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Research and Practice on Improving the Quality of Graduation Design through Professional Mentorship

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Abstract: Graduation design is a significant part of the undergraduate education stage, and the quality of graduation design of undergraduate graduates is an essential indicator of the effectiveness of undergraduate education. However, with the influence of comprehensive factors such as the exponential growth of human knowledge and the year-on-year increase in the pressure of the job market, undergraduates have paid significantly less attention to graduation design, which has led to a continuous decline in the quality of graduation design, which in turn has manifested itself in the decline of the quality of undergraduate education. Combined with the professional mentorship system in undergraduate education, this paper investigates the effective methods to improve the undergraduate graduation design under the professional mentorship system and puts them into practice and the results show that the methods in this paper can effectively improve the quality of undergraduate graduation design.

Keywords: Professional Mentorship; Undergraduate Education; Graduation Design; Quality.

1. Introduction

Graduation thesis is a college student in the university before graduation, in accordance with the requirements of the teaching program, under the guidance of experienced teachers, independently written exercise academic papers. It is a higher education graduate submitted to a certain academic value of the article, is the college students to complete their studies of the landmark assignments, is a comprehensive summary of the results of the study and review, is the college students engaged in the initial attempts to scientific research, is the teacher under the guidance of the scientific research results of the written record, but also to test the degree of mastery of knowledge, analyze the problem and solve the problem of the basic capacity of the students of a comprehensive answer sheet. Undergraduate thesis is an essential part of undergraduate education and an integral and important part of the whole teaching program[1].

Although the graduation thesis belongs to one of the academic theses, it has its own distinctive features compared to the academic thesis[2]:

Secondly, creativity. The creativity of a student's graduation thesis should be understood in a broad sense, which can be manifested in the achievement of results in new areas not explored or on new subjects not done by previous generations, as well as in further research based on the results of previous generations, which has led to discoveries or new perspectives.

Thirdly, guidance. The graduation thesis is a scientific research result completed independently under the mentor's guidance. Teachers should inspire and guide students, give full play to their initiative and creativity, give full play to their ingenuity and hard work, and independently complete the graduation thesis writing tasks.

Fourthly, the exercise. According to the provisions of the teaching plan, students use the fundamental theories, professional knowledge, and basic skills learned at the university level to independently carry out scientific research activities to analyze and solve a theoretical or practical problem. It is an academic paper of an exercise nature.

Fifthly, standardization. The thesis must comply with and skillfully use the increasingly standardized and standardized basic thesis format.

Although the graduation thesis is a crucial course during the university and a teaching link that should be addressed, thesis writing has a variety of problems from the viewpoint of thesis writing in recent years, which should attract our attention. By analyzing the problem, the main reasons are as follows[3]:

1) Students do not pay enough attention to graduation design.

Most of the energy of senior graduates is devoted to job hunting, postgraduate entrance examination, going abroad and certification of various qualification examinations. Some students also use their graduation design teaching time to make up for other courses to complete the credit requirements, which undoubtedly reduces the time for graduation thesis writing. Graduation thesis is a very important practical link in undergraduate education, and it is an important way to exercise students 'ability to find problems, analyze problems and solve practical problems. Through the writing of graduation thesis, students 'scientific research ability and research skills are gradually cultivated, and good scientific literacy is cultivated. However, students do not pay enough attention to the important practical link of graduation thesis, fail to attract enough attention in the thought, and seriously lack of energy investment.

2) Students lack of scientific research exercise and lack of scientific research literacy.

Graduation thesis is an effective way to cultivate students' scientific research quality, but this quality is not developed quickly, and it needs a certain accumulation to gradually form. But students lack of scientific research ability exercise at ordinary times, and it is difficult to develop a certain scientific research quality.

3) Students' graduation thesis writing method needs to be improved

Many students have insufficient awareness of the importance of information collection and collation work, and do not realize that this is an important part of thesis writing,

so the amount of work devoted to this part is often less. Many students lack the channels and methods to obtain literature in their professional field, and often hope to find literature directly related to their topic or even directly applied when they consult literature. Some students even have no way to start, the number of literatures they consult is limited, and some literatures cannot reflect the current research direction and academic frontier issues. Although some students can also consult certain literature materials, but the purpose and attention to the review is not enough.

4) Students lack initiative in their study

Students from middle school to university learning, learning content and methods have undergone great changes, but most of the students have not been able to change from the passive learning of middle school students, feel idle, can not better adapt to university learning, learning blindly focus on textbook knowledge, just to cope with the exam. Some students lack interest in study, they think that just passing the exam represents the completion of the task. In their spare time, some students who cope with the exam do not study the subject field through independent learning, but spend more time on the Internet chatting, playing games, and even the phenomenon of "red light" in the exam, let alone the exercise of scientific research ability.

In summary, the quality of graduation design is a comprehensive issue, which requires students to have certain scientific thinking, innovative practice ability, academic writing ability and scientific expression ability[4]. With the development of science and technology, the complexity of scientific problems increases, and the requirements for these basic abilities also increase[5]. Considering the various actual conditions of current students, it is difficult for our students to complete their graduation project with high quality within half a year[6]. The professional mentor system allows students to receive the guidance of professional teachers from the beginning of the freshman year, and the graduation project of the senior year is also guided by professional mentor[7]. In this way, if students are willing, they can choose to receive training in scientific thinking and academic writing, and participate in innovative practical projects for scientific practice[8]. In the senior year, students who have participated in scientific training and practice have accumulated relevant contents and achievements in their professional fields. The graduation project of the senior year naturally evolves into a concise summary of the previous innovative practice work. In the limited and precious senior year, the graduation project can be completed more calmly, which is conducive to the improvement of the overall quality of the graduation project[9]. The undergraduate mentorship can solve the problem of declining quality of graduation design to a certain extent.

2. Exploring the Professional Mentorship System

1) Practical problem-driven, student-centered topic selection

In the process of selecting topics, attention should be given to the novelty of content and the application of basic knowledge to engage students. A student-oriented approach to topic selection can effectively address the aforementioned issues. Stimulating students' motivation is fundamental in nurturing their innovative abilities. The concept of topic selection centered around students profoundly respects their individual interests and future developmental needs, significantly igniting their drive to accomplish scientific research. A well selected topic is crucial for fostering skill development, and a student-focused approach to topic selection enhances its effectiveness, thereby improving the quality of training students' innovation abilities. In the process of selecting topics, the emphasis is placed on practical engineering problems primarily provided by professional mentors. Ideally, these topics should align with relevant projects from cooperating enterprises or scientific research units. The topic selection process thoroughly considers students' personal interests, allowing room for self-selected topics.

2) Weekly discussion and monthly reporting system to maintain interest and develop scientific thinking and presentation skills

Implementing a weekly discussion system between students and professional mentors enables mentors to grasp students' research difficulties, providing timely corrections, guidance, and necessary encouragement. This effectively sustains students' interest in the subject matter while fostering scientific thinking through consistent interaction with their mentors. The monthly reporting system, where students deliver a PowerPoint presentation on their work from the previous month to the group and field questions, serves as a platform for enhancing students' proficiency in explanation and expression with each monthly exercise.

3) Research results in the form of academic papers or research reports to develop academic writing skills

When students' research results meet innovation criteria, they can be consolidated into academic papers; if insufficient for public dissemination, they may take the form of research reports. Both academic papers and research reports adhere to specific writing standards, distinct from other forms of writing. Rigorous training in scientific and technical paper writing enhances students' academic writing prowess.

The aforementioned research content encompasses the cultivation of students' scientific research, writing, and presentation abilities—fundamental skills necessary for a graduation thesis. By nurturing these skills, the foundational issues regarding the quality of the thesis can be effectively addressed.

3. Implementation of the Professional Mentorship System in Graduation Designs

This practice is aimed at improving the quality of undergraduate baccalaureate, developing students' scientific thinking and research skills as a method, and developing the implementation of this paper based on the professional mentoring system.

3.1. The Process of Practicing

1) Preparation of scientific research questions

The scientific research problems in the process of practice mainly come from the National Marine Environment Monitoring Center, the cooperation unit of the professional mentor's daily scientific research, and these scientific research needs are the business needs of the state in the process of marine environment monitoring, and they are the actual problems that need to be solved. In addition, it also comes from the content of technical services to other enterprises, as well as practical problems that need to be

solved in the industrial production of society.

2) Student Communication

During the practical phase, students undergo scientific quality training based on the principle of voluntarism. This implies that students who are interested in scientific research or aspire to enhance their scientific abilities can voluntarily engage in relevant projects. They receive guidance from professional mentors and engage in related tasks. Taking undergraduate students from the 2018 cohort as an example, during routine meetings with professional mentors, the mentors presented their research focuses and content. Interested students were encouraged to sign up for participation. Eventually, among fifteen undergraduate students majoring in Automation from the 2018 cohort, seven expressed their willingness to engage with the research content offered by the two mentors.

3) Selection of scientific research topics

In the research process, students can opt for topics in a semi-open manner. 'Semi-open' implies the voluntary selection of topics within a specified range. The scientific research content of the mentor falls within the broad domain of image processing, encompassing the analysis and processing of remote sensing images, everyday image processing, as well as image analysis in industrial production. Within this scope, students can select their area of interest. At the same time, the selection of topics is not fixed at once, and in the course of practice, it is also guided and corrected according to the mentor's perception of the characteristics of the student, as well as changes in the student's own points of interest. For instance, during the process, Wang adjusted the topic based on his own abilities, effectively completing a topic that suited his skills better. Liu, after an introduction to image-related issues, shifted interest towards studying and researching deep learning network algorithms, eventually producing a high-quality academic paper.

4) Capacity-building process

After students have selected a topic and direction, discuss with them what all needs to be addressed and in what order to accomplish or solve the chosen topic, culminating in a set of solutions; After the solution is formulated, each student independently studies the knowledge they lack and actively engages in discussions with teachers or classmates. For the basic knowledge of public nature, the mentor will give a common explanation in the form of book-reading. And according to the solutions developed, students follow the implementation progress for weekly summarization and discussion, and will gather together monthly for offline or online monthly reporting. Until the student is guided through the problem that needs to be solved. After this, students are guided through the writing of an academic paper or engineering report.

3.2. Practical Results and Analysis

The research aims to utilize the professional mentorship system within the School of Information Science and Engineering, allowing students with spare capacity and an interest in scientific research to engage in research training early on. This involves summarizing the content and outcomes of scientific research, culminating in the final graduation thesis, thereby effectively enhancing the quality of the thesis design.

1) Problem-driven approach and student-centric topic selection

In the selection of research topics, two principles are adhered to: first, driven by practical scientific problems, and second, centered around the students. The former entails topics sourced from the scientific research of guiding instructors or relevant practical application issues, ensuring the fundamental quality of practical work. The latter, student-centric topic selection, is grounded in actual problems and primarily involves two aspects: aligning with students' interests and building upon their foundational capabilities.

2) Weekly discussions and monthly reporting system: sustaining interest, fostering scientific thinking, and enhancing communication skills

In the practical process, an approach guided by problem-solving was adopted as the overarching strategy. Problem-driven and knowledge-driven are two contrasting processes. For students accustomed to traditional classroom teaching, this shift presents a certain level of difficulty. Problem-driven methodology targets solving real scientific issues, focusing on a clear understanding and description of these problems. Learning knowledge no longer takes precedence; instead, knowledge serves as a tool within this process. Necessary knowledge is acquired as a means to solve problems based on the requirements of addressing these issues.

The weekly discussions and monthly reports are crucial management systems employed during the practical process. By monitoring students' incremental progress, they serve a dual purpose: firstly, to promptly identify any issues encountered by students during their research, whether knowledge-related or psychological, allowing timely guidance to sustain their interest and confidence in research; secondly, these milestone-based summaries and presentations aid in cultivating good study and research habits among students.

Training in Scientific Thinking. Training in scientific thinking begins with analyzing problems, inspiring students to break down a complex issue into smaller components. It involves analyzing the characteristics of each problem and the features of various methodologies, matching appropriate methods to address issues or designing and implementing solutions based on practical circumstances. The training in scientific thinking aims to facilitate a shift in students' mindset from knowledge-driven to problem-driven. It familiarizes students with the primary problem areas within a field and equips them with several commonly used methodological skills.

Regular Discussions and Reporting for Enhancing Expressive Skills. Following the principle that 'one truly understands when they can explain it to others,' students are encouraged to present their research and learning achievements in monthly reports. Through questions from teachers and peers, this method progressively nurtures the ability to articulate scientific problems and methodologies clearly.

The formation of research outcomes into academic papers or engineering reports nurtures academic writing skills. Academic papers and engineering documents serve as vital means of academic or engineering communication. In both academic research and engineering, writing is a critical skill. The cultivation of students' writing abilities primarily includes English and Chinese papers, guidance on writing strategies, and specific content requirements. The refinement of writing skills is achieved through sentence-level discussions and revisions.

Among the seven students, three transformed their research content into graduation designs. Deng completed a graduation

design titled 'Information Extraction of Ocean Remote Sensing Image Raft Cultivation Based on U-net.' Liu completed a graduation design titled 'Oil Spill Extraction in SAR Images Based on CNN.' Wang completed a graduation design titled 'Fault Diagnosis System for Casting Process Inoculant Based on Machine Vision.' All three students achieved scores above 90 points in various stages such as guidance teacher evaluation, reviewer assessment, and defense. Deng's graduation design was recognized as an outstanding undergraduate thesis at Dalian University of Technology. After graduation, both Liu and Wang were admitted to Dalian University of Technology for their postgraduate studies, while Deng was admitted to Dalian Polytechnic University for further academic pursuits.

4. Conclusion

From the practical outcomes, based on the professional mentorship system, as long as students persist throughout the entire training process, they are assured of completing a high-quality graduation thesis and achieving notable research outcomes. Additionally, they can secure favorable outcomes in terms of further academic pursuits and employment opportunities

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