Research on Applied Undergraduate Cultivation Mode Based on Intelligent Construction

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Abstract: With the rapid development of China's construction industry, intelligent construction technology has gradually become the core competitiveness of the construction industry. Applied undergraduate education, as an important way to cultivate engineering and technical talents, how to combine intelligent construction technology with undergraduate education has become a current research hotspot in the field of higher education. This paper takes applied undergraduate education as the background to explore the applied undergraduate training mode based on intelligent construction, aiming to provide strong talent support for China's construction industry.

Keywords: Intelligent Construction; Applied Undergraduate Education; Higher Education; Training Model Research

1. Introduction

With the rapid development of China's construction industry, intelligent construction technology has gradually become an important driving force for the transformation and upgrading of the construction industry [1]. Applied undergraduate education, as an important base for cultivating high-quality engineering and technical talents, how to closely integrate the development of intelligent construction technology, reform the talent training mode, and improve the quality of talent training has become an urgent problem to be solved at present. First of all, the wide application of intelligent construction technology has brought a great impact on the traditional construction industry, and also put forward new requirements for applied undergraduate education. The traditional building construction process relies heavily on manpower, while intelligent construction technology can achieve automation, intelligence and digitalisation, reduce manpower costs and improve construction efficiency. Therefore, applied undergraduate education must adapt to this change, strengthen the teaching and research on intelligent construction technology, and cultivate applied talents with innovative ability, practical ability and comprehensive quality. Secondly, the research of applied undergraduate training mode should emphasise the organic combination of industry, academia and research. Schools, enterprises and research institutions should give full play to their respective advantages, jointly carry out the research and application of intelligent construction technology, provide students with practical platforms, enhance students' practical ability and innovative spirit. In addition, schools should also establish long-term and stable cooperative relationships, maintain close cooperation with enterprises, understand their needs in time, and flexibly adjust the curriculum and teaching content to ensure that talent training is closely integrated with the needs of enterprises. Again, in order to adapt to the development of intelligent construction technology, applied undergraduate education should reform the teaching methods and evaluation system. Teachers should adjust their methods in time and start focusing on cultivating students' independent learning ability, guiding students to participate in scientific research projects and improving their practical operation ability. At the same time, the evaluation system should fully reflect the comprehensive quality of students, focusing not only on students' academic performance, but also on the performance of students' practical ability and innovation ability. Finally, the government, schools and the community should work together to provide strong support for applied undergraduate education. The government should formulate relevant policies, increase

investment in intelligent construction technology research, and encourage enterprises to participate in talent training. Schools should strengthen the construction of faculty and improve teachers' own education and teaching level. The community should also pay attention to the training of applied talents and provide more employment opportunities for graduates. By reforming the talent training mode and improving the quality of talent training, we can work together to contribute to the development of China's construction industry.

2. Overview of Intelligent Buildings and Applied Undergraduate Education

2.1 Overview of Smart Construction

Intelligent construction, as an emerging field of engineering technology, aims to use information technology, automation technology, advanced materials and modern management methods to intelligently transform the engineering construction process in order to significantly improve the quality and efficiency of engineering construction [2]. The rise of this technology is not only an inevitable product of social development, but also an urgent need for the construction industry to move towards a higher level and more efficient development. With the rapid development of China's economy, the construction industry is facing the challenge of transitioning from traditional construction methods to intelligent construction.

The core of smart construction lies in the use of advanced technology to empower the construction process and make it smarter and more efficient. The application of information technology enables the optimisation of all aspects of building design, construction management and material transportation. The introduction of automation technology further realises the autonomy and intelligence of the construction process, significantly reduces manpower input and improves the construction efficiency of the project. At the same time, with the help of advanced materials, intelligent construction can not only improve the structural strength and durability of the building, but also reduce energy consumption and promote the realisation of the concept of green building. The use of modern management methods helps to better organise and coordinate the construction project, reduce resource waste and improve the overall project management level.

2.2 Overview of Applied Undergraduate Education

In recent years, China's higher education reform has actively embraced the concept of applied undergraduate education, placing emphasis on the cultivation of students' practical ability and innovative spirit at its core. This education concept not only emphasises the teaching of subject knowledge, but also focuses on the cultivation of students' ability in practical application. Closely aligned with the needs of industrial development, applied undergraduate education aims to provide students with a more practical and pragmatic education so that they can respond to changes in social development and industrial needs [3]. Applied undergraduate education is not only an extension of traditional undergraduate education, but also a kind of innovation, focusing on cultivating more comprehensive quality of students. Emphasising the cultivation of practical ability, helps students to combine theoretical knowledge and practical ability more effectively and to be able to apply them to real work. This concept of education also pays more attention to the cultivation of students' active learning and teamwork ability, so that they have stronger adaptability and innovative thinking. Under the guidance of this concept, students will be more competitive to face the complex and changing society in the future, and will be able to better contribute to the development of the society and the industry.

3. Application-oriented Undergraduate Training Mode Construction

With the rapid development of China's economy, the construction industry has become an important pillar industry of the national economy. However, the traditional construction industry faces problems such as rising labour costs and low productivity, which make it difficult to meet the development needs of modern society. Intelligent construction, as an emerging technology with remarkable features such as high efficiency, energy saving and environmental protection, is expected to promote the transformation and upgrading of the construction industry. In this context, the study of applied undergraduate training mode based on intelligent construction is of great significance. This study aims to explore the construction of an applied undergraduate training mode based on intelligent construction, with the goal of

cultivating construction talents that meet the development requirements of the new era.

3.1 Training Objectives and Orientation

The study of applied undergraduate training mode based on intelligent construction aims to explore the objectives and positioning of applied talents training adapted to the development of China's construction industry [4]. With the continuous prosperity of China's economy and the acceleration of urbanisation, there is an increasing demand for talents in the construction industry, especially those applied talents with innovative spirit and practical ability. Therefore, this study focuses on the applied undergraduate training mode in the context of intelligent construction, analyses the inadequacy of the existing training objectives and positioning, and puts forward a new training objectives and positioning scheme, in order to provide strong talent support for the development of China's construction industry.

3.1.1 Analysis of existing training objectives and orientation

(1) Insufficiently clear cultivation objectives the existing cultivation objectives of applied undergraduate programmes are rather general, usually emphasizing only the comprehensive quality, innovation ability and practical ability of students. However, these expressions are vague and lack specific requirements for the field of intelligent construction. Therefore, it is necessary to clarify the cultivation objectives of applied undergraduate education for the characteristics of intelligent construction.

(2) Under the existing education model, there is a large gap between the curriculum and actual needs. Especially in the balance between theoretical teaching and practical teaching, the importance of practical teaching is often neglected. In addition, there is no close match between the curriculum content and the actual needs of the intelligent construction industry, which makes it difficult for students to find their working rhythm quickly after graduation. Therefore, we need to combine the curriculum with the actual needs of the intelligent construction field in order to improve the practicality and relevance of the curriculum.

(3) Unreasonable structure of teaching staff the existing teaching staff structure of applied undergraduate colleges and universities generally has the phenomenon of "focusing on theory and light on practice". Teachers are strong in teaching and scientific research, but relatively insufficient in practical engineering experience. Therefore, in order to adapt to the development of the intelligent construction field, it is necessary to optimise the structure of the faculty and improve the practical ability and industry background of the teachers.

3.1.2 Discussion on the Training Mode of Applied Undergraduate Cultivation Based on Intelligent Construction

(1) Clarify the cultivation objective: In view of the characteristics of the intelligent construction field, the cultivation objective of the applied undergraduate programme is clarified as follows: to cultivate students with solid theoretical foundation, rich practical experience and strong innovative ability, so as to enable them to play an important role in the construction industry.

(2) Optimise the curriculum: 1) Strengthen the combination of theoretical teaching and practical teaching, improve students' practical ability; 2) Add courses related to intelligent construction, such as big data, Internet of Things technology, BIM technology, etc.; 3) Strengthen the cooperation with enterprises and carry out industry-university-research projects, so as to enable students to continuously improve their own ability in practice.

(3) Strengthen the construction of faculty: 1) Introduce teachers with rich practical experience and industry background to improve the overall strength of the faculty; 2) Strengthen the construction of the faculty, improve the teaching level and scientific research ability of teachers; 3) Encourage teachers to participate in industry-university-research projects to enhance the practical hands-on ability of teachers themselves.

(4) Optimising the evaluation mechanism: constructing a competency-based assessment system that fully demonstrates students' performance in the areas of theoretical learning, practical operation as well as innovation and entrepreneurship. At the same time, it strengthens the process-based assessment of students and focuses on the development and change of students in the learning process.

3.2 Curriculum and Teaching Content

In the study of applied undergraduate training mode based on intelligent construction, the curriculum system and teaching content are the key links. The curriculum system should follow the principles of completeness, practicability and advancement, covering six modules: general

education courses, professional foundation courses, professional core courses, professional elective courses, innovation and entrepreneurship education courses and public elective courses. The general education courses mainly include the knowledge of natural sciences, humanities and social sciences, and basic sciences of engineering and technology, laying the foundation for the study of professional courses. Among them, natural sciences such as Mathematics, College Physics, College Computer Application Fundamentals, etc., humanities and social sciences such as Ethics and the Rule of Law, College English, College Language, etc., engineering technology basic sciences such as Civil Engineering Drawing, Materials Science, Introduction to Intelligent Buildings, etc [5].Professional core courses are based on intelligent construction, including Intelligent Building Design, Intelligent Engineering Construction, Building Information Modelling (BIM) Technology, Building Automation and Intelligentisation, etc., to cultivate students' professionalism and innovation ability in the field of intelligent construction. The practical courses are set up in several segments, including "Intelligent Site and Application Practical Training", "Building Intelligent Engineering Design", "BIM Operation and Maintenance and Management", "Graduation Internship" and "Graduation Design", aiming to enhance the students' practical skills and problem solving ability. Among them, the course design and practical training are project-based, applying theoretical knowledge to actual projects; the graduation internship arranges students to do internships in enterprises and design institutes, exercising the ability of comprehensive application of knowledge; the graduation design requires students to complete innovative and practical research projects, providing technical support for enterprises. In terms of teaching content, project-driven, case study and industry-academia-research combined teaching methods are adopted, emphasising the cultivation of students' innovation, practice and teamwork ability. In the teaching process, teachers mainly adopt heuristic teaching method to guide students to actively explore and independently think in order to enhance their independent learning skills. At the same time, they strengthen the cooperation between industry, universities and research institutes, and cooperate with enterprises to carry out research projects, so that students can exercise their abilities in actual projects.

3.3 Mechanisms for Cooperation between Industry, Academia and Research

The term Industry-Academia-Research Co-operation Mechanism (IARCM), which covers the three areas of education, industry and research, aims to promote close co-operation among the three, so as to achieve an organic combination of quality educational resources, advanced technological achievements and industrial needs.

First of all, at the educational level, the mechanism of industry-university-research cooperation can integrate the needs of industrial development into the curriculum, providing students with more targeted talent training programmes [6]. Through cooperation with enterprises, we can understand the cutting-edge dynamics of the industry, which can help adjust the teaching content and keep students abreast of the development trend of the industry. In addition, schools can also work with enterprises to carry out practical teaching, providing students with practical engineering project experience and improving their application ability.

Secondly, at the industrial level, University-Industry-Research Co-operation (UIRC) helps enterprises to obtain technical support from universities and research institutes, and to enhance their innovation capacity. Enterprises can set up R&D centres with universities to carry out technological R&D and product innovation to meet market demand. At the same time, enterprises can also make use of the talent advantages of universities and research institutions to enhance their position in the market competition.

Finally, at the research level, an effective way to promote the transformation and application of research results is to establish an industry-university-research co-operation mechanism. Universities and research institutions cooperate with enterprises to organically apply research results to actual engineering projects, thus promoting scientific and technological innovation. This kind of in-depth cooperation can accelerate the application of scientific research results and combine theoretical knowledge more closely with practical engineering applications, providing strong

support for scientific and technological innovation [7]. In addition, enterprises can also transform the problems encountered in production practice into research topics, and work together with universities and research institutions to achieve breakthroughs in industrial technology.

In conclusion, the mechanism of industry-university-research co-operation plays a vital role at the three levels of education, industry and research. By deepening university-enterprise cooperation and promoting the integration of educational resources, technological achievements and industrial needs, it is expected to cultivate more high-quality and applied talents in the field of intelligent construction in China.

3.4 Faculty Development

Teaching staff is the key to the quality of education, and for applied undergraduate colleges and universities to train students, a high-quality teaching staff with relevant professional knowledge and practical experience is crucial.

First of all, we need to make clear the goal of the faculty construction, that is, to create a faculty team with reasonable structure, good quality, with innovative spirit and practical teaching ability. This team should include academic leaders with solid theoretical background, engineers and technicians with rich practical experience, and young teachers who have mastered modern education concepts and information technology means.

Secondly, the training and introduction of teachers should be strengthened. Through domestic and foreign academic exchanges, industry-university-research co-operation and other means, the professional quality and education and teaching level of teachers should be improved [8].At the same time, increase the introduction of talents to attract outstanding talents with doctoral degrees or senior titles to join the faculty.

Once again, must build a sound incentive mechanism to stimulate teachers' enthusiasm in teaching and research. Through the establishment of scientific research funds, title promotion, honour rewards and other means, teachers are actively guided to devote themselves to education, teaching and innovative research. Through these measures, the work motivation of teachers can be effectively improved, prompting them to participate more actively in teaching and research activities, and promoting the continuous improvement of the overall educational level and scientific research strength.

Finally, the stability of the teaching force should be emphasised. On the one hand, it is necessary to protect the welfare of teachers and improve the attractiveness of the profession; on the other hand, it is necessary to strengthen the career planning of teachers and provide them with sufficient space for development. Only in this way, through a period of training, introduction, incentives and other means, can we create a high-quality, stable team of teachers, laying a solid foundation for improving the quality of education and cultivating applied talents.

4. Conclusions

The applied undergraduate training model of intelligent construction has achieved remarkable results in the process of implementation, but still faces certain challenges. The comprehensive quality of students has been significantly improved, including engineering practice ability, innovation ability, teamwork spirit and other aspects. The curriculum system has been optimised, and intelligent construction technology has been integrated into the curriculum, making the curriculum closer to the needs of the industry and improving the competitiveness of students in employment. Teachers have been improved by strengthening the cooperation with industrial enterprises to enhance teachers' practical experience and teaching level. Challenges faced by this cultivation mode include insufficient hardware facilities, rapid changes in industry demands, and resistance to education and teaching reform. To meet the challenge of insufficient hardware facilities, investment can be increased to improve the hardware facilities. To address the challenge of rapid changes in industry demand, a mechanism of close cooperation with enterprises can be established to keep abreast of industry dynamics. To address the challenge of resistance to educational reform, we can strengthen publicity and education to enhance the acceptance of teachers and students.

The directions and recommendations for future development cover deepening the integration of industry and education, expanding international exchanges and co-operation, and strengthening faculty development. Measures to deepen the

integration of industry and education include stepping up collaboration with industrial enterprises, conducting joint research projects, and providing students with a wider range of practical opportunities. Measures to expand international exchanges and co-operation include establishing co-operative relationships with internationally renowned institutions and introducing advanced education concepts and teaching methods. In terms of strengthening the construction of the teaching staff, we should increase the efforts to attract talents and improve the professionalism and teaching level of teachers. Although remarkable results have been achieved in the process of implementation, certain challenges are still faced. In order to further improve this training mode, it is recommended to increase investment, improve hardware facilities, establish a mechanism of close cooperation with enterprises, keep abreast of industry dynamics, strengthen publicity and education, improve the recognition of teachers and students, strengthen the construction of faculty, and continuously strengthen measures in deepening the integration of industry and education and expanding international exchanges and cooperation. Such efforts will lay a solid foundation for China's intelligent construction industry to cultivate more high-quality talents.

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