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Identification and Influencing Factor Analysis of the "Multi-level" Innovation Ability of Civil and Hydraulic Engineering Graduate Students Based on the Career EDGE Model

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Abstract: ***In the context of the new engineering discipline, the cultivation of the innovation ability of civil and hydraulic engineering graduate students is of great importance. This paper conducts a "multi-level" identification of the innovation ability of civil and hydraulic engineering graduate students based on the Career EDGE model and deeply analyzes its influencing factors. By constructing a structural equation model of innovation ability, satisfaction, and influencing factors, the paper explores the mechanism of the influence of university factors, school-enterprise cooperation factors, social factors, and management factors on innovation ability, providing theoretical basis and practical guidance for improving the innovation ability of civil and hydraulic engineering graduate students.***

Keywords: Career EDGE model; civil and hydraulic engineering graduate students; innovation ability

I. INTRODUCTION

With the rapid development of science and technology and the increasingly complex demands of engineering construction, the civil and hydraulic engineering industry has an increasingly urgent need for innovative talents. As an important part of high-level talents, the cultivation of the innovation ability of graduate students has become a key task in university education [1]. However, at present, the cultivation of the innovation ability of civil and hydraulic engineering graduate students faces many challenges, such as the disconnection between the cultivation model and the industry demand and the imperfect innovation ability evaluation system. In this context, it is of great significance to use an effective theoretical model to conduct innovation ability identification and influencing factor analysis. The Career EDGE model provides a new perspective for comprehensively understanding the innovation ability of graduate students and helps to deeply explore the key factors affecting innovation ability, thus providing strong support for precise cultivation.

II. OVERVIEW OF THE CAREER EDGE MODEL

The Career EDGE model was constructed by researchers at the Employ ability Centre of the University of Central Lancashire in the UK and is a relatively complete employ ability model. This model covers multiple dimensions, including career development (Career), professional knowledge and skills (Education), self-management (Development), work experience (Graduate), and interpersonal communication (Employ ability). Its core idea is to emphasize that individuals accumulate knowledge and skills through education and practice in the process of career development, continuously improve their self-management ability, acquire rich work experience, and establish good interpersonal relationships, so as to achieve a comprehensive improvement in employability.

This model provides a multi-dimensional analysis framework for studying the innovation ability of civil and hydraulic engineering graduate students and helps to comprehensively grasp the constituent elements of innovation ability and their interrelationships.

III. HYPOTHESIS OF INNOVATION ABILITY ELEMENTS BASED ON THE CAREER EDGE MODEL

A. *Professional Ability*

The professional ability of civil and hydraulic engineering graduate students is the foundation of innovation. It includes solid professional basic knowledge, such as theoretical knowledge in structural mechanics and hydraulics[2]; proficient professional application ability, such as practical skills in engineering design and construction management; and strong writing ability, such as the ability to write scientific research reports, engineering plans, and other documents. These professional ability elements are interrelated and jointly support graduate students to conduct innovative research and practice in the field of civil and hydraulic engineering.

B. *Communication Ability*

Good communication ability is indispensable in the innovation process. It includes language expression ability, the ability to clearly and accurately expound one's own innovative ideas and research results; team cooperation ability, the ability to effectively cooperate with team members in scientific research projects and engineering practices to jointly overcome difficulties; and social adaptability, the ability to communicate and cooperate with people from different backgrounds to obtain more innovative resources and information.

C. *Problem-solving Ability*

Innovation often stems from the acute discovery of problems and their effective solutions. This includes the ability to learn knowledge, the ability to quickly master new knowledge and technologies to deal with complex problems[3]; the ability to execute tasks, the ability to transform innovative ideas into actual actions to ensure the smooth progress of projects; and the ability to resist pressure, the ability to remain calm and actively seek solutions when facing engineering challenges and scientific research difficulties.

D. *Other Abilities*

Such as physical health guarantee, which provides physical support for innovative activities; a good and stable mentality, maintaining a positive and optimistic attitude in the face of setbacks in the innovation process [4]; and reasonable career planning, clarifying one's own development direction and purposefully improving innovation ability to meet future career needs.

IV. RESEARCH METHODS AND DATA COLLECTION

A. *Questionnaire Design*

Design an innovation ability importance questionnaire for employers, covering the evaluation of the importance of various elements such as professional ability, communication ability, and problem-solving ability[5]. At the same time, design an innovation ability improvement subject importance questionnaire for graduate students to understand their perception of the role of different subjects such as universities, enterprises, and themselves in the improvement of innovation ability. To comprehensively collect data, also design relevant questionnaires for university teachers and administrators regarding university factors, school-enterprise cooperation factors, social factors, and management factors.

B. Sample Selection and Data Collection

Select civil and hydraulic engineering graduate students from multiple universities and their affiliated universities and related cooperative enterprises as the research objects. Distribute questionnaires through a combination of online and offline methods to ensure the extensiveness and representativeness of the sample. Sort and preliminarily analyze the collected data and eliminate invalid questionnaires to provide a reliable data basis for subsequent research [6].

V. CONSTRUCTION AND ANALYSIS OF THE STRUCTURAL EQUATION MODEL

A. Model Construction

Take innovation ability as the core variable, take professional ability, communication ability, problem-solving ability, etc. as observed variables, and incorporate potential variables such as university factors, school-enterprise cooperation factors, social factors, and management factors to construct a structural equation model. Through path analysis, assume that university factors such as teaching quality and faculty strength have a direct impact on the cultivation of professional ability; school-enterprise cooperation factors such as the depth of cooperation and the effect of collaborative innovation have an important role in improving communication ability and problem-solving ability; social factors such as the recognition of innovation in the civil and hydraulic engineering industry and the industry development trend affect the innovation motivation of graduate students; and management factors such as school management policies and teaching management level have an impact on the effective operation of the innovation ability cultivation system.

B. Model Fitting and Result Analysis

Use professional statistical software to conduct a goodness-of-fit test on the model and modify and optimize the model according to the test results [7]. Analyze the path coefficients and influence degrees among various factors. The results show that high-quality teaching resources and faculty construction in university factors have a significant positive impact on the cultivation of professional ability; practical project cooperation and enterprise mentor guidance in school-enterprise cooperation factors have an obvious effect on improving communication and problem-solving abilities; the industry innovation atmosphere and market demand orientation in social factors have a great stimulating effect on the innovation awareness of graduate students; and scientific evaluation mechanisms and incentive policies in management factors help to promote the good operation of the innovation ability cultivation system. At the same time, there are complex interactions among various factors, which jointly affect the formation and development of the innovation ability of civil and hydraulic engineering graduate students.

VI. COMPREHENSIVE ANALYSIS OF THE INFLUENCING FACTORS OF INNOVATION ABILITY

A. University Factors

The discipline construction level, curriculum setting rationality, and teaching method innovation of universities are directly related to the depth and breadth of graduate students' professional knowledge and the cultivation of innovative thinking [8]. The academic level, practical experience, and guidance ability of the teaching staff affect the innovative practice of graduate students in scientific research projects. In addition, the scientific research atmosphere and academic exchange activities of universities also provide environmental support for the improvement of graduate students' innovation ability [9].

B. School-Enterprise Cooperation Factors

As the main body of the market, enterprises can provide graduate students with a real engineering practice environment and information on the demand for cutting-edge technologies. The depth and breadth of school-enterprise cooperation determine the opportunities for graduate students to contact actual engineering projects and the degree of exercise of their ability to solve practical problems. The guidance of enterprise mentors can help graduate students combine theoretical knowledge with practice and cultivate engineering practice innovation ability [10].

C. Social Factors

The degree of social attention to innovation in the civil and hydraulic engineering industry, the industry development trend, and relevant policy orientations affect the innovation motivation and innovation direction of graduate students. A positive social innovation atmosphere can stimulate the innovation enthusiasm of graduate students, and the demand for innovative talents in the industry prompts graduate students to continuously improve their innovation ability to adapt to market competition.

D. Management Factors

Policies and systems in aspects such as teaching management, scientific research management, and student management in universities [11], such as innovation achievement evaluation mechanisms and scholarship incentive policies, have a guiding and incentive role in the innovation behavior of graduate students. A reasonable management mechanism can create a good innovation atmosphere and promote graduate students to actively participate in innovation activities [12].

VII. CONCLUSION AND SUGGESTIONS

A. Conclusion

The "multi-level" analysis based on the Career EDGE model shows that the innovation ability of civil and hydraulic engineering graduate students is a complex system with multiple elements interacting with each other. Professional ability, communication ability, problem-solving ability, etc. are the core elements of innovation ability, and university factors, school-enterprise cooperation factors, social factors, and management factors have an important impact on the formation and development of these core elements. The various factors are interrelated and mutually restrictive, jointly constituting a comprehensive factor system that affects the innovation ability of graduate students.

B. Suggestions

(1)University level. Optimize the curriculum system, increase the proportion of practical teaching links, strengthen the setting of interdisciplinary courses, and broaden the knowledge vision of graduate students. Strengthen the construction of the teaching staff, encourage teachers to participate in enterprise practice and scientific research projects, and improve teachers' practical teaching ability and innovation guidance ability. Create a strong academic innovation atmosphere, hold various academic lectures, innovation competitions, and other activities to stimulate the innovative thinking of graduate students.

(2) Enterprise level. Increase the cooperation intensity with universities and establish a long-term and stable cooperative relationship. Actively participate in the formulation of graduate student training programs, provide practical projects and internship positions, and provide graduate students with more opportunities to contact actual engineering problems. Dispatch experienced enterprise mentors to guide graduate students' practice and promote the in-depth integration of industry, academia, and research.

(3) Social level. Strengthen the publicity and support for innovation in the civil and hydraulic engineering industry and improve the innovation status of the industry. The government should issue relevant policies to encourage enterprises to participate in the innovation cultivation of graduate students, such as tax incentives and scientific research subsidies. Establish an industry innovation exchange platform to promote the sharing and cooperation of innovation resources among universities, enterprises, and society.

(4) Management level. Universities should establish and improve the innovation ability evaluation system to comprehensively, objectively, and fairly evaluate the innovation ability of graduate students. Improve the incentive mechanism and give material and spiritual rewards to graduate students who perform outstandingly in innovation, such as setting up innovation scholarships and honorary titles. At the same time, optimize the teaching management process, improve management efficiency, and provide institutional guarantee for the cultivation of graduate students' innovation ability. Through the comprehensive implementation of the above measures, it is expected to improve the innovation ability of civil and hydraulic engineering graduate students and cultivate more innovative talents that meet the development needs of the new engineering discipline for the civil and hydraulic engineering industry.

Future research can further expand the sample range, deeply explore the differences in innovation ability cultivation under different regional, different types of universities, and enterprise cooperation models, and continuously improve the innovation ability cultivation system.

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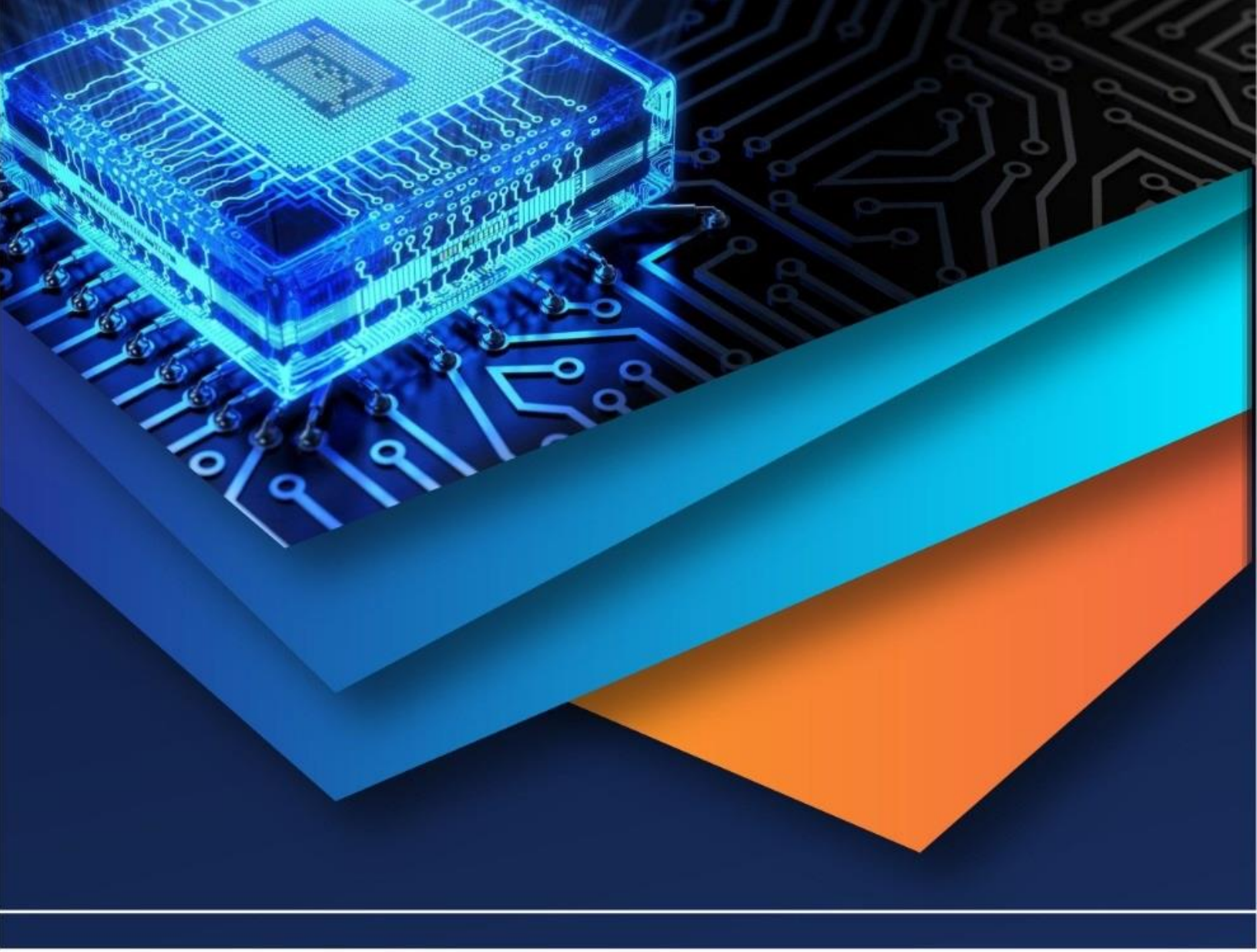

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