International Journal of Core Engineering & Management
Volume-8, Issue-04, 2025 ISSN No: 2348-9510

RESEARCH ON PATHWAYS FOR ENHANCING THE QUALITY OF GRADUATE THESES IN ELECTRICAL AND INFORMATION ENGINEERING DISCIPLINES

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Abstract

Currently, the overall quality of graduate theses in electrical and information engineering disciplines remains concerning. Primary issues include inappropriate topic selection, inadequate literature reviews, non-standardized research methods and data processing, as well as inconsistent writing standards. Factors affecting thesis quality are multidimensional, stemming not only from variations in students' research capabilities and academic attitudes but also closely tied to the sophistication of training systems, the quality of faculty research guidance, and external collaborative resources. To address the aforementioned typical issues, this study proposes improvement pathways in areas such as cultivating students' research capabilities, strengthening supervisors' guidance skills, optimizing training strategies, and managing the thesis writing process, with the aim of enhancing the overall quality of degree theses. The findings indicate that establishing a systematic, full-process research training mechanism significantly improves graduate students' research rigor and innovation capabilities; refining supervisor evaluation and incentive mechanisms effectively enhances the quality of guidance; and optimizing the training system and writing management processes are key to ensuring thesis quality. In summary, a multi-stakeholder collaborative and systematic quality enhancement system holds significant importance for improving the quality of professional theses in electrical and

information engineering disciplines.

Index Terms – Electrical and information engineering, graduate theses, graduate education.

I. INTRODUCTION

With the rapid advancement of information technology, electrical and information engineering has emerged as a vital force driving technological progress and societal development, and the quality of talent cultivation in this field is receiving increasing attention. Graduate theses serve as a crucial benchmark for evaluating the comprehensive abilities and academic proficiency of graduate students. Their quality not only impacts the academic growth of individual students but also influences the innovation capacity and societal service capabilities of the entire academic discipline. The quality standards for graduate theses typically emphasize originality, scientific rigor, practical applicability, and adherence to established norms, with a focus on cultivating students' ability to think independently and solve complex problems. As China's higher education reforms continue to deepen, graduate institutions have increasingly elevated their quality requirements for theses. These works must not only demonstrate innovative content but also comply with academic conventions, reflecting students' professional expertise and comprehensive competencies [1-2].

However, in the face of high standards, the current quality of graduate theses in electrical and information engineering disciplines is not encouraging, plagued by issues such as insufficient innovation and a disconnect between theory and practice. These problems severely hinder the overall improvement of thesis quality and adversely affect students' future career development. The root causes lie partly in students' insufficient capabilities and preparation, and partly in limitations within the scope and methods of faculty supervision, as well as a misalignment between industry demands and academic orientation. Consequently, enhancing the quality of graduate theses in electrical and information engineering has become a critical research priority for the field.

II. ANALYSIS OF THE CURRENT STATE OF QUALITY IN GRADUATE THESES IN ELECTRICAL AND INFORMATION ENGINEERING DISCIPLINES

Graduate theses are required to ensure academic rigor, innovation, practical applicability, and adherence to writing standards. Simultaneously, academic integrity is emphasized, with strict prohibitions against plagiarism, intellectual theft, and other forms of academic misconduct. First, the selection of research topics should emphasize both the frontier and innovative aspects of the discipline. The topic must align with the program's training objectives, demonstrate practicality and advancement, and highlight the integration of theoretical knowledge with real-world applications to address practical problems, while maintaining an appropriate workload. Second, the literature review should summarize both classical works and the latest research findings in the relevant field, trace the current research status and industry trends, and provide a comprehensive and critical analysis that reflects the student's capacity for independent and critical thinking. Third, the research methodology must be appropriate and scientifically rigorous, with logical reasoning and standardized data recording, demonstrating the student's ability to comprehensively apply fundamental theories and specialized knowledge. Fourth, regarding innovation, students are encouraged to propose new ideas or construct new models to highlight the originality of their

research. The research outcomes should contribute to disciplinary development or provide solutions to real-world problems. Innovative contributions constitute the core criterion in the evaluation of graduate theses. Fifth, in terms of writing norms, the thesis should maintain a consistent format, clear logical structure, and precise expression throughout.

In comparison with the fundamental academic requirements for graduate theses, the current graduate theses in electrical and information engineering exhibit several prominent issues, including inappropriate topic selection, insufficient literature review, nonstandard research methodologies and data processing, as well as a lack of adherence to academic writing conventions.

First, the topic selection is inappropriate. Topics are outdated and lack originality, failing to reflect the latest advancements in the electrical and information engineering field. Topics are either too broad or overly ambitious, resulting in papers that lack depth and focus. Topics are either excessively difficult or too easy, failing to align with students' actual research capabilities. Topics are closely tied to the discipline and industry, yet students fail to fully leverage their specialized knowledge to address practical problems. Second, the literature review is inadequate. The literature survey is incomplete and fails to cover the latest research findings in the field of electrical and information engineering. The review commentary is inappropriate and does not accurately reflect the current research hotspots and challenges. Third, research methods and data processing are non-standard. Unreliable research methods or approaches lead to questionable experimental results. Data recording and analysis lack standardization, authenticity, and reliability. Data sources are unclear or plagiarism is present. Fourth, the writing and composition are non-standard. The thesis structure is disorganized, with chapters arranged inappropriately. The language is imprecise, containing grammatical errors and inaccurate use of specialized terminology. Charts, formulas, and other elements are non-standard, impairing readability. Citation formats are inconsistent, lacking necessary references and annotations. Fifth, supervision and management are lax. Faculty advisors exercise insufficient oversight over the content and quality of students' written work. The graduate school and graduate advisors fail to adequately monitor thesis quality, resulting in delayed identification and resolution of issues.

The aforementioned issues not only affect the overall quality of graduate theses in electrical and information engineering but also reflect shortcomings in current electrical and information education. Targeted and effective measures must be implemented to address these deficiencies and enhance the field.

III. FACTORS AFFECTING THE QUALITY OF GRADUATE THESES IN ELECTRICAL AND INFORMATION ENGINEERING

The factors influencing the quality of graduate theses in electrical and information engineering disciplines are multidimensional and intricate. Specifically, these factors are not only deeply rooted in students' individual competency development and academic attitudes but also closely intertwined with institutional training systems, the quality of professional guidance provided by advisors, and external collaborative environments [3-4].

First, students lack sufficient ability and preparation. The lack of adequate capability and preparation among students is one of the key factors affecting the quality of graduate theses in electrical and information engineering. To begin with, graduate education in this field is highly specialized and demands a solid theoretical foundation. However, some students fail to fully

master the core knowledge of relevant courses or lack a deep understanding and practical application of theoretical concepts during their studies. As a result, they often encounter theoretical "bottlenecks" during thesis writing and struggle to effectively apply theoretical knowledge to the solution of real-world problems. Moreover, graduate education emphasizes the cultivation of autonomous learning and independent research abilities, requiring students to actively explore unknown areas and tackle complex problems. Yet, some students remain accustomed to passive learning, lacking motivation and habits for active inquiry. Consequently, during the thesis-writing process, they are unable to stay updated with the latest research developments in their field or independently resolve problems encountered in their work, relying excessively on their advisors or peers. This over dependence limits their personal academic growth and hampers the overall quality of their theses. Finally, writing a thesis is a long and complex process that requires students to manage their time effectively and plan ahead. However, some students struggle to allocate time appropriately between their studies, experiments, and thesis writing. They lack the ability to monitor and adjust their research progress effectively, often resorting to last-minute cramming. This prevents them from identifying and resolving issues that arise during the writing process in a timely manner, ultimately compromising the quality and standard of their thesis.

Second, there are limitations in the intensity and methods of faculty guidance. Advisors are the direct designers of student training programs and the overseers of the entire training process. They exert a significant influence on students' mastery of professional knowledge, as well as their academic attitudes and professional competence. However, as the enrollment scale of higher education institutions expands, the number of students each advisor must supervise continues to increase, making it difficult for advisors to fully dedicate their time and energy to guiding each student's thesis. Particularly in electrical and information disciplines, due to the complexity of research content and lengthy experimental cycles, advisors must dedicate more time and effort to monitor students' research progress and provide specific guidance and advice. However, each student differs in academic background, research interests, and ability levels, necessitating personalized guidance to meet their unique needs. Confronted with multiple responsibilities including teaching, research, and administrative duties, advisors often lack sufficient insight into each student's situation to provide adequate guidance. This results in students being unable to receive timely, targeted assistance when encountering difficulties, ultimately impacting both the quality and progress of their theses.

Third, there is a disconnect between industry demands and academic orientation. Practice serves as an effective means to consolidate theoretical knowledge. Industry demands typically emphasize the practical application of technology and the resolution of real-world problems, requiring research outcomes to be rapidly translated into productive capacity. However, the academic orientation places greater emphasis on the depth, breadth, and innovation of theoretical research, pursuing the accumulation of knowledge and the advancement of disciplines. This difference results in significant variations between the two in terms of research focus, methodology, and objectives. If graduate thesis topics are disconnected from market demands, the research may lack relevance and practicality, making it difficult to effectively translate findings into real-world applications. This not only undermines the thesis's innovation and practical value but may also impact students' employment prospects.

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IV. PATHWAYS TO ENHANCING THE QUALITY OF GRADUATE THESES

Starting from an analysis of the current state of quality in electrical and information engineering graduate theses, this paper identifies existing issues and thoroughly examines the multidimensional factors affecting thesis quality. It then proposes a series of targeted improvement strategies, including strengthening graduate student competency development, enhancing supervisors' research guidance capabilities, optimizing training strategies, and intensifying thesis writing process management. The specific methodology is illustrated in Fig. 1.

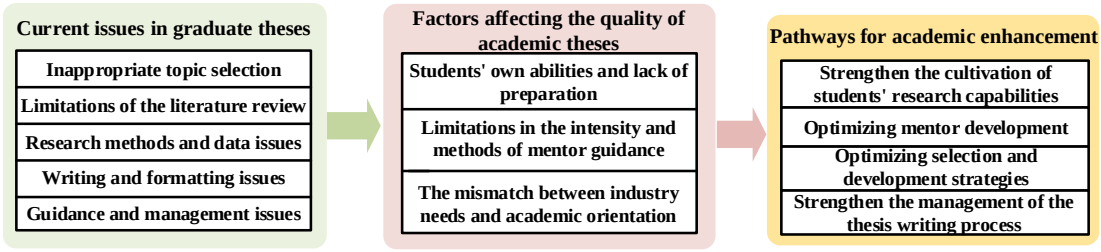

Fig. 1. Pathways for enhancing the quality of graduate theses in electrical and information engineering disciplines

First, the cultivation of students' research capabilities should be strengthened. The core mission of graduate education lies in conducting in-depth exploration of research topics and producing innovative outcomes. Before initiating a research project, graduate students must thoroughly grasp the latest domestic and international research findings and trends within their field. This entails practical validation of key methodologies and core technologies, a deep understanding of existing research, as well as an accurate assessment of unresolved issues, shortcomings in current studies, and the primary challenges and difficulties within the discipline. At this stage, students must possess a certain level of ability to conduct literature searches. Through systematic literature review, seminars, and practical application, students can rapidly master literature retrieval techniques and enhance their reading efficiency, laying a solid foundation for future academic research and innovation. Upon initiating their research projects, graduate students enter a phase of innovative scientific work that demands a clear research approach. This clarity typically does not emerge spontaneously but is cultivated through extensive and deep mastery of existing knowledge, thorough understanding of the research topic, and meticulous analysis and synthesis of literature. At this stage, graduate students should engage in critical reading to examine the research content and key innovations in the literature with a questioning attitude. This includes understanding the experimental methods employed by the authors and the process by which they arrived at their results, comparing these findings with current state-of-the-art methods and technologies, and evaluating their strengths and limitations. Through this meticulous analysis and in-depth discussion, students learn how to scientifically formulate theories and methodologies, design experiments, and conduct statistical analyses. This theoretical study and exploration not only enables students to master key experimental techniques and methods but also significantly enhances their ability to pose and analyze problems.

Practice is the wellspring of innovation and a vital pathway to enhancing innovative capabilities. Higher education institutions should shoulder the responsibility of cultivating graduate students' innovative abilities, placing the enhancement of students' innovative practices and hands-on skills at the core of education. They should focus on nurturing students' innovative spirit, awareness,

and capabilities. Graduate students should engage in independent research throughout the entire process, including designing experimental frameworks, setting parameters, conducting experiments, verifying results, and analyzing data, thereby cultivating innovative capabilities through problem-solving. When facing challenges, graduate students must think independently and resolve issues, which serves as an effective pathway for developing practical innovation skills.

Second, advisors should enhance their research mentoring capabilities. Academic guidance from advisors is the most crucial factor in helping graduate students develop critical thinking skills and build knowledge frameworks, significantly impacting their innovative abilities. Universities may establish a graduate advisor competency training system led by the institution, overseen by academic departments, and involving all faculty members. Regular graduate academic exchange sessions and research-focused symposiums should be organized to facilitate mutual exchange of mentoring experiences among advisors across different research fields. These gatherings enable reflection on teaching successes and shortcomings, distillation of patterns in graduate talent cultivation, and the generation of novel approaches and methodologies for research guidance. This collaborative process fosters an educational philosophy that evolves with the times.

Third, cultivation strategies should be optimized. Currently, China's graduate admissions system exhibits a “strict admission, lenient graduation” pattern, with intense competition for enrollment. Some students often focus solely on entrance exam subjects while neglecting foundational knowledge and relevant coursework in their discipline, which impairs their ability to participate in research projects. Some graduate students do not place sufficient emphasis on their theses, which also leads to a decline in thesis quality. To cultivate graduate students' research and innovation capabilities, universities need to foster a strong academic atmosphere and provide a relaxed research environment. On the one hand, emphasis should be placed on teamwork, encouraging graduate students to tackle research challenges through collaborative efforts and communication. By leveraging each other's strengths and addressing weaknesses, they can enhance problem-solving efficiency and foster innovative thinking. On the other hand, emphasis should be placed on external exchanges by regularly organizing academic exchange activities. This promotes collaboration across disciplines, broadens students' horizons, sparks new research ideas, and lays a solid foundation for enhancing the quality of graduate thesis writing.

Fourth, the management of the thesis writing process should be strengthened. To enhance the quality of graduate theses, implementing strict control over the thesis writing process is crucial. To begin with, graduate-level thesis writing courses should be established to guide students in developing detailed writing plans. This will make the thesis writing process more structured and standardized, helping students maintain progress and complete tasks at each stage in a timely manner. In addition, a dedicated thesis writing guidance platform should be developed to enhance communication between students and their advisors. This will ensure that students receive timely and effective guidance throughout every stage of the graduate thesis writing process—whether it involves the proposal report, interim reports, other various reports, or the actual thesis writing itself.

V. CONCLUSION

Electrical and information engineering disciplines play a vital role in driving technological innovation and economic development. Their applications have significantly enhanced production efficiency, propelled industrial upgrading, and accelerated the process of new industrialization. Improving the quality of graduate theses in electrical and information engineering is crucial for cultivating high-caliber talent and advancing scientific, technological, and industrial progress. In

response to the typical issues currently affecting thesis quality, graduate education institutions should embrace criticism and self-criticism, engaging in thorough reflection and improvement across institutional frameworks, processes, and resource allocation.

- It is necessary to systematically review the critical components of the training system, identify the specific manifestations and underlying causes of subpar thesis quality, such as insufficient research training, limited guidance approaches by advisors, inadequate mastery of research methodologies, and insufficient cultivation of innovative thinking.
- Targeted improvement measures should be developed based on a comprehensive diagnosis, including strengthening foundational research training, optimizing the curriculum structure, enhancing faculty research mentoring capabilities, refining process management mechanisms, and reinforcing academic integrity education. This approach aims to establish a closed-loop management system that progresses from problem identification to measure implementation and ultimately to quality enhancement.
- By continuously advancing these reform initiatives, we can effectively enhance graduate students' research capabilities and thesis quality, providing a more robust talent foundation for the development of electrical and information engineering disciplines. This will propel the professional graduate training system toward continuous progress in high-quality and sustainable development.

ACKNOWLEDGMENT

1. Postgraduate Education Reform Project of Henan Province (2023SJGLX151Y);
2. Postgraduate Education Reform and Quality Improvement Project of Henan Province (YJS2026AL038);
3. Demonstration Curriculum Project for Ideological and Political Education in Graduate Programs of Henan Province (YJS2024SZ08).

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