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Exploration of Quality Improvement in Graduation Projects (Theses) for Vocational Undergraduate Electronic Information Majors

Xiaofeng Luo[1]*, Hongqi Wu[1], Caili Song[2]

[1]School of Electronic Information, Xi'an Vocational University of Automobile, Shaanxi, China
[2]Shaanxi Liuchuan Tonghui Intelligent Technology Co., Ltd., Shaanxi, China

Author to whom correspondence should be addressed.

Abstract: The graduation project (thesis) in vocational undergraduate education aims to demonstrate students' comprehensive application of acquired knowledge and professional skills, with an emphasis on industry-oriented practical implementation. This paper first identifies key issues in vocational undergraduate graduation projects, then proposes solutions using the "Four Truths" principle adopted by electronic information majors at Xi'an Vocational University of Automobile. This approach requires students to solve real-world enterprise problems, deliver tangible outcomes, and gain practical competencies. Improvement measures include: optimizing topic selection to integrate theory with practice; enhancing school-enterprise collaboration to boost corporate involvement; implementing a "dual-tutor" system with jointly built training bases; and refining evaluation mechanisms to increase student engagement. These strategies collectively elevate the quality of vocational undergraduate graduation projects.

Keywords: Vocational undergraduate; Graduation project; School-enterprise cooperation

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1. Introduction

Vocational undergraduate education, a full-time undergraduate program focused on cultivating high-end skilled talents, holds equal importance to regular undergraduate education. It is a new form of undergraduate education that has emerged in the context of deepening the integration of industry and education, as well as school-enterprise cooperation in the field of vocational education. Through on-campus learning, a graduation design (thesis) is required in the fourth year of university, which is designed to showcase students' knowledge, skills, and abilities in their field through research and practice. According to the Ministry of Education's Qualification Assessment Indicators and Basic Requirements for Undergraduate Teaching Work in Vocational Schools, the graduation project (thesis) must meet three criteria: topics should closely align with production and social realities, with appropriate difficulty and workload reflecting professional training requirements; over

50% of the content must be completed through social practices such as experiments, internships, engineering projects, and social surveys; industry experts should participate in guidance and assessment, maintaining a reasonable teacher-to-student ratio, standardized processes, and high quality [1]. Taking the School of Electronic Information at Xi'an Vocational University of Automobile as an example, this article elaborates on the guidance and management model during the implementation of graduation projects (theses), aiming to provide references for related vocational undergraduate institutions.

2. Problems in vocational undergraduate graduation design (thesis)

2.1. Insufficient integration of theory and practice

The selection of topics is overly focused on theoretical research, and some students may only stay at the superficial stages of literature review and data collection. Some students may be too traditional or singular, failing to fully reflect the forefront of industry development and market demand, which limits their innovation capabilities and broadens their perspectives, leading to deficiencies in their ability to solve practical problems.

2.2. Low level of corporate participation

The school-enterprise cooperation mechanisms remain underdeveloped, with limited in-depth enterprise involvement. Consequently, graduation projects lack real-world industrial scenarios and professional guidance, leading to challenges in method selection, data collection, and potential unreliability of results and subjectivity in interpretations.

2.3. Uneven distribution of teacher resources and limitations in practical training conditions

Vocational undergraduate programs emphasize "dual-qualified" teachers, but some schools still need to improve their "dual-qualified" teaching staff. Additionally, certain schools have limited training conditions, which may hinder the implementation of complex graduation projects, thereby affecting the quality of project completion and the effectiveness of students' practical training.

2.4. Imperfections in the evaluation system and insufficient student attitudes and engagement

Graduation theses often follow standard undergraduate requirements and lack attention to practical achievements and innovation, leading some students to adopt a perfunctory approach and resulting in poor-quality graduation theses.

Furthermore, many universities start graduation projects in the 8th semester, clashing with students' job-hunting and exams, leading to insufficient time and poor quality [2].

3. Effective ways to improve the quality of vocational undergraduate graduation projects (theses)

To improve the quality of students' graduation design (thesis) in response to the above issues, it is necessary to gradually solve them from the aspects of topic selection, industry education integration, mentor team, and evaluation system. Taking the electronic information major of Xi'an Vocational University of Automobile as an example, this article analyzes the guidance and operation mode in the implementation process of graduation

design (thesis), as shown in **Figure 1**.

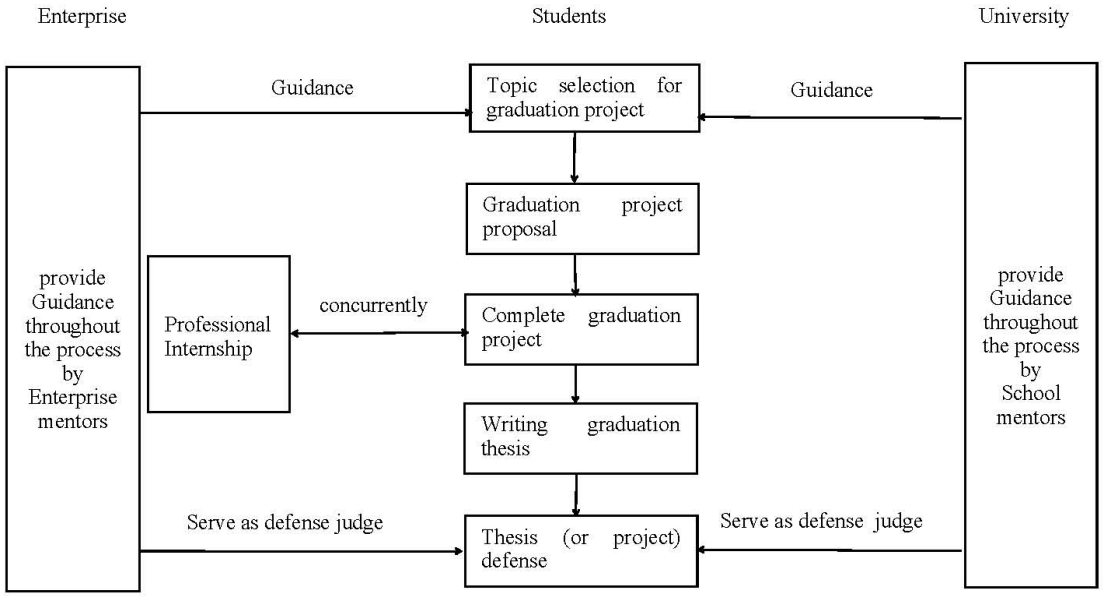

Figure 1. Guidance and operation mode for the implementation process of graduation design (thesis)

3.1. Optimizing the topic selection mechanism and emphasizing the combination of theory and practice

Deepening cooperation with industry enterprises, we establish a standardized information exchange platform and transform real-world technical challenges and product development needs into graduation project topics. This ensures that each topic has a clear application background and market demand, emphasizing practicality, innovation, and relevance to cutting-edge trends.

For example, Xi'an Vocational University of Automobile has collaborated with companies such as Guangzhou Yueqian Communication Technology Co., Ltd., Wuxi Fantai Technology Co., Ltd., and Beijing Huaqing Vision Technology Co., Ltd. In the 2023 and 2024 Internet of Things Engineering programs, graduation projects were derived from actual development projects, ensuring students work on real-world problems from topic selection to completion.

Additionally, students are encouraged to propose their own topics within a defined scope, based on their industry insights and personal interests. Enterprise mentors and academic supervisors then jointly assess feasibility and provide guidance, ensuring a strong integration of theory and practice.

3.2. Deepening industry-academia collaboration and enhancing enterprise engagement

By signing long-term cooperation agreements with enterprises, we jointly establish a project pool, converting real-world technical challenges, product upgrades, and management optimization needs into graduation project topics. This ensures practical relevance and application value. After completing project proposals at school, students conduct professional internships at enterprises (or use enterprise equipment on campus) [3].

For instance, despite pandemic restrictions preventing 2023 IoT students from interning onsite, standards remained uncompromised. To enhance employability and broaden perspectives, we meticulously selected partners like Guangzhou Yueqian Information Technology Co., Ltd., co-designing internship plans aligned with career goals. Resources were pooled to conduct embedded projects, such as STM32-based warehouse monitoring and smart home systems. These projects covered full development cycles—from background

analysis and job role alignment to hardware/software implementation—enabling students to master demand analysis, framework design, module development, system debugging, and corporate culture integration. Through hands-on work, students tackled actual operational challenges, completing graduation designs during internships to achieve tangible outcomes.

3.3. Implementing the "dual-mentor" system and collaborative establishment of laboratory (training) bases by schools and enterprises

Building a "dual-mentor" system guidance team, each electronic information major student in our university is assigned both an academic mentor (campus-based, with rich teaching experience and academic background, responsible for theoretical guidance, research methods, and literature review) and an enterprise mentor (senior engineers or technical experts from relevant industries, providing practical guidance on problem analysis, technical solutions, and on-site operations). Both mentors collaborate in topic selection that integrates theory with practice, and jointly oversee project determination, scheme formulation, mid-term inspection, and result acceptance to ensure graduation designs have solid theoretical foundations and align with industry needs. Through regular communication, dual mentors provide two-way evaluation and feedback to enhance students' academic and practical skills.

Meanwhile, the university collaborates with enterprises to establish laboratories and training bases, introducing advanced equipment and technology platforms to offer real engineering environments. Joint industry-university-research platforms are built to organize regular skills training and project discussions, enabling students to engage in hands-on operations, solve practical production issues, and improve innovation capabilities [4]. Students are encouraged to participate in enterprise R&D projects, applying graduation design results directly to practice and promoting technological achievement transformation.

3.4. Optimizing the evaluation system to enhance student engagement

A scientifically reasonable evaluation system for graduation design (thesis) serves as a critical criterion for measuring and ensuring teaching quality. Through comprehensive and equitable assessment, it ensures that students meet established learning objectives and training requirements during their academic journey, guides them to prioritize and invest in graduation design, encourages in-depth research and active innovation, and effectively evaluates their independent thinking and problem-solving abilities, thereby stimulating initiative and creativity [5]. Moreover, an effective evaluation system not only assesses students but also provides feedback on teachers' instructional effectiveness. By evaluating the quality of graduation projects (theses), teachers can identify strengths and areas for improvement in their teaching methods, content design, and other aspects to further optimize teaching strategies and curriculum development. To enhance the graduation project (thesis) evaluation system, our institution focuses on the following key aspects.

3.4.1. Constructing multiple evaluation indicators for graduation design (thesis)

Establish a multi-dimensional evaluation system covering theoretical research (e.g., circuit design, software architecture, sensor technology, related protocols), practical operation (e.g., hardware/software system design, system debugging), innovation ability, team collaboration, and communication skills. This system not only assesses students' professional knowledge application but also emphasizes their performance and problem-solving capabilities in real-world work scenarios.

3.4.2. Combining process evaluation with outcome evaluation

Throughout the graduation design process, supervising teachers should not only focus on the final outcome but also track and evaluate the students' research attitude, literature reading and analysis abilities, experimental operation skills, scheme formulation, and system debugging during the design. This approach encourages students to fully engage throughout the entire project cycle [6].

3.4.3. Evaluation of "dual-mentors"

Mentor evaluation reflects graduates' overall performance during the graduation design (thesis) process. Compared with other evaluation methods, mentors have a better understanding of the difficulty and workload of students' research topics. Therefore, mentor evaluation accounts for a significant proportion of thesis evaluation. By adopting a "dual-mentor" system, campus teachers and corporate mentors, who jointly guide the graduation project, also participate in the entire evaluation process. This ensures that evaluation opinions consider both academic levels and industry practical needs, enhancing the fairness and comprehensiveness of the evaluation, as shown in **Table 1**.

Table 1. Evaluation of "dual-mentors"

	Campus mentor	Campus mentor	Proportion
Proposal defense	50%	50%	10%
Mid-term examination	70%	30%	20%
Graduation design	40%	60%	30%
Graduation thesis	60%	40%	40%
	Total		100%

3.4.4. Introducing an enterprise expert review mechanism

During the graduation defense phase, industry experts and business representatives are invited to participate in the defense and evaluation, providing the most professional insights and suggestions from an industry perspective for students' graduation designs. On-campus teachers assess from the perspectives of talent cultivation and graduation design (thesis) standardization. This enables students to undergo comprehensive campus and off-campus evaluations, helping them identify strengths and weaknesses, encouraging continuous improvement in future studies and work, and enhancing their understanding of and focus on market demands.

3.4.5. Conducting promotion and education activities for graduation projects

The graduation design works of electronic information students mainly include hardware design, software design, or software-hardware integration. After the graduation defense, each student submits physical hardware works to the college for preservation and records the operational processes of hardware and software via video for submission to professional custodians. Through subsequent campus exhibitions, lectures, and sharing sessions on graduation designs, students can fully appreciate the appeal of electronic information majors and the significance of graduation designs for their future careers, thereby consciously enhancing their focus on this aspect.

4. Conclusion

Improving the quality of graduation projects (theses) for vocational undergraduate electronic information

majors is a complex, systematic task requiring joint efforts from schools, departments, supervisors, and students. Beyond optimizing the topic selection mechanism (emphasizing theory-practice integration), key measures include deepening school-enterprise cooperation to enhance corporate involvement, implementing a "dual-mentor" system with joint school-enterprise construction of experimental (practical) bases, and improving evaluation systems to strengthen student focus. Experienced supervisors can also deliver lectures on literature research, thesis writing standards, and academic integrity education to help students improve the graduation design (thesis) quality from multiple dimensions.

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Disclosure statement

The authors declare no conflict of interest.

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