Integrated Practice Curriculum and Moral Education in Engineering Education: Cultivating Quality Engineers for Sustainable Development

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Abstract: With the deepening accreditation of engineering education, the importance of integrated practical courses in engineering programs has become increasingly evident. This study uses the Building Environment and Energy Applications Engineering major as an example to explore the construction of an integrated practical course system and its application in ethical educatio*n*. This article begins by defining the concept of integrated practical courses, which involves integrating various practical courses into a cohesive teaching unit built upon professional theory courses aimed at enhancing students' ability to solve complex engineering problems. Subsequently, the paper underscores the significance of ethical education in practical courses, proposing the objectives and implications of integrating IE elements into professional course instruction. The goal was to foster students' professional competence and career responsibilities. The article then details the design principles of ethical education in integrated practical courses, the evaluation system, and specific implementation strategies. These strategies include enhancing instructors' moral qualities, optimizing course content, and reforming the assessment system. Finally, the effectiveness of IE in improving students' overall quality was demonstrated through case studies. The results indicate that integrated practical courses effectively combine professional knowledge with ethical education, offering new perspectives and methods for cultivating high-quality engineering and technical talent in line with engineering accreditation standards.

Keywords: Integrated Practice Curriculum; Engineering Education Accreditation; Moral Education; Curriculum Design; Teaching Quality

1. Integrating Practical Coursework into Theoretical Instruction

The rapid development of information technology teaching has gradually diversified the teaching of engineering courses, and the teaching and practice activities between subjects of the same specialty are more closely linked. Against the background of engineering education certification of this specialty, the ultimate purpose of engineering curriculum teaching reform is to cultivate high-quality engineering and technical talent for the country [1]. As a long-established specialty in engineering, the construction and environment program mainly studies the basic knowledge and skills of the physical environment of a building, building energy conservation, intelligent technology of building facilities, etc., and designs, installs, operates, and accepts the systems of heating, gas supply, ventilation, and air conditioning for industrial and civil buildings, which are inextricably linked to actual engineering. China's "Engineering Education Accreditation Standards (2017 Revision)" points out that the graduation attainment requirements for graduates of the construction environment program: can be engaged in the planning and design, construction and installation, operation and management, research and development and manufacturing of industrial and civil building heating, ventilation and air conditioning systems, etc., and has solid basic theoretical knowledge and professional ability of the application of senior engineering and technical personnel [2]. Corresponding to the standard of engineering certification, in order to avoid the

emergence of professional courses without corresponding content support and can not be implemented, so that the evaluation towards the formalization, superficial, can not guarantee the effective cultivation of the quality of talent, damage to the value of engineering education professional certification of the consequences , construction of the environment of the professional courses and practice courses of the courses can not be taught separately, we must do a good job in the construction of the professional curriculum system, the practice of the courses in the professional theoretical courses, based on an organic teaching whole, to form an organic teaching. In order to make the students in the whole process of practical learning, not only can they run the learned mathematics, professional basic theory, and engineering basic knowledge to solve the actual complex engineering problems, but also be good at using professional knowledge in the field of construction and environmental engineering, reasonable analysis of complex problems, in-depth understanding and mastery of the principles of engineering management and economic decision-making methods, and applying them in an interdisciplinary environment [3]. Taking the undergraduate teaching of construction and environmental engineering as an example, the practical courses are mainly concentrated in the junior and senior years, such as building HVAC CAD, building equipment construction technology, building construction organization and economy, building energy-saving technology, and graduation design. If each course is taught separately in each academic year, it is difficult for students to connect the knowledge learned in this course with other practical courses, and the knowledge learned cannot be integrated into actual engineering projects, let alone to solve complex engineering problems. For example, in the section on indoor heating of Building Equipment Construction Technology, when discussing the heating medium, it is mentioned that the annual carbon dioxide emission of heating using fuel oil as the medium is > the emission of natural gas heating > the emission of electric heating. Students only remember this concept when learning, and cannot understand how significant it is: how to design a green building to reduce carbon emissions, how to improve the design concept to achieve carbon neutrality, or even zero net carbon; these technologies are only briefly introduced in a conceptual way in Building Energy Efficiency Technology. Therefore, to achieve the standard of professional accreditation of engineering education, we should first ensure that the course content meets the needs of actual engineering development, keep pace with the development of the discipline, and build a higher-level knowledge application platform for students. Second, we should break through the limitations of the existing disciplines, promote the synthesis of the course content, and build practical courses of construction and environmental protection into a comprehensive practice and internship platform that integrates concepts, designs, constructions, and acceptance. "Construction and Environmental Protection Technology." The second is to break through the limitations of the existing disciplines and promote the integration of course contents and build practical courses into a comprehensive practice and internship from conception, design, construction, acceptance, and so on. Students should take into account the other parts of the project, in the design of air-conditioning systems, to consider the rationality of the design and construction feasibility. The construction part of the information technology teaching tools, such as construction simulation software, is used to complete the virtual construction. Each departmental discipline is taught independently but not isolated assessment when an actual project is conducted, according to the established engineering standards of the students in the results of the sub-projects for assessment, through this practical integration of course teaching, so that students can take into account all aspects of the actual project in practical learning rather than just focusing on the single course learned, so as to cultivate graduates of the construction of the environment in line with the real standards of engineering accreditation.

2. The Practice of Integrated Teaching Moral Education Teaching Design Objectives and Significance

The report emphasizes the construction of a knowledge-based, skill-based and innovative workforce, advocates the spirit of model workers and craftsmen, and creates a

professional culture of respect for labor and the pursuit of excellence [4]. Moral education should be strengthened in theory to enhance its affinity and relevance, so that all kinds of professional courses and Civic and Political courses can pass through the same line and form a synergistic effect [5]. Therefore, in the teaching of practical courses, it is more important to pay attention to the teaching principle of "insisting on grasping with both hands and being hard with both hands": grasping professional literacy with one hand, so that students can organically and comprehensively master the theoretical knowledge of their majors through practical integration courses and apply their professional knowledge to various stages of practical engineering; grasping professional moral education with the other hand, so that students can learn the elements of Civics and Political Science in their undergraduate study stage. At the stage of undergraduate study, students can integrate the elements of ideology and politics into their usual study, and according to the characteristics of the profession and the needs of the post, the spirit of "two studies and two doings" is engraved into the blood of engineering students, and they can always keep the good habits of knowing the rules, observing the rules and discipline, doing practical work and having responsibility. Practical integration courses are closely related to actual construction, including several practical sessions and simulation courses, which mainly cultivate students' teamwork spirit, pragmatic quality, attitude of excellence, and pursuit of perfection of professionalism. Construction technology involves the requirement of standardized occupational positions and incorporates the spirit of great national craftsmanship to cultivate students' sense of striving for excellence. By participating in cognitive internships and professional internships, students are familiarized with the construction cycle of conventional HVAC projects; starting from the proposal of the HVAC demand program by the builder, they have to go through the basic phases of the HVAC project, design, construction, acceptance, etc., and the construction phase is the main phase of the HVAC project, which needs to pay attention to the quality of the project, the safety of the construction, and the construction period, which are related to the subsequent acceptance and delivery of the project, and have a direct impact on the success or failure of the project. As the designer and constructor of the project, graduates of the construction and environmental engineering program, in addition to possessing excellent professional knowledge, also need to have a high sense of responsibility, quality consciousness, and safety consciousness. In the construction phase, they must have the craftsman spirit of seeking truth from facts and the team spirit of solidarity and cooperation [6]. If there is a lack of Civic and Political elements in the practical learning environment, it will make the construction and environmental graduates ignore the sense of norms in learning and practice, will not be able to eliminate the waste of materials, labor, and economy in the process of designing and constructing, and will not be able to ensure the excellent quality of the project, which will lay a hidden danger for the delivery and use of the project in the future.

3. Instructional Design of Moral Education

The instructional design of the integrated practical moral education for the major of Building Environment and Energy Engineering should adhere to the important ideas of the Scientific Outlook on Development and sustainable development, integrate ecological civilization ideology into the integrated practical course teaching, implement materialist dialectics, conduct comprehensive and overall thinking using the viewpoints and methods, incorporate engineering ethics knowledge, inspire students to "set lofty aspirations and be dream chasers," and construct a complete practical teaching ideological education system. For the ideological and political design of such comprehensive courses, the focus should be on improving teachers' moral cultivation and reforming their teaching evaluation.

3.1 Improving Teachers' Moral Cultivation and Optimizing Curriculum Design

As the teaching subject of integrated practical courses, the role of teachers is not only to "impart knowledge, " but more importantly to "preach the truth." Combining "verbal instruction" with "personal example", cultivating oneself morally and teaching others can fully meet the standards of engineering

education certification. Only in this way can the instructor gain enlightenment. Teachers must have profound knowledge, continuously learn, innovate, keep pace with the times, update educational concepts, enhance their own professional qualities, pursue endless learning, and maintain the dignity of the teaching profession. While conducting serious scholarships and organizing teaching, paying attention to students has also become an important part of improving teachers' moral cultivation. Teachers' morality is the unity of rationality and emotion manifested in the act of respecting students and throughout the strict requirements for students' various qualities.

During the teaching process, teachers should be good at discovering the moral education elements contained in the courses and achieving "integrating morality into teaching" and "integrating moral education into education." For example, when formulating a teaching plan, integrating core values and the Scientific Outlook on Development into the teaching and practice of practical courses, it can be carried out through modern construction techniques and HVAC design techniques in the courses.

Integrated practical course teaching involves the requirement of standardizing professional positions and integrating the spirit of craftsmanship to cultivate students' awareness of striving for excellence. The report emphasized the need to build a knowledgeable, skilled, and innovative workforce; advocate the spirit of model workers and craftsmanship; and advocate a social atmosphere of honoring labor and the spirit of striving for excellence [7]. Building Environment and Energy Engineering majors aim to cultivate technical and skilled talent with the spirit of craftsmanship, and the establishment of integrated practical courses is a direct manifestation of the educational concept of the spirit of craftsmanship. The essence of the spirit of craftsmanship is professionalism, concentration, preciseness, and the striving for excellence. The "great country artisans" in the new era need to have high professional ethics, strong professional abilities, excellent professional qualities, and at the same time have the spirit of craftsmanship of dedication, refinement, concentration, and innovation.

3.2 Guided by Values, Reform Teaching Evaluation

In the process of promoting ideological and political reform, course-teaching is integrated, guided by values, and makes corresponding adjustments to the teaching evaluation. The core of evaluating the course is to assess students' ideological and political qualities, professional qualities, and knowledge application abilities [8]. Adopting an evaluation model led by teachers and participating in students can effectively stimulate students' interest and enthusiasm in learning and participating in teaching and guide them to actively acquire knowledge and establish an enterprising spirit. Teaching evaluation can start from the following aspects: ideological and political performance, teamwork awareness, theoretical knowledge learning, practical skills mastery, and practical effect control, as well as the sense of collective honor and participation shown in the learning and practical process. The objective of the integrated practical course is to have students complete a virtual engineering project and solve a practical problem. Therefore, the assessment criteria should also start from a practical perspective and examine the course objectives in the practical chain of "science - technology - engineering - industry - economy".

4. The Implementation of Ethical Education

This course constitutes a complex of several mandatory professional practice courses. The primary pedagogical objective is to furnish students with the requisite skills for HVAC calculations, programming design and selection, installation of common materials and piping, as well as the installation techniques for building heating, ventilation, water supply and drainage, and cold and heat sources. Moreover, students acquire knowledge regarding green building technology and further cultivate their professional proficiency. This methodology facilitates the expansion of students' knowledge spectrum and augments their practical application capabilities in engineering scenarios.

During the incipient stages of the practice course, students independently collect professional information and engineering regulations and standards to formulate green building design plans. Midway through, they utilize a self-developed integrated simulation

teaching platform, which is segmented into sections for green building design, HVAC construction, and HVAC budgeting. These segments incorporate civic and political elements, facilitating the integration of explicit theoretical education with implicit quality education [9]. This not only fortifies professional knowledge and skills but also intensifies moral education, interlinking theory with practice, fostering a spirit of self-motivation, an affection for the profession, and a commitment to serving the public. The ultimate aim is to perpetually enhance students' comprehensive competence.

In the instructional design, specific aspects of moral education are incorporated and implemented appropriately based on the course's characteristics and teaching approaches:

4.1 Awareness of Rule of Law and Engineering Ethics

In the teaching process, engineering ethics and morality are introduced in conjunction with construction engineering regulations and related knowledge. This guides students to prioritize honesty in design and construction, adopting an "honesty-first" approach to become accountable HVAC professionals. We also employ the latest HVAC engineering safety incidents to instill a sense of legal compliance. On the construction equipment simulation platform, students participate in the development of construction plans, familiarizing themselves with relevant policies and standards. They simulate common HVAC engineering accidents, attaining a lucid understanding of the safety and environmental issues engendered by non-compliance. This reinforces the principle that "the safety, health, and well-being of the people take precedence."

4.2 Education on Social Responsibility and National Craftsmanship

At the onset of the course, open-ended research topics are assigned to students, encouraging them to amass domestic and international data related to construction and environmental protection. Students establish their own research subtopics, completing comparative studies to comprehend the current status of HVAC design and construction technology in China. This nurtures the development of a correct engineering value system, aligning personal growth with professional advancement, and inspiring students to contribute beneficially to society. Multimedia tools are employed during the teaching process to showcase videos such as "Great Power" and "A Hundred Years of Giants," demonstrating the nation's technological prowess and the legends it has fabricated. This inspires students to embrace a passion for their profession, dedication, conscientiousness, and a pursuit of excellence, enabling them to make substantive contributions and forge new trajectories in their careers.

4.3 Innovative Thinking

Innovative thinking is accentuated both in teaching and learning. As modern teaching tools evolve, the traditional lecture formats employing lesson plans, chalk, and blackboards are being supplanted by multimedia resources such as the internet, PowerPoint presentations, and videos. In explicating concepts, the most avant-garde materials are assimilated, including green building design principles and methods based on Building Information Modeling (BIM), and video materials that adhere to current trends. This stimulates students' interest in learning while reducing the instructor's workload and facilitating timely knowledge transfer. When elaborating on practical processes and technical requirements, we focus on cultivating students' creative thinking and their ability to analyze and solve engineering problems in real-world construction circumstances. Students also acquaint themselves with new equipment, materials, technologies, and methods in the HVAC domain, considering the societal, safety, and sustainability ramifications of their choices. They develop the capacity to critically appraise design and construction techniques.

In summary, in alignment with the objectives of engineering education accreditation and ethical education, we have transformed the integrated course of construction and environmental practice. We have reconfigured the course standards and integrated civic and political elements into the teaching and learning design. By allowing students to engage with online construction case studies, we guide them to apprehend that the pursuit of excellence in engineering demands the

collective endeavor of the entire team. This deepens their appreciation of the significance of teamwork and attains the objective of nurturing teamwork awareness. Continuously seeking the organic coalescence of explicit and implicit education in professional ethics education propels the development of professional talent to a novel level.

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