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Original Research Article

Exploration of the interdisciplinary integration talent cultivation model for master's degree students in water conservancy engineering under the background of new engineering disciplines

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Abstract: To address the urgent need for high-level compound talents in water conservancy industry's tech innovation and industrial upgrading under new engineering, and solve issues in master's training (unstable interdisciplinary concepts, supervisors' single research directions,curriculum-social demand disconnection), this study develops a "system-platform-faculty-method" four-in-one multi-disciplinary integration talent cultivation model.The model integrates resources and deepens industry-education integration by improving compound talent-oriented multi-disciplinary training systems(increasing cross-disciplinary courses), optimizing collaborative education mechanisms, strengthening recruitment/development of multi-disciplinary teachers and grassroots teaching organizations,innovating teaching methods, and enhancing industry-education integration. Aiming to break disciplinary barriers, it boosts students' cross-disciplinary knowledge integration, innovative practical ability and industry adaptability, meeting national strategic needs and industry transformation. Conclusion:The model has significant theoretical and practical value in cultivating new water conservancy talents (tackling complex challenges, leading tech innovation), improving training quality and service capacity, and advancing new engineering in water conservancy. Future efforts require continuous optimization and strengthened policy-resource support.

Keywords: water conservancy project; new engineering; cross-fusion; talent cultivation mode

1. Introduction

With the new round of technological revolution and industrial transformation,engineering disciplines face new opportunities and challenges,requiring talent cultivation to shift to multi-disciplinary cross-integration models meeting the new era. On February 18,2017, "new engineering" was officially proposed at Fudan University's engineering education development strategic discussion [1]. Subsequently,theoretical research on new engineering discipline construction and higher engineering education reform practices emerged.In new engineering construction, goals, contents and paths vary among comprehensive universities, engineering-advantaged universities and local universities. The "Fudan Consensus", "Tianjin University Initiative", "Beijing Guidelines" and follow-up documents provided targeted designs for new engineering construction in different university types [2]. In this context,exploring a multi-disciplinary integrated talent cultivation model for water conservancy engineering master's students is urgent,aiming to cultivate high-quality, high-level talents solving practical water conservancy industry problems and promoting its development.

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2. The current situation of interdisciplinary integration under the background of new engineering

2.1. The necessity of interdisciplinary integration

Broadly, interdisciplinary integration dates back to the 19th century, while true interdisciplinary research began in the 1940s-1950s and advanced rapidly in the 1960s-1970s. In the 1960s, student movements in Europe and elsewhere pushed governments to rethink education models, prompting higher education in many countries to focus on interdisciplinarity. Interdisciplinary research then developed rapidly with wider coverage and greater influence. Since the 21st century, China's economic and technological progress has expanded talent cultivation demands; single-discipline teaching can no longer meet social development needs. Multi-disciplinary integration leverages each major's strengths and complements weaknesses, cultivating students with comprehensive, multi-dimensional thinking.

In recent years, China's demand for master's graduates in water conservancy and related engineering has grown steadily. Yet industry demands show water conservancy master's students need better research/practical abilities and creative thinking. Under new engineering, multi-disciplinary integration is key for universities to cultivate engineering talents meeting enterprise needs. Thus, in water conservancy master's cultivation, universities must adopt interdisciplinary training to optimize postgraduates' knowledge structure, foster creative thinking, and produce innovative talents for sci-tech innovation and economic-social development [3].

2.2. Typical cases of interdisciplinary practice in domestic universities

At present,top water conservancy universities have promoted interdisciplinary practices through diversified forms: Tsinghua University offers compulsory "Comprehensive Design Project of Smart River Basin" and elective "Digital Simulation of Water System in Xiongan New Area", and jointly establishes "Digital Twin Engineering Joint Laboratory" with China Three Gorges Corporation to strengthen integration of engineering practice and cutting-edge technologies.Hohai University researches interdisciplinary "Great Protection of the Yangtze River" and co-founds "Smart Water Conservancy Industry-Education Integration Base" with NARI Group to promote technology application.Wuhan University conducts satellite remote sensing hydrological analysis,develops "water-electric-carbon" trading simulation sand table,and co-builds "Cross-Disciplinary Research Center for Carbon Neutrality in River Basins" with Yangtze River Water Resources Commission to advance in-depth interdisciplinary research and tech innovation.

2.3. Existing problems

Limited by the traditional education model,the postgraduate education of water conservancy engineering still faces many problems.Combined with the typical cases of multi-disciplinary cross-practice in domestic universities at present,the multi-disciplinary cross-training of postgraduate students in water conservancy engineering still has the following problems at present:

(1)The concept of interdisciplinary integration is not firm

Although current universities advocate the cross-integration of multiple disciplines in policy documents,the employment and development paths of cross-disciplines in each university are ambiguous,and there is a lack of systematic policy guidance and financial support.As a result,the plan to establish a multi-disciplinary cross-integration talent cultivation model for master's degree students in water conservancy engineering has been shelving.

(2)The supervisor's research direction is single,and there are insufficient research projects involving

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interdisciplinary fields

Under the background of new engineering and the new form of the water conservancy industry,the integration process of water conservancy engineering with automatic control technology,Internet of Things engineering and digital twin technology urgently needs to be accelerated.The upgrading of these technologies involves the deep integration of multiple disciplines.However,at present,most of the supervisors of master's degree students in water conservancy engineering are deeply engaged in a certain professional field,and the content of their research projects is highly focused,deep but insufficient in breadth.This makes it difficult for postgraduate students majoring in water conservancy engineering to have access to research topics that integrate multiple disciplines.The improvement of their interdisciplinary research and practical abilities faces bottlenecks,and their adaptability to the industry and market is somewhat lacking.

(3)The teaching of courses is disconnected from social development

The current master's curriculum system for water conservancy engineering is seriously in line with the demands of social development.Smart water technologies such as digital twins and AI flood forecasting,which have been widely applied in the industry,still remain at the theoretical analysis level in the teaching field,with almost no practical operation.This directly leads to a significant disconnection between students' abilities and the actual requirements of their work,restricting the improvement and development of students' professional abilities. It fails to meet the needs of students' graduation and actual work.

3. A multi-disciplinary cross-training model for master's degree students in the field of water conservancy engineering

3.1. Establish and improve the multi-disciplinary cross-training system

Based on the development trend of the water conservancy industry,through conducting special research in water conservancy institutions and top national universities,we deeply combine theoretical exploration with practical experience,systematically study the teaching models of characteristic majors and multi-disciplinary cross-training mechanisms of various universities,and construct a multi-disciplinary cross-integration talent training model with water conservancy characteristics [4]. This model will be oriented towards the diversified demands of society for compound talents,taking into account the dual development paths of students' further studies and employment.By improving the training program and curriculum system,it will significantly increase the proportion of interdisciplinary courses,and ultimately achieve the training goal of cross-integrated and innovative practical water conservancy engineering talents [5].

3.2. Establish a multi-disciplinary communication platform and improve the collaborative education mechanism

This training system,driven by research topics and relying on multiple research platforms,integrates multi-professional and interdisciplinary research forces to form interdisciplinary teams,building a multi-disciplinary academic exchange platform for students.It implements a full-process mentor responsibility system,requiring mentors to grasp students' academic progress,focus on their academic ability and comprehensive quality development,and tailor personalized training plans.In core links like course study,professional practice and thesis (design),a team collaboration model is adopted to strengthen interdisciplinary cooperation ability.Regular interdisciplinary academic reports and seminars are held,with senior experts and young scholars invited to share insights,offering students in-depth exchanges with cutting-edge researchers.Through interactions,students absorb

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multi-disciplinary knowledge to improve academic literacy and comprehensive abilities.Based on the water conservancy engineering master's training program,postgraduates must participate in no less than four recognized academic activities during their studies,which significantly promotes their innovative practical abilities [6].

3.3. Strengthen the construction of cross-integrated capital teams

In professional construction,the expansion of the international perspective of the teaching staff and the innovation of teaching methods should be placed at the core position, and efforts should be made to strengthen the overall construction of the teaching staff and the effectiveness of grassroots teaching organizations,so as to build a solid teaching staff guarantee for the cultivation of outstanding talent.Actively introduce top experts and scholars in this professional field to offer cutting-edge courses and special lectures for master's degree students,effectively enhancing their professional qualities. At the same time,intensify the recruitment and cultivation of outstanding talents with multiple degrees to form a high-level teaching team.At the level of grassroots teaching organization construction, the school focuses on improving the internal cultivation mechanism and enhancing the overall quality of teachers.Specifically, it is manifested in implementing the mentorship system for young teachers to systematically guide their teaching and research development,and actively building interdisciplinary teaching innovation teams to promote collaboration and resource sharing.And by strengthening the awareness of educational and teaching reform,establishing and improving the incentive mechanism,and regularly organizing teaching discussion and exchange activities,the continuous optimization of teaching quality and the continuous improvement of the teaching system can ultimately be achieved.

3.4. Enrich the design of teaching methods

The design of teaching methods needs to respond bidirectionally to the individualized development needs of students and the goal of cultivating cross-integrated talents.The teaching content and method system should be reconstructed based on the talent cultivation plan to drive the in-depth teaching reform of multi-disciplinary cross-integrated cultivation for master's degree students in water conservancy engineering. Modular teaching is carried out by establishing a case base and embedding interdisciplinary knowledge integration training; Build a dual-track integrated platform of "online virtual resource library-offline physical exercise field" to strengthen the forging of experimental capabilities for virtual-real interaction.Ultimately, it is condensed into a three-in-one teaching model of "individual adaptation-cross-integration-innovative practice", achieving a three-dimensional ability advancement from knowledge construction,ability transfer to quality cultivation.

4. Conclusion

Against in-depth new engineering advancement, the water conservancy industry faces urgent tech innovation and industrial upgrading needs, demanding higher-level compound talents with multi-disciplinary knowledge, innovation and practical abilities.Focusing on water conservancy master's cultivation,this study analyzes key issues in current multi-disciplinary cross-integration, including weak concepts,supervisors' single research directions,and curriculum-social demand disconnection.

To address these issues,this study proposes and constructs a new engineering-adapted multi-disciplinary integrated talent cultivation model for water conservancy engineering master's students. Its core is improving the multi-disciplinary cross-training system,clarifying compound talent goals,and significantly increasing cross-course proportion.Via a multi-disciplinary communication platform,improved collaborative education mechanisms,scientific research project links,integrated cross-disciplinary forces,and academic/practical

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collaboration platforms,it strengthens students' cross-disciplinary cooperation and innovation capabilities. Strengthening cross-integrated teaching staff focuses on introducing/cultivating high-level teachers with multi-disciplinary backgrounds and international perspectives, and promoting teaching collaboration/resource sharing through grassroots teaching organizations.In teaching method design,focusing on innovation, it proposes a virtual-real dual-track platform and a "personalized adaptation-cross-integration-innovative practice" trinity model to enhance teaching effectiveness and practical ability cultivation.

In conclusion,the "system-platform-faculty-method" four-in-one multi-disciplinary cross-integration talent cultivation model for water conservancy engineering master's students,explored and constructed here,aims to break disciplinary barriers,integrate high-quality resources,deepen industry-education integration,and cultivate new compound talents capable of meeting complex water conservancy project challenges and leading industry technological innovation.Its implementation has great theoretical and practical significance for improving water conservancy master's training quality,enhancing their ability to serve national major strategic demands and water conservancy industry transformation/upgrading,and promoting in-depth new engineering development in water conservancy.Future efforts need to optimize model details,strengthen policy-resource support,and promote wider implementation and effectiveness.

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