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Research on Teaching Reform of “Installation Engineering Measurement and Valuation” Based on the Xuexitong Learning Platform

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Abstract: With the deepening integration of information technology and education, the blended online-offline teaching model has emerged as a major direction in higher education reform. Traditional instructional approaches in courses such as “Installation Engineering Measurement and Valuation” often face challenges including abstract theoretical content, inadequate practical training, low student engagement, and oversimplified evaluation systems. To address these issues, this study utilizes the Xuexitong Learning Platform to explore and implement teaching reforms. The reform is designed to establish a student-centered and competency-oriented teaching framework. Key initiatives include restructuring the curriculum and content, redesigning blended teaching processes, enhancing practical components, and refining assessment mechanisms. Empirical evidence indicates that the Superstar-based blended teaching model effectively increases students’ initiative and participation, improves the efficiency and depth of classroom interactions, and facilitates the integration of theoretical and practical knowledge. It also helps develop students’ core professional competencies-such as blueprint reading, quantity calculation, and cost estimation-while supporting a more comprehensive, objective, and dynamic evaluation of the learning process. This approach not only enhances instructional quality and outcomes in the “Installation Engineering Measurement and Valuation” course but also offers valuable insights for reforming other practice-oriented engineering courses.

Keywords: Xuexitong Learning Platform; Installation Engineering Measurement and Valuation; Blended Learning; Teaching Reform

1. Introduction

In the current digital era, information technology is transforming education at an unprecedented pace and scale, leading to profound shifts in instructional models. Blended online-offline teaching, along with emerging formats such as AI-powered teaching assistants, are increasingly recognized as important directions in higher education reform. These approaches capitalize on the wealth of available online resources while retaining the efficiency of face-to-face interaction.

“Installation Engineering Measurement and Valuation” is a core engineering course distinguished by its highly practical and application-oriented nature. It plays an essential role in developing students’ core professional competencies, such as the ability to interpret engineering drawings, perform quantity calculations, and estimate construction costs. The effectiveness of instruction in this course has a direct impact on students’ future professional advancement within the engineering sector [1].

However, traditional instructional approaches in “Installation Engineering Measurement and Valuation” face several significant challenges. Chief among these is the highly abstract and theoretically dense nature of the course content, which students often find difficult to master. As noted by Wan Xin, the field of installation engineering encompasses a broad scope and a complex knowledge system, requiring foundational understanding across multiple disciplines including water supply and drainage, HVAC, and electrical engineering [2]. Similarly, Zhu Li of the Guangxi Institute of Ecological Engineering Technology has highlighted that the course involves intensive information, demands strong practical skills, and aims to cultivate multi-dimensional technical talents with integrated competencies [3].

Furthermore, the prevailing teaching model remains predominantly unidirectional, prioritizing knowledge transmission over active student engagement. This instructor-centered approach hinders the ability of learners to relate abstract theories to practical engineering contexts, thereby limiting the effective transfer of theoretical knowledge to real-world applications.

Secondly, there is inadequate emphasis on practical skill development. Constraints such as limited class hours and a lack of hands-on opportunities prevent students from fully developing operational competencies, resulting in insufficient mastery of measurement and pricing techniques. Furthermore, student participation remains low, with limited classroom interaction and diminished enthusiasm and initiative for learning. Fang Jihan from Liaocheng University proposed that the content and objectives of the installation measurement and pricing course need to be upgraded, and the traditional teaching mode can no longer meet the needs of teaching [4]. Tian Xing proposed that the “Installation Engineering Measurement and Valuation” course is highly comprehensive, and traditional teaching mainly focuses on theoretical learning, lacking practical skills [5].

Finally, the evaluation system remains predominantly focused on final examination results, which fails to capture the complexity of the learning process or provide a holistic assessment of students’ comprehensive abilities. These shortcomings collectively inhibit meaningful improvements in teaching quality and restrict the development of students’ multidimensional competencies. In light of this, Deng Taiping (Sichuan University of Arts and Sciences) has advocated for a shift away from traditional monolithic evaluation models, calling for updated pedagogical approaches and clearer alignment with contemporary learning objectives [6]. Echoing this concern, Hu Ziyan from Guangdong Huali University further noted that the existing assessment framework lacks the flexibility to accommodate varying learning contexts across different classes, and overlooks critical dimensions such as students’ attitudes, foundational knowledge, psychological adaptability, and resilience—factors essential for a thorough evaluation of student development [7].

In this context, the present study utilizes the Xuexitong Learning Platform to investigate teaching method reforms in the course “Installation Engineering Measurement and Valuation”. The objective is to develop a student-centered, competency-driven instructional model designed to address limitations inherent in traditional pedagogy and enhance both the quality and effectiveness of course delivery.

2. The Current Status and Limitations of Traditional Teaching in “Installation Engineering Measurement and Valuation”

2.1 Teaching Schedule and Current Situation

The course “Installation Engineering Measurement and Valuation” is structured with 48 hours of theoretical instruction and 24 hours of practical training. The theoretical component covers economic and technical indicators across various sub-disciplines—including electrical engineering, water supply and drainage, and HVAC (heating, ventilation, and air conditioning)—as well as methodologies for preparing engineering budget documents. As a highly practice-oriented course, it aims to equip students with the ability to apply industry standards, utilize consumption quotas, perform quantity take-offs from drawings, and calculate installation project costs. Emphasis is placed on enhancing proficiency in using budgetary norms and valuation standards.

The practical segment focuses on instructing students in the operation of widely-used measurement and valuation software, such as Guanglianda’s Installation Engineering GQI2021 and the cloud-based pricing platform GCCP6.0. This segment includes detailed demonstrations of measurement procedures for specialized fields including electrical and water supply/drainage engineering. Through hands-on computer exercises, students develop foundational skills in software-based quantification and pricing. A detailed breakdown of the course structure is provided in Table 1.

Current teaching practices in the course predominantly rely on a traditional instructor-centered approach, characterized by unidirectional knowledge transmission and limited student engagement [8]. Furthermore, practical software sessions are constrained by large class sizes and limited instructional time, which reduces the capacity for individualized guidance and results in slow development of software operational skills among students. Although the course design module is intended as a major practical component, the absence of structured process supervision and consistent feedback has led to inconsistent student commitment and considerable variability in the quality of final design outputs.

Table 1. Teaching Content Arrangement of "Installation Engineering Measurement and Valuation"

No.	Teaching Module	Teaching Content	Time Allocation
1	Theory of Installation Engineering Cost	1. The pricing basis for engineering cost, such as quota, bill of quantities pricing standards, etc; 2. The basic pricing methods for engineering costs include the concepts, processes, and scope of application of the quota pricing method and the bill of quantities pricing method.	4
2	Measurement of water supply and drainage system	1. Common types of water supply and drainage systems; 2. Measurement of water supply and drainage pipelines, including calculation rules for the length of pipelines of different materials and specifications, and measurement methods for pipeline supports; 3. Measurement of sanitary appliances, such as washbasins, toilets, bathtubs, etc; 4. Measurement rules for accessories such as valves and water meters, as well as measurement methods for pipeline rust removal, oil painting, insulation, and other projects. 5. Application of relevant quotas and calculation of various expenses.	12
3	Measurement and Pricing of Electrical Engineering	1. Common systems in electrical engineering; 2. Measurement of piping and wiring, determining the length based on different laying methods and materials; 3. Quantity measurement of electrical appliances such as lamps, switches, sockets, etc; 4. Measurement rules for cables, busbars, etc; 5. Application of relevant quotas and calculation of various expenses.	12
4	Measurement and valuation of fire engineering	1. Classification of fire protection engineering; 2. Calculation of the quantity and length of fire pipes, fire hydrants, sprinkler heads, alarm devices, etc; 3. Measurement of equipment such as fire pumps and fans; 4. The pricing method for equipment and materials used in fire engineering, as well as the calculation of various costs based on the project situation.	10
5	Building ventilation and air conditioning system	1. Introduction to ventilation and air conditioning system; 2. Size calculation of ventilation ducts; 3. Measurement of ventilation and air conditioning equipment; 4. Measurement rules for air duct components; 5. Pricing points related to ventilation and air conditioning systems, selection of equipment and material prices, and installation costs.	10

2.2 The Disconnect between Theoretical Knowledge and Practical Application

"Installation Engineering Measurement and Valuation" covers extensive specialized terminology, calculation rules, and normative standards—much of which is highly theoretical and abstract. In conventional teaching environments, instruction often emphasizes the delivery of isolated knowledge points rather than contextualized application. This approach frequently lacks meaningful connection to real engineering scenarios, hindering students' ability to understand how theoretical principles are employed in practice. As a result, the learning process may become monotonous and unengaging, ultimately restricting students' capacity to convert abstract knowledge into practical problem-solving abilities [9].

During the 48-hour theoretical instruction, instructors often accelerate the pace to cover essential content—including drawing interpretation, construction techniques, and measurement and valuation methods—across three sub-disciplines: water supply and drainage, HVAC, and electrical engineering. Substantial time is devoted to enumerating technical concepts, often neglecting their practical application within real engineering contexts. Consequently, students assume a passive learning role, hindering the development of deeper conceptual understanding and applied skills.

For example, when teaching the calculation of pipeline supports in water supply and drainage, instruction typically focuses solely on weight formulas correlated to pipe diameters. Practical aspects—such as installation positioning, spacing standards, and material variations dictated by different pipeline media—are rarely demonstrated. Students thus learn mechanical formula application without understanding how to accurately quantify supports in real projects.

A similar issue arises in the valuation of cable termination and splicing in electrical engineering. Instruction often emphasizes listing standardized quota items and base prices for various cable types, without examining real-world applications—such as the use of cable terminal heads versus intermediate heads—or addressing how varying construction conditions may affect pricing strategies. This gap frequently leads to errors in item selection and pricing in practical assignments, such as graduation projects, where students are required to produce bill of quantities and cost estimates.

2.3 Weak Practical Teaching Link

The course is highly practical, requiring students to develop applied skills such as construction drawings reading, quantity calculation, and cost estimation. However, traditional teaching methods often overlook or simplify hands-on training. Installation engineering comprises three major systems, each containing multiple subsystems; even a simple residential building design includes over one hundred drawings per specialized discipline. Although the 24-hour computer lab session offers some practical exposure, the extensive content and high intensity of the coursework leave insufficient time for adequate practice. Consequently, even with optimal instruction, the development of proficient practical skills remains difficult to achieve.

During computer lab sessions, students are often limited to practicing only a selection of simplified yet essential software operations, which fails to adequately reflect the full scope of real-world engineering projects. Owing to time constraints, instruction prioritizes overarching measurement concepts before introducing software tools such as GCCP for integrated pricing exercises. Additionally, the high number of students makes it difficult to provide individualized support, leading to unresolved operational difficulties that undermine learning outcomes. Meanwhile, students who are introverted, less confident, or passive may struggle to seek help proactively. Without structured guidance and ongoing supervision, such students often face unresolved issues during the design process, resulting in mediocre project quality.

2.4 Low Student Initiative and Participation In Learning

The traditional classroom model remains predominantly teacher-centered, positioning students as passive recipients of knowledge rather than active participants. This approach offers few opportunities for meaningful interactive activities and limits communication between instructors and students, which in turn diminishes learning enthusiasm and initiative. During the 48-hour theoretical instruction period, students often devote considerable time to mechanical note-taking and memorization of isolated knowledge points, with little emphasis on critical thinking or independent inquiry. As a result, knowledge retention and conceptual understanding remain limited.

2.5 Single Assessment and Evaluation Method

The traditional assessment system relies predominantly on final examination results, emphasizing the evaluation of students' theoretical knowledge retention while neglecting their learning processes, practical competencies, and comprehensive skills. This narrow approach fails to provide a holistic reflection of student progress and may encourage rote memorization for exam performance rather than meaningful understanding. Consequently, such a system is ill-suited to fostering innovative thinking and practical abilities [10].

In the 2019 edition of the teaching syllabus, the evaluation system assigns a disproportionately high weight to final exam results within the overall grading structure. This emphasis incentivizes excessive focus on examination performance at the expense of consistent engagement throughout the learning process and participation in practical activities. Consequently, some students exhibit minimal effort during regular instruction, resorting to last-minute cramming shortly before exams. Although this approach may yield superficially acceptable final grades, it often fails to reflect genuine mastery of the course's core knowledge and competencies.

3. Teaching Reform Measures for "Installation Engineering Measurement and Valuation" Based on Xuexitong Learning Platform

To enhance student learning outcomes and reduce instructional burdens, educational reforms should more effectively integrate existing artificial intelligence technologies and leverage these tools to address practical teaching challenges. In response to the issues previously identified, and in alignment with the specific characteristics of the "Installation Engineering Measurement and Valuation" course—including its allocation of 48 theoretical hours and 24 computer lab hours—a systematic instructional redesign will be implemented across four dimensions: teaching content, instructional process, practical training, and assessment. Supported by the Learning Platform, this reform aims to establish a teaching framework characterized by modularized content, blended learning processes, project-based practice, and process-oriented evaluation. The ultimate goal is to improve educational quality and strengthen students' core competencies.

3.1 Refactoring the Teaching Content System

Guided by competency-based educational principles, the teaching outline for the course "Installation Engineering Measurement and Valuation" has been restructured. The course content is modularized and segmented according to a systematic logical framework, forming several interrelated yet self-contained knowledge modules. Examples include the water supply and drainage engineering measurement and valuation module, and the electrical engineering measurement and valuation module. Each module is further subdivided into smaller, discrete learning units, facilitating step-by-step student comprehension and mastery.

At the same time, practical engineering cases drawn from installation projects of varying types and scales are integrated into each knowledge module. The inclusion of real-world examples helps bridge abstract theoretical concepts with concrete engineering applications, enabling students to contextualize knowledge within professional practice and strengthening their analytical and problem-solving skills. Instructors can use the Xuexitong Learning Platform to systematically organize and upload these modularized knowledge components and practical cases, and to develop supplementary resources such as task modules, mind maps, and knowledge graphs. This structure supports flexible and self-paced learning, allowing students to access materials conveniently at any time.

3.2 Design a Blended Learning Process

Leveraging the full functionality of the Learning Platform, a scientifically structured blended learning process is designed to ensure seamless integration across pre-class, in-class, and post-class activities.

Prior to each session, instructors distribute preview materials—such as instructional videos, PowerPoint slides, key concept summaries, and relevant case studies—via the Xuexitong Learning Platform. These resources enable students to familiarize themselves with upcoming content and identify core learning objectives in advance. Additionally, students are encouraged to pose questions in the platform's discussion forum during their preview. Instructors can then address these inquiries in a timely manner, fostering a more interactive and prepared learning community.

During class sessions, instructors utilize the Learning Platform to facilitate diverse interactive activities. Attendance is efficiently managed through the platform's automated check-in feature, minimizing time spent on administrative tasks. Real-time quizzes and interactive questioning are used to stimulate student interest and evaluate their pre-class preparation. Additionally, group discussions are organized to encourage in-depth exploration of specific issues, fostering collaborative skills and critical thinking. By monitoring student participation and response patterns, instructors can dynamically adjust instructional pacing and strategies, thereby enhancing the relevance and effectiveness of classroom teaching.

After class, instructors assign homework via the Xuexitong Learning Platform, which students complete and submit online. This enables prompt grading and individualized feedback. Additionally, instructors can share supplementary learning resources—such as relevant industry news, the latest regulatory standards, and exemplary engineering cases—to encourage self-directed learning and knowledge expansion. These materials help students broaden their understanding and stay current with professional practices.

3.3 Strengthen the Practical Teaching Process

The practical teaching process is reinforced through the Xuexitong Learning Platform to strengthen students' practical skills. Instructors post real-world project tasks tailored to the curriculum and students' proficiency levels, specifying task objectives, deadlines, and evaluation criteria. These tasks may include simulating measurement and valuation processes for actual engineering projects, or focused exercises targeting specific technical knowledge points.

The Xuexitong Learning Platform offers students a wide range of practical resources. Instructors can share actual engineering drawings, specifications, standards, calculation software, and other relevant materials on the platform, enabling students to access and utilize these resources at any time. Throughout the project task cycle, teachers provide ongoing guidance, respond promptly to student inquiries, and monitor and evaluate progress and output quality via the platform.

Upon completion of the project tasks, students upload their outcomes to the Learning Platform and deliver in-class group presentations to demonstrate their progress, results, and learning insights. Instructors facilitate peer evaluation sessions, enabling students to assess one another's work constructively. This process encourages mutual learning and enhances both evaluative skills and professional competence. Through these reinforced practical activities, students develop core professional capabilities—including blueprint reading, quantity calculation, and collaborative pricing—within an authentic operational context.

3.4 Optimize the Assessment and Evaluation Mechanism

A multidimensional process-oriented evaluation system has been established to optimize the assessment framework. Evaluation criteria encompass multiple dimensions, including online learning engagement, classroom participation, midterm assessments, project-based assignments, final examinations, and project presentations.

Online learning metrics primarily consist of pre-class preparation, video viewing duration, and timely submission of assignments. The Learning Platform automatically records and analyzes these indicators, providing objective data to assess students' learning attitudes and self-directed learning abilities.

Classroom participation is evaluated based on factors such as attendance, response quality during questioning, and contributions to discussions and presentations. Instructors assign scores according to observed engagement levels, which reflect students' interaction skills and learning motivation. Mid-term assessments are administered following the completion of each knowledge module. These tests evaluate students' grasp of key concepts within the module, enabling early identification of learning gaps and facilitating timely remediation. Project assignments serve to assess practical competencies. Evaluation criteria include the quality of deliverables, innovation demonstrated, and effectiveness of collaboration within teams. The final examination is conducted under closed-book conditions and aims to measure students' overall understanding of the course material as well as their ability to synthesize and apply knowledge comprehensively.

The project report requires students to work in groups to present and explain their project outcomes, covering aspects such as methodology, workflow, results, challenges encountered, and solutions adopted during the engineering measurement and valuation process. Instructors and peers evaluate the reports based on content quality, clarity of expression, and logical coherence. This exercise enhances students' communication and teamwork abilities while providing instructors with a more holistic understanding of each student's project proficiency.

Through the implementation of this multidimensional process-oriented evaluation system, a more comprehensive, objective, and dynamic assessment of the student learning process can be achieved. This approach mitigates the limitations associated with sole reliance on final examinations and offers a more accurate reflection of students' true learning outcomes and comprehensive competencies. A comparative analysis of pre- and post-reform outcomes for the "Installation Engineering Measurement and Valuation" course is illustrated in Figure 1.

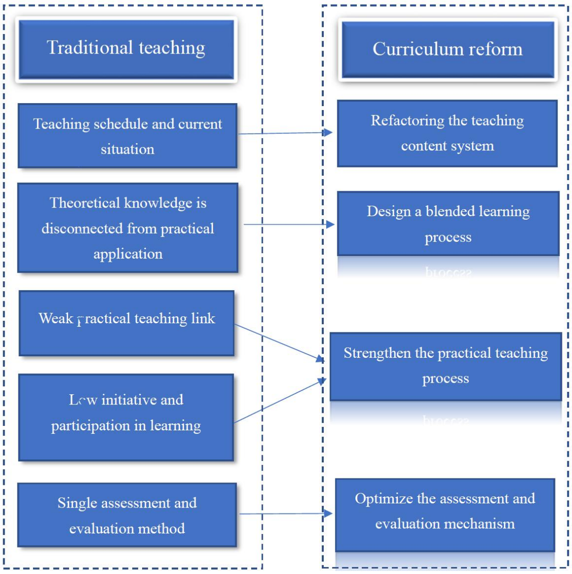

Figure 1. Comparison before and after the Teaching Reform of "Installation Engineering Measurement and Valuation" Course

4. Conclusion

Based on the Xuexitong Learning Platform, the teaching reform in "Installation Engineering Measurement and Valuation" has established a student-centered instructional model oriented toward competency development. This was achieved through restructuring the curriculum, designing blended learning processes, enhancing practical components, and optimizing the assessment mechanism. The reform effectively addresses limitations of conventional teaching methods by increasing student initiative and participation, improving the efficiency and depth of classroom interaction, and integrating theoretical and practical learning. It also strengthens core professional skills, enables a more comprehensive and objective evaluation of the learning process, and significantly enhances both the quality and effectiveness of course delivery.

In future teaching practices, the functionality of the Learning Platform can be further expanded through integration with emerging technologies such as virtual reality (VR) software, AI-powered teaching assistants, and intelligent Q&A systems. These innovations can help create more immersive learning environments and enhance the overall educational experience. Additionally, the incorporation of a wider range of real-world engineering project cases will allow students to better understand industry demands and practical workflows. Such continuous improvements will ensure that teaching reforms remain aligned with both contemporary advancements and the evolving needs of student development.

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