Research on the Correlation Between Grades and Graduation Project Grades of Engineering Cost Major in Applied Universities

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[**Abstract**] The content of graduation project of engineering cost major is closely related to the ability of job requirements, so it is very important to study the influencing factors of graduation project grades to improve students' graduation project level. This paper analyzes the current situation of graduation project of an applied undergraduate university in Henan Province, and then analyzes the course results of 153 students of engineering cost major in class of 2022, exploring the correlation between grades of graduation project and various professional courses, and finding out the countermeasures to improve students' graduation project level. This study is of great significance for analyzing the influencing factors of graduation project grades, and the analysis results are helpful for students to improve their graduation project level.

[**Key words**] applied university; engineering cost; graduation project grades; correlation analysis

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1 Introduction

Graduation project, as the final comprehensive practical teaching segment in the education of engineering cost, plays a crucial role. It is not only an essential path to achieving the professional training objectives but also a vital platform where students, under the guidance of instructors, apply the fundamental theories, specialized knowledge, and basic skills learned during their undergraduate studies. This component not only enhances students' ability to analyze and solve real-world problems, but also lays a solid foundation for their future work in engineering cost and construction fields. Enhancing the quality of graduation projects is significant for both the individual development of students and the overall reputation of schools. Schools should strengthen the guidance and management of graduation projects to ensure that students can fully utilize their acquired knowledge while completing these projects, fostering practical work skills and innovative spirit. Students should also cherish this valuable practical opportunity, fully engage in their graduation projects, and strive to improve their overall competencies, laying a solid foundation for their future careers.

2 Current status of graduation projects

Currently, the graduation project of our school's engineering cost major involves creating a detailed tender control price, which encompasses two different methods of preparation for civil engineering and installation projects.

However, during the execution of these graduation projects, it has been observed that students are unable to complete this task independently, failing to meet the anticipated educational outcomes. The following analysis will delve into the current state and issues present in the graduation projects.

2.1 Students do not place enough importance on their graduation projects

Our school schedules the graduation project in the last semester of the senior year, requiring students to juggle job hunting and academic work. Students majoring in engineering cost often start their internships in the seventh semester but tend to overlook the importance of the graduation project due to their busy work schedules. Specific issues include: students who have secured internships often leave school midway, believing that their internship alone is sufficient for completing the graduation project; students who haven't found internships are preoccupied with attending job fairs and interviews, making it difficult for them to focus on their graduation projects; some students' internships are unrelated to their major, resulting in a lack of interest in the graduation projects; additionally, students face difficulties in obtaining materials for their graduation projects, relying mainly on guidance from instructors and online resources, which also affects their attention to the graduation projects.

2.2 The topic of the graduation project does not align with the internship

In the field of engineering cost, graduation projects typically revolve around the preparation of bid control prices. The specific direction of such topics is usually determined by the supervising teacher and explained through a detailed task book. This task book outlines projects' type, design content, time schedule, and submission format of the final output. For the calculation of quantities, it requires both manual operations and the use of professional software, adhering to a specific compilation format. For graduates who have engaged in cost work during their internships, these design tasks, while not particularly challenging, involve significant workload. In contrast, those who intern at construction sites or in non-cost fields may face more challenges. Due to the lack of familiarity with pricing software and related pricing documents, students' ability to complete tasks on time and with high quality is limited, thereby affecting their initiative. Only a few students in the class are able to intern at cost-related firms or construction units, closely integrating practical work experience with their graduation projects. These factors undoubtedly have an impact on the progress and quality of the graduation projects.

2.3 Students' comprehensive application ability of professional knowledge is weak

The aim of training students in the field of engineering cost is to cultivate professionals who can accurately estimate costs, are familiar with construction processes, and are proficient in analyzing drawings. During their university studies, they delve into key courses such as interpretation of architectural drawings, construction methods, cost accounting, and engineering economics. However, the performance of graduates in completing bid control price preparation tasks in recent years has revealed some issues: many students can only apply the knowledge they have learned to a single course, lacking the ability to integrate it across disciplines. Due to limited opportunities to engage with real-world engineering projects, students often feel overwhelmed when faced with complex engineering drawings, exhibiting deficiencies in several aspects of comprehensive skills:

(1) Insufficient proficiency in interpreting drawings: Many students, upon receiving a complete set of engineering drawings, are unable to effectively identify the starting point of reading, lack the knowledge on how to systematically analyze the content of the drawings, struggle to connect architectural and structural designs, and have a vague understanding of the annotations on the drawings.

(2) Inadequate mastery of calculation rules for quantities: Insufficient understanding of the calculation rules in professional standards leads to discrepancies in quantity calculations.

(3) Weak application ability of list and quota: In the process of preparing the budget, students often do not

know how to effectively make the material list or how to correctly apply the quota for cost estimation.

The existence of these issues indicates a need to bolster practical teaching and enhance students' ability to apply theoretical knowledge in real-world scenarios, thereby better equipping them for future career development.

3 Research methods and countermeasures

3.1 Research subject

This study focuses on analyzing the correlation between the graduation project grades and their grades in various subjects of our school's engineering cost major graduates over the past three years during their undergraduate studies. Through this analysis, we aim to explore effective strategies to enhance students' performance in the graduation project phase, thereby strengthening their career adaptability and improving our school's overall influence.

3.2 Research methodology

This study has continuously observed students' academic performance in on-campus courses from their enrollment to graduation over a period of four years, comparing and analyzing it with their graduation results. The analysis was conducted using SPSS software to explore the inherent correlations and differences. To enhance the reliability of the analysis, only quantitative examination results were considered for analysis, excluding qualitative assessment results such as excellent, good, fair, and pass.

4 Empirical analysis

4.1 Research subject

In this study, we selected 153 students from the engineering cost major in class of 2022 for analysis. The research covers their scores in 11 specialized courses taken during their studies. All grades were assessed using a percentage system, with the smallest scoring unit being an integer 1. For instances where students are unable to participate in exams due to disciplinary actions or absences, their scores are recorded as 0. Moreover, for students who re-take exams, only their last attempt's score can be recorded. The detailed information about these data is shown in Table 1.

Table 1. Student grades for various subjects

Student Number	Measurement and Pricing of Installation Engineering	House Construction	Engineering Economics	Engineering Mechanics	Construction Project Management	
1	73	74	92	85	93	……
2	71	87	86	85	94	……
3	71	66	75	86	89	……
4	77	92	90	94	94	……
5	72	89	87	86	92	……
6	64	84	86	92	92	……
7	78	69	88	87	100	……
8	61	70	90	68	93	……
9	73	90	96	95	92	……
10	54	63	61	63	70	……
……	……	……	……	……	……	……

4.2 The correlation between graduation project grades and course grades

The analysis focuses on the data of the 2022 graduates, examining the correlation between students' graduation project grades and their scores in various specialized courses within the school by calculating the Pearson correlation coefficient(as shown in Table 2). Among our school's subjects, Engineering Mechanics has the highest correlation with the graduation project ($r = 0.501$, $P < 0.001$), followed by Engineering Economics, Quantity Surveying and Cost Estimation in Construction Engineering, and Building Structures. However, the correlation between Engineering Drawing and Recognition and the graduation project grade is relatively low ($r = 0.220$). Nevertheless, there are certain courses that are essential for completing the graduation project but cannot be quantitatively analyzed due to being assessed without specific scores, such as Application of Engineering Cost Software and Drawing Recognition of Reinforced Steel.

Table 2. Correlation analysis between graduation project grades and academic course grades

Courses	The Pearson correlation with graduation project grades	Prominence
Measurement and Pricing of Installation Engineering	0.277 **	0.001
House Construction	0.245 **	0.002
Engineering Economics	0.475 **	0.000
Engineering Mechanics	0.501 **	0.000
Construction Project Management	0.360 **	0.000
Bidding and Contract Management in Engineering	0.322 **	0.000
Engineering Drawing and Recognition	0.220 **	0.006
Quantity Surveying and Cost Estimation in Construction Engineering	0.416 **	0.000
Building Structure	0.376 **	0.000
Civil Engineering Materials	0.319 **	0.000
Civil Engineering Construction	0.323 **	0.000

**: At the 0.01 level (two-tailed), the correlation is significant. *: At the 0.05 level (two-tailed), the correlation is significant.

4.3 Correlation analysis between the grades in various courses of engineering cost major

In assessing the strength of correlation between variables, we define their closeness based on the absolute value of the correlation coefficient. Specifically, if this value is between 0 and 0.09, it is generally considered that there is no significant correlation between the two variables; a range of 0.1 to 0.3 indicates a slight correlation; an absolute value of the correlation coefficient falling between 0.3 and 0.5 represents a moderate level of correlation; and when this figure increases to the interval of 0.5 to 1.0, it strongly suggests a high degree of correlation between the two variables. This study particularly focuses on the analysis of correlations among various professional course grades within the field of engineering cost, at least showing a moderate or higher level of intensity. This focus aims to deeply explore the intrinsic connections and mutual influences between courses, with detailed data presented in Table 3. To be clearly displayed in the table, courses are represented as follows: X1 for Measurement and Pricing of Installation Engineering, X2 for House Construction, X3 for Engineering Economics, X4 for Engineering Mechanics, X5 for Construction Project Management, X6 for Bidding and Contract Management in Engineering, X7 for Engineering Drawing and Recognition, X8 for Quantity Surveying and Cost Estimation in Construction Engineering, X9 for Building Structure, X10 for Civil Engineering Materials, and X11 for Civil Engineering Construction.

Table 3. Correlation analysis between the grades in various courses of engineering cost major

Courses	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11
X1	1										
X2	0.351 **	1									
X3	0.431 **	0.396 **	1								
X4	0.401 **	0.510 **	0.508 **	1							
X5	0.203 *	0.342 **	0.563 **	0.527 **	1						
X6	0.074	0.159	0.351 **	0.230 **	0.458 **	1					
X7	0.294 **	0.332 **	0.266 **	0.281 **	0.193 *	0.034	1				
X8	0.462 **	0.308 **	0.489 **	0.540 **	0.474 **	0.254 **	0.307 **	1			
X9	0.512 **	0.217 **	0.648 **	0.493 **	0.411 **	0.325 **	0.262 **	0.564 **	1		
X10	0.417 **	0.407 **	0.522 **	0.514 **	0.452 **	0.189 *	0.217 **	0.472 **	0.498 **	1	
X11	0.269 **	0.313 **	0.501 **	0.473 **	0.451 **	0.262 **	0.232 **	0.480 **	0.540 **	0.528 **	1

**: At the 0.01 level (two-tailed), the correlation is significant. *: At the 0.05 level (two-tailed), the correlation is significant.

5 Reform ideas for graduation projects

5.1 Improving the topic selection process by integrating it with graduation internships to broaden the range of topics

Currently, the graduation project in the field of engineering cost focuses primarily on preparing bid control prices, which is somewhat monotonous. To enrich this process, it is recommended to introduce diverse design patterns based on students' internship experiences. In terms of topic selection, besides traditional teacher-assigned topics, students should also be encouraged to choose their own topics according to the positions and content of their internships. For instance, students who have interned as construction workers could be encouraged to combine the projects they have worked on with their professional knowledge, to select topics such as preparing construction organization design schemes or papers focused on specific construction techniques for their graduation projects. Moreover, students can write reports based on the organizations, positions, content and personal reflections of their internships, using these as their graduation achievements. Therefore, teachers should broaden their perspective and scope in topic selection, not only considering actual projects, research topics, and curriculum content from training programs but also paying attention to students' job positions and career directions; at the same time, encourage students to independently choose topics based on their interests, internship content, and positions, thereby optimizing topic selection from multiple angles and comprehensive ways.

5.2 Improving the rules for grade assessment

The evaluation ratio should be changed. Previously, it was a multi-dimensional evaluation model consisting of the guidance teacher (30%), reviewing teacher (20%), and defense panel (50%). During the defense, the questions asked by the judging teachers are repetitive, which benefits students who defense later in the sequence. The short 10-minute defense period cannot fully demonstrate a student's true capabilities. As most of our faculty members are young teachers with limited experience, and some teachers are temporarily drawn from other disciplines and are not very familiar with the content of engineering cost, scoring tends to be more subjective. In order to obtain certificates of excellence as guidance teachers and associated bonuses, some young teachers at our school have been known to preemptively inform judging teachers and ask for favoritism, resulting in discrepancies between the defense outcomes and students' actual abilities. Therefore, it is suggested that the evaluation ratio be revised, shifting from being primarily based on the defense panel to focusing on the guidance teacher, as they have a clearer understanding of each student's theoretical foundation, learning attitude, communication intensity, and other relevant aspects. This allows for a more objective assessment of students' real performance during their four

years in college and their graduation projects, thereby fostering a diligent and earnest work ethic among students.

6 Conclusion

Recent literature has shown a positive correlation between students' comprehensive grades and their graduation project grades. However, there is scarce research on the specific relationship between individual course grades and graduation project grades. This study reveals that courses such as Quantity Surveying and Cost Estimation in Construction Engineering, Engineering Drawing and Recognition, and House Construction have lower correlation with graduation project grades compared to Engineering Mechanics. Despite this, knowledge from these courses is essential for completing a graduation project in engineering cost major, including using Engineering Drawing and Recognition to understand construction drawings and applying Quantity Surveying and Cost Estimation in Construction Engineering for manual calculation of quantities in the initial floor. The relatively low correlation between these course grades and graduation project grades suggests that the assessment methods of these courses do not focus on practical application. Instructors teaching Engineering Drawing and Recognition should not assign simple exercises that are identical and overly simplistic for all students, as they fail to evaluate students' true capabilities. For Quantity Surveying and Cost Estimation in Construction Engineering, teaching should not be based on very simple cases. Instead, students could be divided into groups and each group could be asked to practice with a set of drawings, which would encourage broader understanding. Instructors of courses like Quantity Surveying and Cost Estimation in Construction Engineering, Engineering Drawing and Recognition, and House Construction should align their teaching with the requirements of the graduation projects. They should use drawings of similar complexity to those in graduation projects rather than simpler ones, focusing on theoretical teaching, practical skills training, and evaluation methods to seamlessly integrate teaching with graduation projects. Additionally, courses such as Application of Engineering Cost Software and Drawing Recognition of Reinforced Steel show a significant correlation with graduation projects. However, these courses at our school are assessed through examinations with results categorized as excellent, good, average, or pass, which does not allow for quantitative analysis. As they are examination-based courses, students tend to lack motivation due to the perception that passing is guaranteed. It is recommended that these courses be changed to exam-based to improve students' graduation project grades, thereby enhancing their overall capabilities to meet job requirements.

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