

Strategies for Improving the Effectiveness of Professional Practice for Full-Time Professional Master Degree Postgraduate in Mineral Processing Engineering

Jiushuai Deng^{1,2}, Juan Hu^{1*}, Zhiqiang Xu^{1*}, Weidong Wang¹, Zhongyi Bai^{1,2}, Tingting Hu^{1,2}

¹Graduate School and School of Chemical & Environmental Engineering, China University of Mining & Technology (Beijing), Beijing 100083, China

²Inner Mongolia Research Institute, China University of Mining and Technology (Beijing), Ordos 017001, China

**Corresponding authors:* Juan Hu, hujian16897168@sina.com; Zhiqiang Xu, xzq@cumtb.edu.cn

Copyright: © 2023 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: In order to gain practical experience and hands-on skills, full-time professional master degree postgraduate in mineral processing engineering should engage in professional practices. Nonetheless, a series of problems, including insufficient time for practice, low management level, inadequate implementation of the double-supervisor system, and poor results of professional practice, has reduced the effectiveness of professional practice. In view of the aforementioned problems and the characteristics of the discipline, this paper proposes several strategies for improving the effectiveness of professional practice for postgraduates in mineral processing engineering.

Keywords: Mineral processing engineering; Full-time; Application-oriented; Master's degree; Professional practice

Online publication: January 5, 2023

1. Introduction

In the context of rapid social and economic development, the demand for talents with strong practical skills has intensified in all professional fields. On March 11, 2009, China's Ministry of Education issued several guidelines for the training of full-time professional master degree postgraduate, providing instructions for the training of these students and specifying that full-time professional master degree postgraduate programs should include at least six months' practical training, which may be implemented through the combination of intensive and distributed practice. By 2025, professional master degree postgraduates are expected to account for two-thirds of all postgraduates enrolled in China. Mineral processing engineering is an applied technical discipline that deals with mineral separation and directed at separating useful minerals from the gangue. The training of professionals in mineral processing engineering plays a crucial role in promoting clean and efficient utilization of mineral resources as well as in facilitating the high-quality development of the mining industry.

Researchers have studied the professional practice of full-time professional master degree postgraduate extensively, analyzed the problems in various aspects, and proposed feasible solutions that include improving the training plan, optimizing the curriculum, upgrading the management system, and constructing bases for professional practice. At present, significant results have been achieved in the

training of full-time professional master degree postgraduate, with a wealth of experience accumulated in professional practice. Nonetheless, professional practice has yet to demonstrate desirable effects. Previous studies have rarely explored pathways for improving the effectiveness of professional practice for full-time professional master degree postgraduate in mineral processing engineering. Therefore, it is a necessity to carry out further research on this field of interest.

2. Importance of professional practice for full-time professional master degree postgraduate

A full-time professional master degree postgraduate program is a type of degree program in China that aims at cultivating high-caliber application-oriented professionals who have a solid understanding of basic theories and a vast amount of professional knowledge in a specific discipline (or occupation) and are capable of solving practical problems and performing technical or management duties. The professional practice module enables full-time professional master degree postgraduate to gain practical experience, amass topics and materials for their dissertations, as well as develop hands-on and innovative skills ^[1-3]. This module connects theory with practice and offers rehearsals for their future career. Therefore, a high-quality and sufficient professional practice plays a significant role in ensuring the quality of application-oriented education.

3. Main forms of professional practice for full-time professional master degree postgraduate in mineral processing engineering and the existing problems affecting the effectiveness of professional practice

3.1. Main forms of professional practice

As a traditional engineering major in the field of mining, mineral processing engineering is an applied technical discipline that has been established in response to the talent demand brought about by the national economic construction. The major has trained a large number of professionals to work in coal, metal, and non-metal mining industries. In the field of mineral processing engineering, the professional practice for full-time professional master degree postgraduate appears in two forms: campus practice and off-campus practice ^[4,5]. With regard to campus practice, universities are often equipped with a beneficiation pilot plant or processing plants with different capacities for postgraduates to participate in professional practice activities according to the training plan. For example, China University of Mining and Technology (Beijing) has a pilot plant for coal beneficiation, while Kunming University of Science and Technology has one for metal beneficiation. Besides these universities, many have their own technological park, with enterprises offering opportunities for practice. This major requires students to be familiar with the properties of minerals, configuration of beneficiation machinery, and the analysis of beneficiation products. Students are also required to be engaged in the debugging and operations of machinery, ensuring expected beneficiation targets are achieved and improving their own hand-on skills and ability to apply classroom knowledge in practice. On the other hand, off-campus practice is held at practice bases that have been established through university-industry cooperation. In general, off-campus practice employs the “double-supervisor system,” with postgraduates’ professional practice guided by an internal supervisor and an external one. Off-campus practice bases provide opportunities for postgraduates to be fully involved in the industrial production of the beneficiation plant and to assist field engineers in solving various problems that arise during production. A period of field practice allows postgraduates to consolidate and expand their knowledge and skills, facilitates the completion of their master’s dissertations and relevant research projects, and helps postgraduates transition into their professional roles smoothly after graduation ^[6].

3.2. Problems affecting the effectiveness of professional practice

- (1) The lack of professional practice bases has narrowed the scope of professional practice. Currently, postgraduates are often placed at a single practice base—for example, an iron mine. In that case, they have no opportunities for exposure to practical activities at coal mines, copper mines, or gold mines. This restricts the scope of their professional practice. This problem may be caused by an insufficient number of practice bases or unreasonably scheduled professional practice.
- (2) There is also a need to strengthen the management of postgraduates' professional practice and increase their professional practice duration. Some postgraduates do not engage in professional practice strictly according to the training plan and detailed training requirements; likewise, some supervisors do not manage professional practice well, thus rendering professional practice ineffective. Meanwhile, increasing the duration of professional practice at engineering sites should be considered based on specific conditions, since certain factors such as COVID-19 have shortened the professional practice of postgraduates at engineering sites ^[7,8].
- (3) The double-supervisor system should play a greater role in promoting the quality of postgraduate training. The functioning of the double-supervisor system largely determines whether the professional practice of full-time professional master degree postgraduate is able to run smoothly and produce practical results. In addition, some of the external supervisors are not academically capable or possess a weak sense of responsibility. Meanwhile, some internal supervisors lack practical experience in engineering ^[9]. Such supervisors pass on rather limited knowledge to their students. Another problem is the lack of interaction between internal supervisors and external supervisors. In particular, the guidance provided by both supervisors often lacks comprehensiveness and consistency.
- (4) The specific content of professional practice needs to be optimized. The professional practice of full-time professional master degree postgraduate aims not only at equipping students with deeper professional knowledge and broadening their horizons, but also at enhancing their ability to solve real-world problems, especially those that arise at engineering sites. Therefore, the content of existing professional practice should be arranged in a more reasonable manner. For example, some postgraduates merely work in laboratories at the beneficiation plant, rather than being personally involved in frontline production, thus rendering them incapable of identifying and solving practical problems, and going against the purpose of professional practice.
- (5) The evaluation and supervision of professional practice should be strengthened. Currently, the credit system, which covers a series of criteria including the practice plan, the professional practice process, case analysis, practice journal, and the final report, is used to evaluate the professional practice of full-time professional master degree postgraduate. However, it can be seen that the supervision of student performance is neglected in the evaluation process. In particular, the absence of evaluation for postgraduates' on-site problem-solving skills tempers the effectiveness of professional practice. Moreover, some postgraduates simply muddle through, which runs counter to the goals of professional practice.

4. Strategies for improving the effectiveness of professional practice for full-time professional master degree postgraduate in mineral processing engineering

4.1. Make appropriate adjustments to existing application-oriented training programs in mineral processing engineering

The professional practice of postgraduates in mineral processing engineering differs from that of other majors in many ways. For example, their practice bases are usually located in remote areas. Moreover, mineral processing engineering activities involve many disciplines, including geology, mining, beneficiation, solid waste disposal and treatment, environmental protection, machinery, *etc.* Therefore, the

training program for these postgraduates should underline prior interdisciplinary knowledge and its field application. Besides, the professional practice module should not only develop postgraduates' understanding of beneficiation techniques in mines, but also guide them to compare the beneficiation levels of similar ores in the industry, be it in China or other countries, implying that they should be familiarized with the cutting-edge techniques in the industry. In addition to the processes, equipment, and reagents of beneficiation, the module should include and strengthen the students' learning of the management system and models of beneficiation plants. Furthermore, it is necessary to emphasize the training of innovative thinking in the process of professional practice and encourage students to spot on-site problems and devise feasible solutions for them. Through the adjustments and improvements of the training program, the professional practice module will be more rational and advanced, thus being more effective in promoting the comprehensive abilities of postgraduates.

4.2. Increase the number of professional practice bases

Universities should seek partnerships with more mining enterprises to build practice bases at mines, covering diverse types of deposits or ores. In addition, the forms of practice should be optimized. For example, each postgraduate should be given opportunities to work at multiple practice bases to gain practical experiences with ferrous metal mines, nonferrous metal mines, coal mines, *etc.*

4.3. Optimize the evaluation criteria and provide incentives

Higher standards should be applied to the double-supervisor system ^[10,11]. Supervisors should be trained before and during professional practice, and both internal supervisors and external supervisors should interact and collaborate at deeper levels. The traditional evaluation only focuses on practice journal and the final report. Therefore, it is necessary to adopt more open-ended and comprehensive criteria. For example, innovative outcomes and successes from solving practical problems should be included in the evaluation. Meanwhile, rewards may be presented to the supervisors and postgraduates who perform remarkably well in their professional practice.

4.4. Combine professional practice with innovation and entrepreneurship education

Innovation education is a type of education that cultivates the consciousness, ability, mindset, and thinking pattern of an individual for innovation, thus training innovative talents accordingly. It aims to prepare students for future industrial and business activities by expanding their skillset and developing their creativity, thus transforming their role from being jobseekers to value creators who hold professional posts ^[12]. Therefore, professional practice should chime with innovation and entrepreneurship education. The double-supervisor system should underscore the training of innovative and entrepreneurial thinking during professional practice and encourage students to take innovative and entrepreneurial actions, which would immensely improve their hands-on skills and comprehensive abilities.

5. Conclusions

Professional practice for full-time professional master degree postgraduate plays a crucial role in training high-caliber application-oriented professionals. From the perspective of mineral processing engineering, this paper describes the main forms of professional practice for application-oriented postgraduate and several problems that affect its effectiveness. In view of these problems and the characteristics of the discipline, several measures are proposed to improve the effectiveness of professional practice for postgraduates in mineral processing engineering, including improving the existing training program, increasing the number of practice bases, optimizing the evaluation criteria, and combining professional practice with innovation and entrepreneurship education. This paper provides a reference for improving the

effectiveness of professional practice for full-time professional master degree postgraduate in mineral processing engineering.

Funding

This work was supported by The Graduate Education and Teaching Reform Project of CUMTB (YJG202200301), The Yueqi Outstanding Scholar Award of CUMTB and Science and Technology Major Project of Ordos City-Iconic Innovation Team (202204).

Disclosure statement

The authors declare no conflict of interest.

Author contributions

J.D. and J.H. conceived the idea of the study, P.P. performed the experiments, X.O. analyzed the data and wrote the paper; J.D., J.H., Z.B., and T.H. were involved in the methodology, data curation, writing of the original draft; Z.X. and W.W. supervised the study.

References

- [1] Wen G, Jiang W, Chen H, 2010, Focusing on Professional Practice to Ensure the Quality of Full-Time Professional Degree Graduates. *Academic Degrees & Graduate Education*, 8: 1–4.
- [2] Zhang Y, Xiong F, Kuang L, 2020, Reform of the Quality Evaluation System for ‘New Engineering’ Computer Professional Degree Graduate. *Computer Era*, 11: 113–116.
- [3] Gao W, 2011, Practice and Thinking on Improving the Training Quality of Full-Time Professional Master Degree Students. *China Electric Power Education*, 29: 58–61.
- [4] Qu W, Xia J, Song R, et al., 2017, An Exploration on the Model of On-Campus Practical Training Bases for the Full-Time Professional Degree Graduates – A Case Study in XAUAT. *Journal of Xi’an University of Architecture & Technology (Social Science Edition)*, 1: 92–94.
- [5] Wang X, 2014, Study on the Challenge and Countermeasure of Full-Time Professional Degree Graduate Education to the Teaching Staff Structure. *Academic Degrees & Graduate Education*, 3: 9–13.
- [6] Yang X, Huang W, Yu Y, 2018, Issues on Professional Practice Training for Full-Time Professional Degree Postgraduates. *Education and Teaching Forum*, 18: 258–259.
- [7] Hill K, Fitzgerald R, 2020, Student Perspectives of the Impact of COVID-19 on Learning. *All Ireland Journal of Higher Education*, 12(2): 1–9.
- [8] Li Y, Wen X, Li L, et al., 2021, Exploration of Online Education Mode for Postgraduate Education Under the Background of COVID-19. *Advances in Applied Sociology*, 11(05): 223.
- [9] Zhang F, 2019, Implementation Status and Improvement Strategy of “Double-Supervisor System” in Chinese Educational Master Cultivation. *Journal of Higher Education*, 24: 150–152.
- [10] Wang X, 2015, The Design and Management of the Supervisor Team for Professional Degree Graduate Students under the School-Enterprise Cooperation Model. *2015 Conference on Informatization in Education, Management and Business (IEMB-15)*, Atlantis Press, 1033–1037.
- [11] He J, Yu H, Geng Y, 2015, Exploration of Double Tutorial System for Professional Master Degrees. *International Conference on Education, Management and Computing Technology (ICEMCT-15)*,

Atlantis Press, 1457–1460.

- [12] Wu K, 2018, Design and Practice of Innovation and Entrepreneurship Education System for Professional Degree Postgraduates. *Journal of Innovation and Entrepreneurship Education*, 9(05): 99–102.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.