Research on Quality Assurance Strategies for Graduate Education in Computer Science

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Abstract: This paper summarizes common problems and proposes countermeasures to solve them through an in-depth study of the quality of graduate training in computer science. In the process of program improvement, opinions are widely collected, details are refined and polished, and the program is piloted within the college and iteratively improved according to the feedback. After practical testing, a scientific and effective evaluation program will be formed, and universal standards will be formed by combining the characteristics of other colleges. The program will be extended to the whole university after validation, and corresponding policies and documents will be issued to improve the breadth of the program's application, and other colleges can refine and improve the program according to their specific conditions in order to further enhance the quality of training.

Keywords: Graduate Education; Complex Talents; Computer Science Majors; Education Quality Assurance; Selection Mechanism

1. Background and Objectives of the Study

Nowadays, the quality of postgraduate training has become an important index to measure the comprehensive ability of universities. Many researchers believe that the quality of postgraduate training is comprehensively reflected through the training process and graduation results, which include factors such as personal ideological concepts, psychology, scientific research, practice and innovation [1]. These factors can reflect whether the educational quality of postgraduate training meets the postgraduate students' own development, social needs and future needs. Due to the special characteristics of computer graduate students, the rapid development of the information technology industry and the deep integration of computers and other disciplines have put forward higher requirements for computer graduate students. These requirements include, but are not limited to, richer information reserves, deeper knowledge accumulation, and continuous learning ability for new technologies. Therefore, the quality of the training of computer graduate students also needs to be more strictly controlled and improved. Computer graduate students not only need to master a solid basic knowledge of computers, but also need to pay attention to industry dynamics, keep up with technology trends, and constantly update their knowledge system. In addition, with the deepening of the cross-fertilization of computers and other disciplines, computer graduate students also need to have interdisciplinary learning and research capabilities in order to better adapt to the future needs of diversified career development [2].

In order to deepen the reform of graduate education in computing, improve the quality and level of graduate education, and promote the exchange of educational experience, Fudan University has piloted the "Annual Report on the Quality of Graduate Education in Fudan University Faculties" since 2021. The system takes world-class universities as a benchmark, and assesses the quality of graduate education of all faculties and departments of Fudan University in an all-round and multi-dimensional way during the past year. In 2022, Henan University hosted the China Computer Graduate Education Conference 2021, which provided an important communication platform for the reform and development of graduate education. 2023 On July 9, 2023, the National Conference on Computer Education 2024 was jointly hosted by China Computer Federation (CCF) and National Research Society for Computer Education in Higher Education (NRSCEHE). Computer Education Research Society jointly organized the 2023 China Computer Graduate Education

Conference in Xi'an. The conference gathered many experts and scholars to discuss the new mode, new path and new challenges of graduate education.

Although major universities and colleges have made great progress in researching and improving the quality of graduate training in computer science, there is still room for improvement in the development of concepts and elements of the quality of graduate education in computer science as well as the optimization of training programs. Therefore, in the future, we need to further explore and research with a view to improving the quality of China's computer-based graduate training.

In view of the above problems and shortcomings in the research context, the research objectives of this paper are categorized into the following two areas:

(1) Optimizing the selection mechanism of computer graduate students to cultivate composite talents

The selection of master's degree students is a key link in the enrollment of master's degree students, and it is also an important means for schools to select excellent students. Optimizing the selection mechanism of computer graduate students is an important step to cultivate more composite application talents of computer majors. The mechanism adheres to the core of talent cultivation, centers on the school's disciplinary advantages and development direction, fully considers the students' professional ability and comprehensive quality, and builds a scientific selection mechanism. The mechanism not only considers students' professional knowledge of computer science, but also focuses on students' knowledge reserves in other disciplines, as well as their ability to participate in practical activities such as scientific research projects and competitions in the undergraduate stage. These are important aspects of evaluating a student, which can demonstrate the student's practical ability and ability to learn new knowledge. Meanwhile, considering the actual situation of the School of Computer Science and each research lab, a two-way selection mechanism is proposed. This mechanism allows graduate students to establish a higher match with research laboratories and supervisors, which leads to a better utilization of resources and an increase in the efficiency of teaching and research.

In order to realize this mechanism, combined with a number of management regulations of the School of Computer Science, such as the Management Regulations of the Management Committee of the Research Laboratory, the Regulations on the Establishment of Open Research Laboratory, the Internal Management Regulations of the Research Laboratory, the Cultivation Program for Graduate Students of the Research Laboratory and the Program for the Construction of the Research Team of the Research Laboratory, we have realized a perfect mode of graduate students joining the Research Laboratory and a management mode of the practical cultivation process, so that we can better Cultivate compound application talents in computer science.

(2) Establishment of an improved training program to enhance the quality of student training and dissemination to other engineering majors

In order to cultivate the ability of graduate students to analyze and solve problems by comprehensively applying the knowledge they have learned, to improve the quality of the dissertation, and ultimately to realize the goal of improving the quality of graduate students' cultivation, the mechanism of assessing the quality of the dissertation has been strengthened. This program has already achieved remarkable results in the cultivation of computer graduate students. At present, combining with the training characteristics of graduate students in this specialty, a set of more mature training programs has been initially worked out, and these quality training programs or methods that can be extended to other specialties have been incorporated into the official teaching system of the university. It is suggested that the Graduate School of the university has revised a series of training management documents such as Implementing Rules for Handling Dissertation Falsification in Changchun University of Science and Technology, Regulations on Achieving Innovative Achievements in Applying for Academic Doctoral Degrees in Changchun University of Science and Technology, and Measures for the Administration of Changchun University of Science and Technology Graduate Student Scholarships, which will be implemented and promoted to other majors throughout the university after the revision of these documents.

2. Elements of Quality Assurance in Education

The purpose of this study is to explore in depth the ways to optimize the training program of computer graduate students, especially focusing on the key aspects of how to improve the quality of graduate students' training more effectively and the setting and universality of their assessment standards. The goal of our study is to enable more graduate students to fully participate in the training process and to realize quantitative assessment, so as to improve the overall training effect. In order to achieve this goal, we adopt a comprehensive assessment method with multi-links and multi-dimensional indicators, with a view to improving the quality of postgraduate training in a more scientific way.

2.1 Master's Degree Re-examination

As an important part of the enrollment work, the re-examination of master's degree students is not only the main way for enrollment units to select excellent students, but also a key step to ensure the quality of talent cultivation [3]. Colleges and universities should adhere to the core of talent cultivation, closely combined with their own disciplinary advantages and development direction, taking into account the characteristics of different disciplines and the differences in their cultivation methods, to build a set of comprehensive and scientific re-examination system. This system should take into account the candidate's professional ability and comprehensive quality assessment, taking into account the undergraduate scholarships, competition results, scientific research achievements and other factors, so as to ensure the fairness and accuracy of the qualification of postgraduate enrollment.

2.2 Postgraduate Scholarships

As an important part of the financial aid system of colleges and universities, postgraduate scholarships have gone through the evolutionary process of "awarding excellence" to "assisting hardship" and then back to "awarding excellence" in terms of their autonomous values. The establishment of scholarships is aimed at motivating young students to be aggressive, study hard, realize all-round development, and eventually become qualified future builders and successors [4]. Through the granting of scholarships, not only can reduce the economic burden of students, but also stimulate their enthusiasm for learning and innovation, and promote the quality of talent training.

2.3 Scientific Research Projects

As an important vehicle for scientific and technological research, scientific research projects are unique and complex. Generally speaking, scientific research projects can be categorized into various types of funds set up by the state, vertical scientific research projects supported by funds set up by governments at all levels, and horizontal scientific research projects. In the process of participating in different types of scientific research projects, students can exercise and improve their scientific research ability, innovation ability and teamwork ability and other qualities. Therefore, colleges and universities should encourage and support students to actively participate in scientific research projects and provide them with sufficient practical opportunities and platforms to promote their overall development and growth.

2.4 Thesis

Dissertation, as an important milestone of postgraduates' study, is not only a summary of their academic exploration, but also a key indicator of the quality of postgraduates' training. The dissertation of postgraduates reflects the theoretical foundation, professional knowledge mastery, academic level, innovation ability and writing ability of postgraduates, and is an important carrier and concrete expression of the quality of postgraduates' cultivation. Through writing the dissertation, graduate students can systematically sort out the knowledge they have learned, deepen their understanding of their specialized fields, and at the same time enhance their problem-solving and innovation abilities, laying a solid foundation for their future academic and professional development.

2.5 Pre-defense

As an important link in the quality control of master's thesis, predefense has a central position in the quality system of postgraduate training. It is not only an important reflection of the cultivation level of graduate students, but also a key step to ensure the quality of the

dissertation. Pre-defense undertakes the important task of the last quality control and review of the dissertation before leaving the university for blind examination. The supervisory team will collectively monitor and manage the quality of the dissertations to be defended in a highly responsible attitude to the graduate students and the discipline, as well as in a far-reaching consideration for the sustainable development of the discipline. Through the pre-defense, the overall quality of the dissertation can be fully controlled, problems and deficiencies can be found and corrected in a timely manner, and strong guidance can be provided for the subsequent dissertation revision and graduation defense.

3. Specific Measures for Quality Assurance in Education

With the widespread popularization and increasing importance of computer technology, the training of computer graduate students has gradually become the focus of social attention. Especially in the context of the current trend of massification of higher education gradually extending to postgraduate education, it is even more crucial to improve the quality of the training of computer graduate students. This task is faced with increasingly complex influencing factors, which requires us to explore deeply and find effective solution strategies. In order to effectively improve the scientific research ability of computer graduate students and cultivate innovative talents who can adapt to the needs of future social development, this paper proposes a set of comprehensive training program. The program covers a number of key aspects, such as the selection of excellent graduate students, participation in actual research projects, evaluation of scholarships, and strict control of thesis quality (Figure 1).

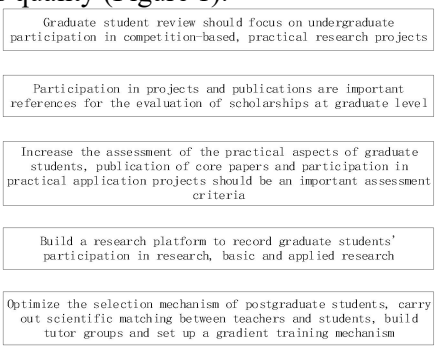

Figure 1. Specific Measures to Ensure the Quality of Graduate Training

The main processes and activities are described below:

(1) Graduate students' reexamination should focus on participation in competition-type and practical scientific research projects during the undergraduate period. As a key link to further investigate the comprehensive quality and personal ability, the postgraduate reexamination is of great significance in selecting compound talents and cultivating innovative talents [5]. In the retesting work of computer graduate students, we should pay special attention to the experience of candidates in the undergraduate period to participate in competitions and actual scientific research projects, to assess the ability of candidates to use theories learned to discover, analyze and solve problems, as well as their understanding of the development of the discipline and the potential for development in the field of specialization. At the same time, we shall focus on students' mastery and application of basic knowledge to ensure that the examination is both comprehensive and focused [6].

(2) Participation in projects, publication of papers, academics, and participation in public activities are important references for the evaluation of scholarships at the graduate level. Scholarships, as a kind of monetary rewards for specific students, are designed to recognize individuals who excel in academic achievement, conduct performance or social activities. Through both material and spiritual incentives, the scholarship system plays a pivotal role in enhancing students' motivation and promoting their overall development [7]. For graduate education, the scholarship system is an indispensable part of the training mechanism. Students who receive graduate scholarships not only represent their academic excellence, but also reflect their solid quality and deep attainments in their professional fields. Therefore, improving and optimizing the postgraduate scholarship system has far-reaching significance for improving the quality of postgraduate training and promoting academic innovation [8].

(3) Increase the assessment of postgraduates' practical aspects, and the publication of core papers and participation in practical application projects should be taken as important assessment criteria. The quality of academic papers is not only an important

measure of graduate students' scientific research ability and level, but also plays a key role in improving students' scientific research thinking ability and summarizing ability [9]. Postgraduates publishing high-level academic papers can not only refine their scientific and technological paper writing skills and cultivate scientific elements, but also further enrich their professional theoretical knowledge and broaden their knowledge [10]. In this process, students can get comprehensive exercise and enhancement from searching and arranging Chinese and English literature, posing and summarizing problems, optimizing experimental methods, processing and analyzing data, to writing papers. Table 1 shows the published academic achievements of master's degree students in the School of Computer Science from the class of 2018 to the class of 2020.

Table 1. Published Scholarly Achievements of Master's Degree Students in the School of Computing, Class of 2018-2020

grade	Total number of publications	Number of publications as a percentage	Total number of patents published	Number of patents published as a percentage
Class of 2018	73	75%	12	13%
Class of 2019	19	16%	-	-
Class of 2020	69	38%	10	6%

(4) Build a research platform to record graduate students' participation in scientific research, basic research and applied research. There is a significant correlation between the quality of students' innovative ability and the frequency of their participation in scientific research activities and the number of declarations. The more innovative students are, the more often they participate in and declare research projects. For computer graduate students, the exercise of actual projects is especially important. By building a research platform, a broader space for academic communication and collaboration is provided for graduate students. Such a platform not only helps to promote academic exchanges, mutual collaboration and mutual learning among graduate students, but also encourages innovative thinking and forms a good learning and academic atmosphere. In such an environment, graduate students can better utilize their potentials, enhance their innovation ability and lay a solid foundation for their future academic and professional development.

(5) Optimize the selection mechanism of postgraduate students, set up tutor groups and establish a gradient training mechanism. At the stage of graduate student selection, universities should uphold the principle of two-way selection between tutors and students, and carry out rigorous and scientific graduate student selection and evaluation to realize the accurate matching between teachers and students. Especially in the field of computer science, the graduate training team establishes mentor echelons or mentor groups in research platforms or training teams to guide students from different stages to participate in research projects or innovative activities. Professors or academic leaders act as the core of the team and undertake high-level research projects. At the same time, young teachers or technical backbones serve as the backbone of the team, leading students to innovate in application-based projects. Such a model enables students to start from the foundation of scientific research, and through the exercise of multiple projects, cultivate the ability of scientific research and innovation, and gradually be able to participate in and undertake high-level scientific research projects. Students can start from the foundation of scientific research, and gradually develop the ability of scientific research innovation through the practical exercise of multiple projects.

4. Summary and Outlook

Through in-depth research on the quality of graduate training in computer science, this paper condenses and summarizes the common problems existing in the process of graduate training and their corresponding countermeasures to solve them. In the process of refining the program, opinions and suggestions from teachers and graduate student groups were collected, and the details of the program were refined and polished. Subsequently, a trial implementation was carried out within the college, and continuous iterative improvement was made according to the feedback, specifically tapping the landing

form of the program. After practical testing, a set of scientific and effective evaluation program was gradually formed and calculated and assessed by scientific means. Combined with the characteristics of other colleges, a set of universal standards was further formed. After demonstrating the rationality of its operation, the program will be extended to the whole university, and corresponding policies and documents have been issued from the university level, which effectively enhances the credibility and improves the breadth of the program's application. As different majors have different training characteristics. Therefore, other colleges, when drawing on the program, can refine and improve it by combining with the specific conditions of their own colleges, so as to ensure that the quality of cultivation is further improved.

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