a timely, appropriate, and moderate manner during the process of cultivating their innovative abilities. In the process of teaching and educating postgraduates for many years, the author builds the relationship between the cultivation of the innovation ability of postgraduates in materials and ideological education (**Figure 1**), and scientifically formulates the evaluation index system of the innovation ability of postgraduates in materials (**Figure 2**) by playing the core role of supervisors in postgraduates' cultivation and communicating between supervisors, counselors, and teachers. Based on the comprehensive analysis of factors such as the number of conference participations by graduate students, the quality and quantity of published papers, the level and number of patent applications, the number of awards received, and evaluations from teachers and peers, an objective and quantitative approach is used to establish the scoring and weighting of indicators for innovation capability and intellectual level in the evaluation system. This approach assesses the contribution rate of both explicit and implicit indicators in evaluating the impact of graduate student ideological education on the enhancement of their innovation capabilities. The practical results show that the evaluation indexes are related to whether the incentive mechanism is reasonable, and has a significant impact on the stimulation of graduate students' innovation motivation, which is the engine of innovation and the source of power to support graduate students to overcome the difficulties in scientific research; reasonable evaluation and rewards are prerequisites to stimulate the innovation motivation of graduate students, and they can effectively promote the improvement of the level of students' ideology, and realize the fusion of the cultivation of graduate students' innovation ability and ideological education.

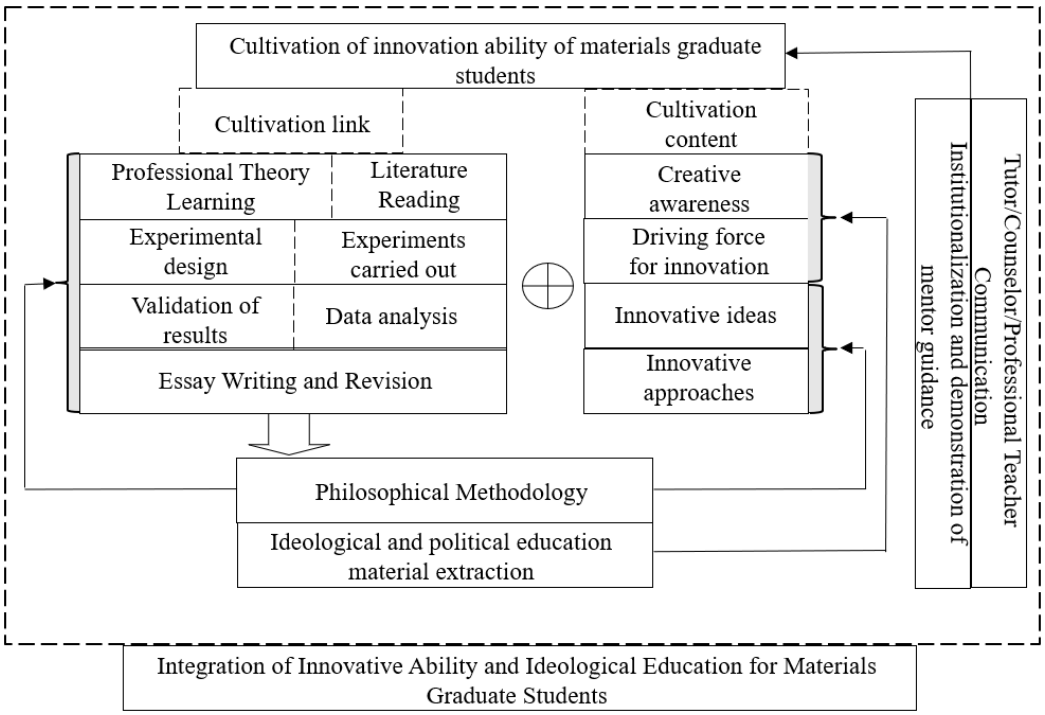

Figure 1. Relationship between innovation ability and ideological education fit of postgraduate students of materials

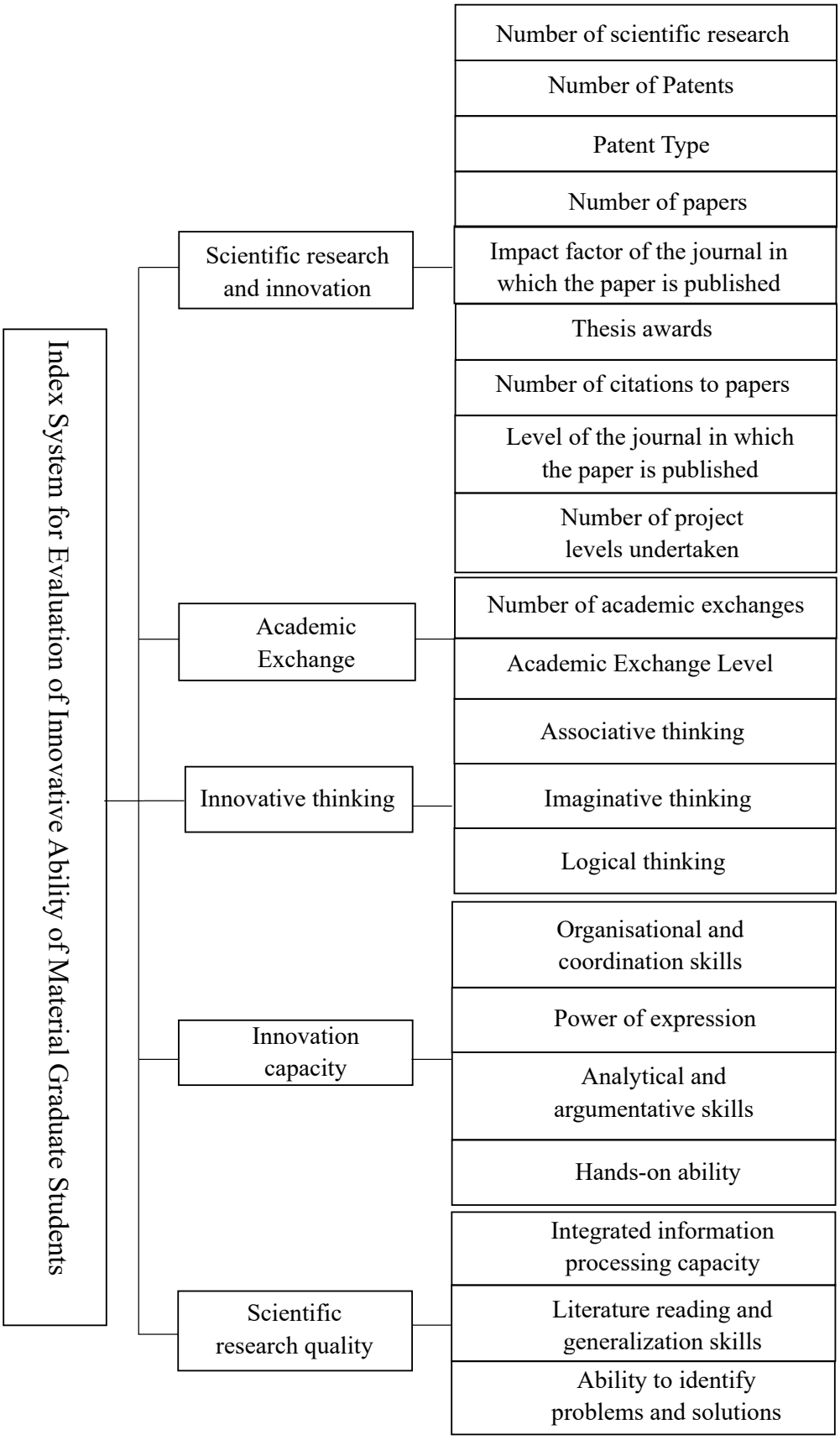

Figure 2. Evaluation index system of innovation ability of postgraduate students of materials majors

4.2. Institutionalization of tutor guidance and establishment of a communication mechanism for tutors + counselors + professional teachers

A tutor is the first person responsible for quality cultivation. Taking the tutor's enhancement of the responsibility and enterprise of cultivating talents as the focus point, we regularly organize and hold regular experimental meetings, lectures, academic presentations, academic seminars, ideological exchanges, and other activities to guide and stimulate graduate students' scientific spirit and motivation of primitive innovation, and to realize the institutionalization of the tutor's academic guidance and ideological guidance, and the tutor's words and example guide the graduate students to set up a correct outlook on the world, life, and values, and abide by the Academic ethics. By participating in political theory learning and postgraduate guidance business training, tutors' sense of responsibility and personal sentiments are improved; by requiring tutors to regularly organize and hold regular experimental meetings, academic presentations, ideological exchanges, and other activities, tutors' academic guidance and ideological guidance are institutionalized.

Based on the concept of all-member, all-process, and all-round education, tutors, counselors, and teachers have regular talks to discuss common problems among postgraduates and make collective efforts to solve individual problems. With the help of WeChat, QQ, and other means of information exchange, we have established channels of communication among tutors, counselors, and professional teachers, so that we can exchange information in a timely manner and comprehensively grasp the problems existing in the postgraduates' scientific research, life, and ideology. Through heart-to-heart talks, psychological interventions, and other forms, we integrate ideological education into the cultivation of students' scientific research and innovation capabilities. This will achieve the integration and permeation of ideological education in the development of innovation abilities, creating a situation where the responsibility for fostering graduate students' innovative capabilities is shared by their mentors, with ideological education being a collaborative effort. Practice has shown that graduate students, as the main agents of innovation, experience dynamic changes in their innovative consciousness and face various obstacles in research. To address this, it is necessary for advisors, counselors, and professional teachers to collaboratively conduct ideological education interventions. Establishing a communication mechanism among the teaching group can maximize the integration of cultivating graduate students' innovative abilities and ideological education.

4.3. Relying on materials experimental platform and discipline competition and expanding the integration space of ability cultivation and ideological education

Laboratory is the main workplace of postgraduates in materials, and the experimental platform is an important support for the cultivation of their innovation ability, and the discipline competition is a carrier for cultivating postgraduates' innovation consciousness and spirit, and also provides an opportunity for postgraduates' ideological education. Therefore, relying on the experimental platform of materials discipline, we encourage postgraduates to participate in Shandong Province Postgraduate Frontier Materials Innovation and Practice Competition, National University Metallurgy Science and Technology Competition, China University Students' Mechanical Engineering Innovation and Creativity Competition: Materials Heat Treatment Innovation and Entrepreneurship Competition, and other competitions, which on the one hand, extends the space for cultivating the innovation ability, provides students with more opportunities to innovate and put their learning into practice, and enhances the students' interest and motivation in innovation; on the other hand, it enhances students' resistance to frustration, improves students' ability to analyze and solve complex engineering problems with philosophical viewpoints, strengthens the sense of innovation, prolongs the time for the fusion of professionalism and students' ideological and political teaching, and strengthens the effect of the fusion of the two.

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Disclosure statement

The authors declare no conflict of interest.

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