

Current Situation Analysis and Countermeasure Research on Graduation Internship of Mineral Processing Engineering Major

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Abstract: The graduation internship is an important practical teaching content combined with theory and practice at the undergraduate level, consolidate and apply what we have learned, solve practical problems on site; Through graduation internship, students will go deep into the production frontline, master hands-on skills and get practical experience, deepen our understanding and application of theoretical knowledge learned in class and lay down a relatively solid foundation for entering society and working place later. This has great significance from the perspective of guiding the concept of engineering education accreditation to optimize the teaching mode of the graduation internship course so as to improve the teaching quality. We put forward some suitable methods for the graduation internship of the Mineral Processing Engineering major according to analyzing the common problems in the implementation of graduation internship (such as clarify objectives, bring students' initiative into play, combine multiple methods, refine process management etc.), the result shows that this system can effectively expand students' professional horizons, greatly enhance students' professional practical ability, and significantly improve the quality of graduation internship, which provides a certain reference for cultivating Mineral Processing Engineering talents.

Keywords: graduation internship; current situation analysis; countermeasures; process management

1. Introduction

Graduation internship is a very important practical teaching component in the teaching process of higher engineering colleges and universities^[1] and it's the last practical teaching component conducted by students after learning the basic theory courses, professional basic courses, and professional courses stipulated by the teaching plan before their graduation design. Through conducting the teaching component of graduation internship, students are able to reinforce what they learned theoretically; deepening their understanding of industry development; understanding production practice; exercising their professional abilities; cultivating their independent working skills so as to lay down the foundation for the graduation design to be carried out in the next step^[2]. In this paper, we will take the Mineral Processing Engineering major as an example, analyze the actual situation of the Mineral Processing Engineering major, study the problems existing in the current graduation internship, propose some countermeasures according to these problems, provide references for improving the quality of applied talent cultivation in the Mineral Processing Engineering major.

Students who are studying Mineral Processing Engineering will have three compulsory internships: cognition internship, production internship, and graduation internship. Graduation internship is a first-hand practice that joins into the actual work of an enterprise after finishing all professional course studies but before going to the workplace which is an important teaching activity applied theory to production practice, improve engineering practice ability and solve practical production problems. It's also an initial try made by students to solve complex engineering problems in actual enterprise production^[3]. During this internship process, students will mainly do some tasks. First, they will understand the actual situation at the production site such as the production practice of the mineral processing plant, organization management content, the mechanism of enterprise operations, production operation and maintenance management etc., secondly, they will obtain actual data from the production site such as production indicators, process evolution, equipment specifications and models, process parameters and others; thirdly, they will draw on the actual site situation (such as plant layout, equipment placement, pipeline layout and other practical issues) provide reference for their next

graduation design. They will know through the graduation internship process what the content and management methods of scientific research, technology, production planning, production raw materials, costs, equipment, safety and environmental protection, automation and other aspects from the initial preparation of the mineral processing plant to the production process.

The undergraduate students who majored in Mineral Processing Engineering must design and complete a mineral processing plant alone for their graduation design after the graduation internship. This involves the calculation of process flow, justifying the rationality of production indicators, choosing equipments and preparing drawings. Quality of the graduation internship has an effect on consolidating students' professional knowledge and the quality of their future graduation design. In the present overall situation, there are many teaching tasks that should be finished in the graduation internship but weren't done by them; they delay it until they really encountered some problems during the graduation design which they can't solve, at this moment they go back on-site to collect materials as a supplement. Problems like unclear objective, imperfect measure, unscientific method and insufficient quality are relatively prominent, resulting in bad results in the graduation design and affecting the school's teaching quality.

Mineral processing engineering major of the University of Science and Technology Liaoning is one of the key majors of the university; It is an unique major which has relative long history and strong professional strength at the University of Science and Technology Liaoning. This major was built up and developed through a long period of time, giving many outstanding graduates to Liaoning province, its surroundings and even the whole country. For the current implementation of the 2022 version of the talent cultivation program for the Mineral Processing Engineering major, there are five graduation requirement indicator points supported by the graduation internship. Achieving these course objectives will give us opportunities for continuous course improvement. So we do our graduation internship work closely around these five supporting points. We focus on these five supporting indicator points to analyze the problems occurred in the graduation internship process and find solutions according to these problems.

2. Main Problems and Deficiencies in Graduation Internship Work in Colleges and Universities

The mineral processing engineering major's graduation internship happens every year: it will change a little bit depending on the special circumstances of the university, enterprises, and students but the basic model stays unchanged. Mostly centralized internship is adopted where students go deep into the production site. It is mainly unified organization by the major under the leadership of supervising teachers, assign students to certain enterprises for internship. Final grade of the internship includes comprehensive grades of on-campus supervising teachers and off-campus supervising teachers. Generally, graduating students at our university amount to about 60 in two classes per year. If the centralized internship mode is adopted, students are usually divided into several different directions (slightly different according to the actual situation), e.g., during the graduation internship which has just finished in March 2026, we divided the students into several major groups including five directions like mixed-type iron ore, single magnetite ore, gold ore, magnesite, and copper ore. Two teachers lead each group take the students to the site for on-site internship. All teaching tasks have been basically accomplished throughout the whole internship process, and some obvious results have been achieved while some problems were also revealed in a concentrated way.

The problems are mainly concentrated in the following aspects:

a. Unclear internship objectives. Most students have no clear objective through all processes. Students don't pay attention to the content, technical characteristics, and production process of the graduation internship; they don't know what kind of knowledge needs to be mastered and what tasks are needed to accomplish. After the whole internship process is over, they gain nothing at all and don't even know this internship helps them in preparing their next graduation design. It becomes a formality and it's superficial. They can not completely understand the site or get first-hand data to prepare for the graduation design, thus affecting the effectiveness of the graduation internship.

b. Lack of weak awareness of active learning: They can't think actively; during internship time, they don't observe with questions or think with questions; they only take what is explained by their supervising teachers without digesting and understanding them; they do not summarize nor reflect; they are not paying any attention to the main focus points of the internship (process flow, production indicators, equipment layout, and slurry movement routes of the mineral processing plant); they have no impression about what was taught by their supervising teachers after leaving the plant; when facing

some problems in the production site, they will not ask or communicate with supervising teachers, on-site staff, and classmates; instead, they bring on-site problems back to school; they did not really realize the purpose of going deep into the site; there is no initiative for them to actively go deep into the site.

c. Monotonous teaching model. Supervising teachers usually introduce the geological conditions, topographic conditions, ore properties, production scale and production indicators, process flow, equipment layout, equipment placement, on-site safety training, etc. about the mineral processing plant for the internship before the on-site internship. Since students don't have on-site experience, if we use traditional courseware or textbook explanation, it's hard for students to establish a concrete concept of the actual environment of the mineral processing plant, so during the on-site internship, they just have a superficial understanding of process flow, production indicators, equipment parameters, pipeline layout, etc., there are many problems when doing the subsequent graduation design.

d. Internship work is not in-depth enough. The graduation internship work in colleges and universities are usually scheduled for the second semester of senior year which can be easily affected by some external factors (postgraduate entrance examination and employment); students' incompleteness, inadequacy and carelessness on graduation internship work leads to the fact that their internship work is not deep enough but just a mere formality and they do it as a required routine thus affects the teaching effect of the graduation internship link in colleges and universities^[4,5].

3. Paths to Improve the Effectiveness of Graduation Internship Work in Colleges and Universities

According to the above reasons, we adopt a centralized internship mode for all internships in the Mineral Processing Engineering major: combined with graduation thesis and graduation design, formulate an appropriate internship plan including such means as internship locations, number of students participating in the internship, number of supervising teachers, hiring of enterprise supervising teachers etc., so that we can realize our purpose of the internship.

a. Clarify internship objectives and carry out the internship with graduation design tasks. Firstly, clarify the specific task of the graduation internship. After the clarification of the tasks, the students will know what they should do. Based on the actual situation of the Mineral Processing Engineering major at our university, we clearly point out at the graduation internship mobilization meeting that the main content of the graduation internship is divided into two items: Collecting data at the production site. And Learning from actual production conditions and designing a mineral processing plant by referring to the production site. We divide these two tasks into the following specific items which are given to the students, so that students carry out the internship with tasks and complete the tasks one by one. These items mainly include: Understanding the physical and chemical properties of the ore processed by the mineral processing plant, the design scale, and the work system; Understanding the main basis for selecting the process flow; Familiarize yourself with all kinds of advanced equipment and plant structure used in the mineral processing plant; Understanding the production process parameters of advanced technologies and equipment in the mineral processing plant, and the rationality of using these equipment and technologies; Master the basic concept of equipment selection and process design, and can propose basic process flows according to different ore properties, analyze and compare them, choose suitable solutions; Understand the main problems existing in the mineral processing plant's operation process such as process, electromechanical, water supply and drainage, and maintenance issues; Can improve the problems found in process, equipment, management, and other aspects in their own graduation design and give specific improvement plans. With these specific questions, students will know what they need to understand at the site, have a clear idea, check item by item, and complete tasks one by one, so that each student has clear tasks^[6].

b. Supervising teachers lead students to actively learn and think, completely play the subjective initiative of students, transforming passively internship into active internship. Supervising teachers should take students centered, leading them to actively learn by various ways: 1) Letting students using "Graduation Internship Outline for the Mineral Processing Engineering Major" list the doubts and questions they want to resolve in the internship; 2) Require students to form graduation internship group of three or four people on their own. During the lectures and on-site internship visit, groups need to raise questions and think, and teachers should encourage students to actively discuss with other members within a group as well as between different groups; 3) Supervising teachers should raise questions based upon actual problems of the internship mineral processing plant and the location of key

internship position, requiring students to answer, record and summarize after visiting and learning; 4) Encourage students to find problems that exist at the internship site and seeking solutions to those problems on their own^[7].

c. Multiple teaching models are used at the internship site. The main methods we adopted to do our internship work when doing the graduation internship avoid the previous model where only supervising teachers give explanations: Firstly, the interaction between supervising teachers and internship students. Both teachers and students have their own opinions, using a combination of students asking questions and teacher guidance can cultivate students' innovative thinking and spirit of active learning. Secondly, hiring on-site engineers to explain actual problems at the internship site. Interaction between on-site engineers and internship students discuss the solution of on-site problems. Encourage students to actively ask questions and put forward their own views about actual production problems. This not only solves the internship doubts of students in real time, but also deepens the thinking and understanding of students on actual production problems on site. Thirdly, use the original design drawings of the mineral processing plant collected previously and the actual situation of the production site for on-site explanation. On the one hand, it helps students understand the drawings and get familiar with the layout of on-site equipment. On the other hand, it also allows students to gradually understand how to express the actual on-site situation through drawings in their own designs, and also encourage students to observe and think carefully while visiting sites. Finally, during the internship in different workshops and positions, internship students use mobile phones, notebooks, drawings or other methods to record the details of the actual situation of each platform in the workshop (main equipment, platform layout, supporting production facilities etc.) after ending each day's internship. Each day an internship summary was conducted. One person from each group summarizes the specific situation of each position and each platform in great detail, so that students could be familiar with the site, deepen their understanding and improve their memory.

d. Improve the internship process. Teachers should make an internship plan according to the internship management plan and the content of the teaching syllabus when doing internships; managing students according to the internship plan; and keeping correct teachers' internship diaries. Supervising teachers mostly supervise, inspect and evaluate from the following aspects of students' internship process in their internship diaries: Firstly, checking students' data collection, summary and induction at the site; Secondly, checking the process parameters of main production equipment at the production site, equipment layout, platform settings and elevation data, positioning dimensions and fixed dimensions of main equipment, layout and direction of main pipelines connected to main equipment; Thirdly, check the important process indicators of the whole mineral processing plant (output, recovery rate, concentrate grade, tailings grade, primary and secondary classification particle size, ball mill throughput, feed ore and discharge ore particle sizes etc.), which makes it clear for students to understand and firmly remember the main data. Full-process supervision, inspection, and assessment are carried out by hand-by-hand, point-by-point, and face-to-face manner, so as to let teachers fully understand the actual situation of every student. Based on each student's different mastery of knowledge, they do key monitoring and individualized attention, trying to ensure that all internship students can successfully complete their internship tasks^[8].

4. Conclusion

Graduation internship as an indispensable part of the teaching plan for undergraduates who are majoring in Mineral Processing Engineering is very important for cultivating college students' basic professional literacy; it enhances the professional practical ability of college students and comprehensively improves their ability to adapt to the site. The improvement on the internship model and process management will effectively improve the quality of graduation internship, fully mobilizing the enthusiasm of students to learn, laying a solid foundation for the graduation design to be carried out next.

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