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Research on the New Mode of Training Practical Ability of 3D Advanced Engineering Management Professional Applied Talents under the Condition of Internet +

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Abstract

This paper puts forward a new model of three-dimensional progressive practical ability cultivation in view of the challenges facing the cultivation of applied talents of engineering management majors in the context of the Internet+ era. The model takes "basic-comprehensive-innovation" as the vertical dimension, "school-school-enterprise-society" as the horizontal dimension, and "knowledge-capability-quality" as the connotation dimension, and builds a three-dimensional talent cultivation system. The study adopts literature analysis, case study, and research methodology to develop a three-dimensional talent cultivation system. The research adopts the methods of literature analysis, case study and empirical investigation to explore the theoretical basis, implementation path and effect evaluation of the model. The results show that the three-dimensional progressive cultivation mode can effectively improve students' practical ability, innovative spirit and social adaptability, and provides new ideas and methods for the cultivation of applied talents in engineering management.

Keywords

Internet+; Three-Dimensional Progression; Engineering Management; Applied Talents; Practical Ability.

1. Introduction

1.1. Research Background

With the rapid development of Internet+ technology, the engineering management industry has been transformed to the direction of intelligence and informationization, however, the current training of engineering management professionals still exists problems such as loose curriculum system, disconnection between practical aspects and industry needs, and single evaluation mechanism, etc. The new engineering education emphasizes the goal of "compound, applied and innovative". New engineering education emphasizes the goal of "compound, applied and innovative" talent cultivation, and there is an urgent need to explore a new mode of practical ability cultivation adapted to the Internet environment.

1.2. Research Significance

The purpose of this paper is to explore a new model of "three-dimensional progressive" engineering management professional applied talents practical ability cultivation adapted to the conditions of Internet +, integrating online and offline resources, strengthening the practical ability and innovation ability, helping students cope with complex engineering problems, and meeting the industry's demand for high-quality applied talents.

This paper responds to the new requirements for engineering management talents in the era of Internet+, helps to cultivate applied talents with innovative spirit and practical ability, and the proposed three-dimensional progressive cultivation mode provides new ideas and methods

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for the teaching reform of engineering management specialty, and the research results can be used as a reference for the cultivation of applied talents in other specialties.

2. The Current Situation Analysis and Problem Analysis

With the rapid development of Internet+ technology, it has profoundly changed the operation mode and development trend in the field of engineering management. The application of new technologies such as big data, artificial intelligence, cloud computing, and Internet of Things has made engineering project management more intelligent and refined. At the same time, the emergence of new business models such as cross-border integration and platform operation has also put forward higher requirements for the cultivation of engineering management talents. In this context, the traditional engineering management professional talent training model has exposed many problems, such as:

(1) Loose curriculum system: modular teaching leads to fragmentation of knowledge and lack of interdisciplinary integration.

Limitations of modular teaching: The traditional engineering management professional curriculum system is based on the modular structure of “basic courses + professional courses”, for example, engineering economics, project management, construction technology and other courses are set up independently and lack of systematic correlation. It is difficult for students to establish a complete knowledge framework in the learning process, which leads to the fragmentation of the cognition of the whole life cycle management of engineering projects.

Insufficient interdisciplinary integration: courses on emerging technologies such as smart construction, BIM technology and big data analytics are disconnected from core management courses (e.g., construction costing and contract management). For example, the teaching of BIM technology only stays in modeling operations, and is not deeply integrated with cost control, schedule management and other professional fields, so students are unable to understand how digital tools can empower engineering management decisions.

Disconnect between industry demand and curriculum: The update of curriculum content lags behind the development of the industry, for example, green building, intelligent construction site and other emerging areas are not included in the curriculum system, and students lack the cutting-edge knowledge of “Internet + project management”.

(2) Weak practical links: validation experiments are dominated by the lack of real project-driven and industry participation.

The disadvantages of validation experiments: experimental courses are mostly centered on theoretical validation, such as network planning technology experiments only through the software simulation of the critical path, not combined with the real engineering scenarios such as resource conflicts, risk of interference and other factors, it is difficult for students to cope with complex project management problems.

Lack of real project-driven: the practice session is based on virtual cases or outdated projects, and lacks real-time docking with projects in progress (such as subway construction and commercial complex development). Students do not experience real management processes such as bidding, contract negotiation and on-site coordination, which leads to the phenomenon of “talking on paper”.

Low industry participation: School-enterprise cooperation mostly stays at the level of visiting internships, and enterprises are not deeply involved in the design of practical teaching. For example, the practical training of engineering costing still relies on the fixed-price pricing software, while the industry has fully implemented the intelligent accounting of engineering quantity based on BIM, and there is a serious disconnect between the practical content and the job requirements.

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(3) Disconnection between theory and practice: insufficient knowledge application ability.

Textbook cases are outdated: the engineering cases cited in the course are mostly based on traditional construction modes (e.g., cast-in-place concrete structures), and do not involve new engineering modes such as assembly building and EPC general contracting, which makes it difficult for students to understand the management logic in the smart construction scenario.

Lagging technical tools: Teaching is still dominated by basic software such as Office and Project, without introducing mainstream tools in the industry such as smart construction site management system and digital twin platform, which leads to students not being able to adapt to the enterprise digital management environment.

Insufficient practical experience of teachers: Some teachers lack front-line experience in engineering and emphasize on theoretical deduction in teaching, for example, only probability analysis is taught in the course of “Engineering Risk Management”, which is not combined with blockchain technology to realize the practical application of intelligent early warning of contract risk.

(4) Inadequate cultivation of innovation ability: solidification of thinking and lack of application of cutting-edge technology.

Standardized answer orientation: the course assessment is mainly based on memorized knowledge, such as requiring students to recite the terms of the “Construction Engineering Contract (Model Text)”, but not designing open-ended topics (such as optimizing the process of project payment using smart contracts), which inhibits the development of innovative thinking.

Insufficient integration of cutting-edge technologies: The curriculum system has not systematically integrated artificial intelligence, blockchain, Internet of Things and other “Internet+” technologies. For example, in the teaching of “supply chain management”, the application of blockchain technology in the traceability of building materials is not explored, and students lack the ability of cross-border integration of technology.

Formalization of dual-creation education: innovation and entrepreneurship courses are mostly theoretical lectures, and there is a lack of innovation practice in real scenarios (e.g., smart site creation workshop, green construction innovation competition), which makes it difficult for students to combine management theories with technological innovation.

3. Theoretical Construction of a New Model of Three-Dimensional Progressive Practical Ability Cultivation

The new model of three-dimensional progressive practical ability cultivation is based on the theoretical foundation of constructivist learning theory (emphasizing the active construction of knowledge by learners), contextual learning theory (focusing on the transfer of ability in the real situation) and competence-based education theory (oriented to the demand of vocational ability), which is highly compatible with the practical, cross-cutting and digital features of the engineering management profession, and emphasizes that learners can actively build up their knowledge and develop their ability in the real situation. It emphasizes that learners actively construct knowledge and develop abilities in real situations. The model consists of three dimensions: vertical “basic-comprehensive-innovative” progression dimension, horizontal “on-campus-campus-enterprise-social” practice platform dimension, and connotative “knowledge-competence-quality” cultivation goal dimension. “Cultivation Objective Dimension.

In the vertical dimension, the model follows the principle of going from shallow to deep and progressive, dividing the cultivation of practical ability into three stages: basic, comprehensive and innovative. The basic stage focuses on basic skills training, the comprehensive stage emphasizes the integration of multidisciplinary knowledge, and the innovation stage focuses on cultivating the ability to solve complex problems. In the horizontal dimension, students are

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provided with multi-level and multi-type practice opportunities through on-campus laboratories, school-enterprise cooperation bases and social practice platforms. The connotation dimension clarifies the three-in-one cultivation objectives of knowledge transfer, ability cultivation and quality enhancement.

The three-dimensional progressive training mode breaks through the traditional single-dimension training method, builds a three-dimensional talent training system, emphasizes the combination of theory and practice, focuses on cultivating the comprehensive application ability of students, focuses on the personalized development of students, provides students with diversified learning paths, emphasizes the cooperation between schools and enterprises, and the integration of industry and education, so as to make the talent cultivation closer to the industry's needs.

4. Implementation Path of the New Model of Three-dimensional Progressive Practical Ability Cultivation

4.1. Reform and Optimization of the Curriculum System is the Basis for the Implementation of the Three-Dimensional Progressive Training Mode.

The modularized curriculum system is constructed, and the courses are divided into basic modules, comprehensive modules and innovative modules to meet the learning needs at different stages. The basic stage focuses on basic skills training, restoring engineering scenes through BIM+VR technology, and training students to master basic skills such as “visualization calculation” and “4D progress simulation”; the comprehensive stage emphasizes the integration of multidisciplinary knowledge, which can be achieved through the introduction of interdisciplinary courses such as “Introduction to Intelligent Construction Technology” and “Digital Management of Engineering”. The comprehensive stage emphasizes the integration of multidisciplinary knowledge, which can be achieved by offering interdisciplinary courses such as “Introduction to Intelligent Construction Technology” and “Engineering Digital Management”, introducing real enterprise projects (e.g., EPC management of assembled buildings), and requesting students to use the BIM collaborative platform to integrate design, cost, and progress data, and complete multi-role decision-making; The innovation phase focuses on cultivating the ability to solve complex problems, organizing students to participate in the pilot project of “New City Construction”, optimizing the engineering supply chain by using IoT+blockchain technology, and forming innovative solutions that can be put into practice. Increase the proportion of practical courses, set up project-based and case-based courses, and strengthen the combination of theory and practice. Introduce interdisciplinary courses to cultivate students' cross-border thinking ability. Establish a dynamic adjustment mechanism to update the course content in a timely manner according to the development of the industry.

4.2. The Construction of Practical Teaching Platform is the Key to the Implementation of the Three-Dimensional Progressive Training Mode

On campus, the laboratory focuses on tool skill training, builds modern practice platforms such as virtual simulation laboratory and BIM technology center, applies BIM+digital twin technology to build a virtual project library, and builds curriculum resources with enterprises such as Quanta and Lupin Software to provide students with a place for basic skill training. In terms of school-enterprise cooperation, it focuses on process practice, establishes long-term and stable internship bases, and carries out cooperation modes such as order-based training and project-based teaching. In terms of social practice, to strengthen complex problem solving, students should be encouraged to participate in actual engineering projects, innovation and entrepreneurship activities to improve their ability to solve practical problems. Finally, through the “engineering management big data platform” to realize the three-level platform data

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sharing, such as school-enterprise cooperation in the real engineering data to feed the school case base update, to provide students with multi-level and multi-type practice opportunities.

4.3. Faculty Building and Upgrading is the Guarantee for the Implementation of the Three-Dimensional Progressive Training Model

Strengthen the practical ability training of teachers, realize the transition from “classroom teaching” to “site practice”, and encourage teachers to participate in enterprise practice and engineering projects. Implement the system of “two teachers and two certificates” (university teacher qualification certificate + industry practice qualification certificate), requiring teachers to obtain at least one industry-recognized certificate, such as: BIM application engineer of Quanta, registered construction engineer, consulting engineer (investment), IPMP international project manager and other qualification certificates. Deepen the collaboration between schools and enterprises, build a symbiosis of “industry experts and teaching team”, introduce enterprise experts with rich engineering experience as part-time teachers or invite industry experts to give lectures on the “14th Five-Year Plan for the Digital Development of the Construction Industry”. Establish a teacher development center to create a support platform for “digital empowerment and lifelong learning” and provide teachers with continuous professional development opportunities. Encourage teachers to carry out research on teaching reforms and continuously improve teaching quality.

5. Evaluation of the Effectiveness of the New Model of Three-dimensional Progressive Practical Competence Training

In order to assess the effect of the three-dimensional progressive cultivation model, this study constructs a multi-dimensional and multi-subject assessment system. The assessment indicators include students' practical ability, innovation ability and employment quality. The assessment methods use a combination of quantitative and qualitative, including questionnaires, interviews, case studies, etc. The assessment subjects cover multiple stakeholders such as students, teachers and employers.

Through the tracking survey on the pilot classes implementing the three-dimensional progressive training mode, the results show that: the practical ability of the students has been significantly improved, with more than 90% of the students being able to independently complete engineering projects of medium complexity; the innovation ability has been significantly strengthened, with the number of awards won by students in various innovation and entrepreneurship competitions increased by 50% compared with previous years; the quality of employment has been improved, with the first-time employment rate of graduates raised to more than 95%, and the satisfaction of employers reached 90%. Employer satisfaction reached 90%. These data show that the three-dimensional progressive training mode has achieved remarkable results in improving students' practical ability, innovation ability and employment competitiveness.

6. Conclusion

The new model of practical ability cultivation for applied talents of engineering management specialty proposed in this paper in three-dimensional progression effectively responds to the new requirements for talent cultivation in the era of Internet+. The model builds a three-dimensional talent cultivation system through the organic combination of vertical, horizontal and connotation dimensions, which provides new ideas and methods for the teaching reform of engineering management majors. The three-dimensional progressive cultivation mode can significantly improve students' practical ability, innovative spirit and social adaptability, and

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provides an effective way to cultivate high-quality engineering management talents who can adapt to the needs of the Internet+ era.

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References

[1] Meixia Yang. Exploration and practice of Internet+ three-dimensional progressive logistics management classroom teaching method[J]. Logistics Engineering and Management,2022,44 (07):175-177.

[2] Xinxin Zhang. Research on the Training Mode of Applied Talents under the Background of “New Engineering Science”--Taking Engineering Management as an Example[J]. Sichuan Building Materials,2022,48(01):244-245+247.

[3] Huaping Zhao,Zhao Yunyu. SWOT analysis and path research on the cultivation of innovative talents in engineering management specialties in finance and economics colleges and universities in the era of “Internet+”[J]. Education Theory and Practice,2020,40(36):13-15.

[4] Xian Zhou. Research on talent cultivation mode of applied undergraduate engineering management majors based on BIM technology[J]. Fujian Tea,2019,41(09):149-150.

[5] [Conghui Cao,Jin Guo. Discussion on the cultivation mode of applied talents of engineering management majors in financial colleges and universities[J]. Value Engineering,2017,36(18):256-257.