Exploration on the Cultivation of Compound Innovative Talents for Graduate Students Majoring in Computer in Colleges of Finance and Economics

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Abstract. There are many problems in the cultivation of innovative talents for postgraduates majoring in computer science in finance and economics colleges in terms of training target, cultivation Model, and curriculum system. In particular, the construction of "double first-class" and "emerging engineering" puts forward higher requirements for talent training. This paper focuses on these issues, sums up years of experience in postgraduate training, and explores the cultivation model of computer majors under the background of finance and economics from the aspects of Scientific Orientation of postgraduate innovative talent’s training target, improving the postgraduate compound innovation training curriculum system with financial characteristics, strengthening the construction of interdisciplinary cooperation tutor groups and building an all-round financial feature Innovation platform, strengthening the connection between industry, university and research. These measures are to achieve the goal of cultivating highly distinctive compound innovative talents.

1. Introduction

The 21st century is a century of talent competition. Innovation ability is the core competitiveness of talents. High-level innovative talents are the backbone of promoting and strengthening national independent innovation capability and building an innovative country. Graduate education is at the top of higher education and shoulders the important mission of cultivating top-notch innovative talents and developing innovative science and technology. The innovative ability of graduate students is not only related to the level of knowledge innovation in institutions of higher learning, but also related to the country’s overall innovation ability in the future. Therefore, it is the basic responsibility of higher education to cultivate high-quality innovative graduate students. The state formally proposed the "Overall Plan for Promoting the Construction of World-Class Universities and World-Class Disciplines" in 2015, and Shandong proposed "Opinions on Promoting the Comprehensive Reform of Higher Education" in 2016, which all emphasized that in order to achieve new breakthroughs in the construction of high-level universities in China, it is necessary to
put the construction of first-class graduate education system in an important position. Therefore, under the background of “Double First-Class” construction, we must pay full attention to the reform and development of graduate education. Regardless of whether they are listed in the “Double First-Class” construction or not, training first-class talents is our goal of construction[1].

The scale of graduate students in China is expanding very rapidly, and graduate education has changed from elite education to mass education. Most finance and economics colleges have also launched postgraduate education in computer science. Since February 2017, the Ministry of Education has actively promoted the construction of emerging engineering education. The development of the economy in the new era poses new challenges to the training of traditional engineering talents. Compared with the traditional engineering education, the "emerging engineering education" emphasizes the practicality, interdisciplinary and comprehensiveness of the discipline. Experts pointed out that, compared with traditional engineering talents, emerging industries and the new economy in the future need high-quality compound "emerging engineering" talents with strong engineering practice ability, strong innovation ability, and international competitiveness. And they know how to integrate technology with economy, society, and management, and can play a leading role in future technology and industry. Emerging engineering education must take root in the integration of multiple disciplines, promote implementation in practice, and conduct innovation and entrepreneurship education throughout talent training.

However, what does not match the new era environment is that the imbalance between supply and demand of computer talents is becoming more and more serious. The core problem is the lack of effective supply which refers to the supply of unique graduate students who can solve problems in a specific field. The lack of innovative talents in enterprises, government and other organizations coexist with the employment difficulties of graduates, which formed a structural surplus of talent.

In such an educational environment, the problems that may arise in the training of computer graduate students in financial universities are concentrated in the following three aspects:

(1) The cultivation orientation is not accurate enough, the training target and cultivation model are slightly single, which makes the cultivated talents lack of characteristic and uncompetitive. This problem has a lot to do with the characteristics of financial institutions. From the reality, computer majors in finance and economics colleges are generally set up for a short period of time, and they are often not superior majors in their schools. The training objectives of computer majors in most financial colleges are the same as, or similar to those of other comprehensive colleges and universities of science and technology, and they are all positioned to train high-end computer professionals and the orientation and characteristics of the school itself are often ignored.

(2) The training curriculum system is not scientific enough and relatively single. The training curriculum system is set up under the guidance of training target, and taking into account the research knowledge structure and research direction of the tutor team, in accordance with the rules of talent training. Usually the members of the tutor group are limited to the school of computer and the knowledge structure is similar, which will inevitably lead to the single content of the curriculum system, then it is not conducive to the cultivation of students' interdisciplinary knowledge and skills. The content of the curriculum system established under the guidance of traditional training objectives is relatively single.

(3) Common problems from the cultivation of postgraduate’ innovative ability, such as the lack of
an effective innovation ability training mechanism, and the low enthusiasm of graduate students to participate in innovative activities; the lack of an effective postgraduate innovation platform; the lack of effective independent innovation activity carriers, Most graduate students are in a position of passive learning and so on.

Under this circumstance, how can the innovation ability of graduate students be improved? How to highlight the characteristics in a large number of homogeneous graduate students to ensure strong competitiveness? How to train highly distinctive compound innovative talents who not only has a solid basic theory of computer majors, but also has the professional skills and rich experience in order to meet the needs of economic and social development. These series of problems are currently urgent problems in the cultivation of graduate students in many financial colleges and universities. Therefore, it will be very necessary to develop a compound innovative talent training system for computer graduate students in financial colleges and universities with the characteristics of "emerging engineering" talents.

2. Current Status of Similar Research at Home and Abroad

The cultivation of compound innovative talents for graduate students, especially the cultivation of graduate students in computer majors with strong professional applicability, has always been a hotspot in graduate education research at home and abroad, and many important results have been achieved in this field.

The United States has infiltrated collaborative innovation and engineering applications into the training of graduate students, bound engineering education and local high-tech, and cultivated highly educated talents with "thick academic, strong practice, and multi-skills". For example, the Massachusetts Institute of Technology (MIT) pay attention to postgraduate innovation education, emphasize the cultivation of students' innovative ability, give play to the importance of both in-class and extra-curricular learning, and integrate the two to form an overall optimal environment, which is unique in promoting the cultivation of innovative talents. The UK focuses on the cultivation of high-quality and application-oriented talents, and the postgraduate training model is regulated by the demand of the talent market. For example, Cardiff University in the UK puts forward a talent training model that aims to cultivate creative, intelligent and professional talents for research and training. Japan regards the cultivation of innovative talents as an important strategic goal, promotes joint degrees, diversifies training concepts and training goals, and forms a complete postgraduate training system that integrates the rich connotations of "internationalization" and "graduate training". For example, the educational goals and curriculum design of Tokyo Institute of Technology emphasize the cultivation of innovative ability: flexible teaching methods, emphasis on the development of innovative consciousness, and encouraging students to participate in various innovation competitions[2].

Xue Jing[3] summed up the experience in the exploration and practice of postgraduate' innovative ability training, and proposed a model of graduate students' innovative ability training with a comprehensive platform as the main measure. Wang Huiqiang[4] has built a collaborative, multi-dimensional and integrated postgraduate training system for computer disciplines in response to the current disconnection between social needs, educational concepts and educational practices. Li Mingdong[5] emphasized highlighting the role of driving clues for practical innovation, optimizing implementation details, and taking into account the unity of academic and
professionalism, so as to effectively improve the quality of professional degree graduate training. In response to the problems in the current postgraduate training process, Fu Yan[6] proposed a "five-in-one" computer professional postgraduate innovative talent training system that implements research-oriented teaching, scientific research training, engineering practice training, international cooperation and exchanges, and scientific and technological competitions. Peng Qingyan[7] analyzed the characteristics of the five stages of postgraduate training, including entrance, course study and assessment, proposal, project research and dissertation writing, and thesis defense. Based on these five stages, combining actual work experience, the ability requirements for key links in the graduate training process and the work points and results evaluation indicators are put forward. Guided by the concept of integration of production and education, Zhang Shibin[8] has studied and practiced professional degree graduate engineering practice ability training system:"Five-dimensional talent training standard& Double practice base", which includes "Professional Basic Ability-Engineering Practice Ability-Organizational Communication Ability-Innovation and Entrepreneurship Ability-Professional Ethics and Accomplishment" and "Campus practice teaching base-Off campus engineering practice base integrating industry and education".

For the training of graduate students majoring in computer science in finance and economics colleges, many scholars have also analyzed the existing problems in depth and proposed solutions. Dong Yuyou[9] puts forward the "interdisciplinary" training mode, in which universities, scientific research institutes and various social organizations participate. Jin Xin[10] believes that what needs to be urgently considered is how to reform the teaching content of computer application based on the current status of the distribution of graduate students in finance and economics colleges, so that it can play a better supporting role in various disciplines and can contribute to the cultivation of graduate research capabilities. Shao Keyong[11] took the concept of "emerging engineering" as an opportunity and aimed at cultivating double-creation and compound talents, and constructed a set of practical innovation and entrepreneurship mechanisms to enhance graduates' entrepreneurial capabilities as a whole. Kong Xiangjun[12] used reverse thinking to reflect on the postgraduate training model based on the employment status of graduate students under the background of emerging engineering, and proposed a postgraduate quality assurance system.

To sum up, we must deeply analyze the deep-seated reasons for the contradiction between graduate training and social needs in accordance with the characteristics of schools and colleges, and categorize training, ensure quality, change from adapting services to supporting and leading guided by industry needs, only then can we effectively propose solutions and establish a reasonable training model for compound innovative talents. For finance and economics colleges, most of them have strong advantages in financial and economic management disciplines, and we can make full use of existing resources and talents in terms of research direction, curriculum system, and tutor team building, and set diversified training goals reflecting the characteristics of interdisciplinary, which can guarantee the cultivation of compound innovative talents with different multi-disciplinary foundations and multiple skills to meet the needs of industry informatization development.

3. Cultivation of Compound Innovative Talents for Computer Major Graduate students in Finance and Economics Colleges

Emerging engineering has already challenged traditions. Things such as big data, artificial...
intelligence, and the Internet of Things (IOT) are just the tip of the iceberg. Future-oriented knowledge and technology will be replaced faster and faster. Graduate students are the important undertakers of national scientific and technological innovation and the cultivation of innovative ability is the core content of graduate education. The significant difference between graduate students and undergraduates lies in the word “research”, and “research” work requires innovative consciousness and innovative ability. Therefore, one of the important goals of graduate training is to cultivate graduate students’ innovative ability. As mentioned above, there are many problems in the cultivating objectives and methods of innovative talents for graduate students majoring in computer science in financial colleges. It is necessary to combine the characteristics of the school, scientifically position the graduate students’ training goals of innovative Compound talents, build a curriculum system that reflects characteristics and cultivates innovative capabilities, innovate the cross-tutor cooperation group system, form a distinctively unique research and cultivating direction, accelerate the construction of cross-innovation platforms, pay attention to the cultivation of students' interdisciplinary knowledge and skills, and truly cultivate innovative multi-talents with not only solid basic theories of computer majors but also professional skills to enter the work position and rich experiences who can effectively meet the needs of economic and social development, as shown in Figure 1.

Figure 1. Key Factors for Cultivation of Compound Innovative Talents for Computer Major Graduate students in Finance and Economics Colleges.

3.1. Establishing Operational Scientific and Reasonable Compound Innovative Talent Training Goals

The determination of training goals mainly depends on the needs and development of the country, region, and society, the nature and conditions of schools and professions, the development needs of talents, and the trend of knowledge development in the subject area. From the perspective of students’ professional development needs, in the future, both academic graduate students who are competent for teaching and research positions in scientific research institutes or universities are needed, and they also need to have both theoretical foundations and skills in computer majors in enterprises, government agencies and other units. Abundant industry management knowledge and experience, capable of technical management, organizational innovation, and process transformation, compound innovative talents who can provide advice and suggestions. The demand for such talents is also more urgent and there are more of them. This requires colleges
and universities to not only require students to master solid professional theoretical knowledge and
skills, but also to increase the teaching of knowledge and skills of other disciplines, focusing on
students' practical operation ability and the ability to apply theoretical knowledge to practical
problem solving, in order to improve students' employment competitiveness.

The training objectives of computer major graduate students should follow the unification of
academic and vocational, adhere to academic is to follow the objective law of higher education, and
encourage innovation is an important way of academic education. Finance and economics
colleges have distinctive features of general economy and finance, so they should advocate the
training of graduate students in line with the characteristics and development of finance and
economics universities. In other words, it should adapt to the intelligent era technology
development, be able to use computer technology to solve domain information such as finance and
economics, data processing and application problems, fully reflect the advantages of the
professional setting of the University of Finance and Economics, and cultivate an innovative,
international Compound talents with vision and good development potential can enhance the core
competitiveness of graduate students.

Therefore, the cultivating objectives of graduate students should be divided into different levels
according to the professional needs or research interests of students. While ensuring the
development of scientific research capabilities, the educational resources of the school’s superior
disciplines should also be fully utilized to carry out interdisciplinary postgraduate training and
manifest the characteristics of interdisciplinary, cultivating innovative multi-talents with solid basic
theories of computer majors, professional skills to enter the work position, rich experiences and the
characteristics of financial intelligence who can effectively meet the needs of economic and social
development.

3.2. Improve the Postgraduate Compound Innovation Training Curriculum System with
Financial Characteristics

The scientific nature of the curriculum system is the prerequisite and guarantee for the quality and
efficiency of postgraduate training.

First of all, the curriculum system should reflect the characteristics of diversity. In addition to
the traditional professional theoretical courses, experimental courses and professional elective
courses, it is necessary to appropriately increase inter-professional elective courses, mainly offering
inter-disciplinary courses and inter-disciplinary cutting-edge courses, highlighting the advantages of
financial institutions and the intersection of liberal arts and sciences, allowing students according to
their own career planning or research interest in freedom of choice, such as opening "Securities
and Decision Making", etc., to enhance students' understanding of financial information-related
issues, discover the Problems, and cultivate students' ability of using computer to solve these
problems.

Secondly, the curriculum system should reflect the characteristics of practicality. From the
perspective of curriculum settings, elective courses and cutting-edge courses must have a certain
degree of flexibility and be adjusted in time according to economic and social development. From
the perspective of curriculum content design, professional elective courses and cutting-edge courses
must timely reflect the theoretical research hotspots of various computing majors and the frontiers
of technological development. Elective courses and their cutting-edge courses focus on solving practical problems encountered in economic and social development, and are oriented towards problem solving and must be updated in time.

Thirdly, the curriculum system should reflect systematicness. The setting of the curriculum system must follow the law of talent training, combine with the setting of the research direction of the major, and guide the construction of the curriculum system with systematic principles. First, clarify the knowledge and ability requirements for each interdisciplinary research direction, and then tutors of relevant disciplines are invited to discuss and design the types and quantity of courses required for each research direction, so as to form interdisciplinary course groups with different research directions, allowing students to freely choose from them according to their career development needs and scientific research interests.

### 3.3. Refining Cross-disciplinary Research Directions and Strengthening the Construction of Interdisciplinary Cooperative Tutor Groups

To ensure the realization of the goal of cultivating innovative compound talents, it is necessary to condense research directions with characteristics and competitiveness. For example, finance, economics, and management are the ace majors of general financial colleges, and they usually have very high academic strength and academic reputation. Combine these advantages and majors to form a unique training and research direction can better improve the innovative compound talent cultivating system, such as computer, combined with finance to form the direction of intelligent financial information processing, combined with statistics to form the direction of data mining and visualization, and combined with information management to form the direction of intelligent information processing and big data analysis.

Take our university’s postgraduate training as an example, and actively carry out the cross-integration application of related technologies for the application or research problems in the school’s economic, financial management and other dominant disciplines in our university. Such as the mining and visualization of stock information, analysis and forecasting, personal credit evaluation and other issues. Specifically, for stock information processing and prediction, the combination of stock-related news and stock price fluctuations is used as the feature of the prediction model, and the hybrid neural network based on the Glove model is used to predict stock price fluctuations. The accuracy of the model is improved by 5% compared with the existing model. As shown in Figure 2.

![Figure 2. Stock price forecast.](image)
At the same time, the quality and ability of the tutor team are important factors restricting the cultivation of graduate students.

First of all, in order to give full play to the role of mentors and mentor groups in talent cultivating, we can combine the school’s superior majors with computer advantages based on the establishment of interdisciplinary, strengthen the cooperation of superior subjects of the same school, integrate subject resources, conduct subject penetration, explore interdisciplinary tutor resources, establish and improve the selection, evaluation and elimination system of tutors and tutor groups. The formation of graduate students' scientific research and innovation ability usually goes through three stages: initial stage, accumulation, and formation, so as to establish cultivating goals, determine the training curriculum system, and achieve effective guidance by analyzing the role of tutors or tutor groups at each stage after building a tutor group.

Secondly, in order to strengthen the cultivation of students' operational skills and practical problem-solving ability, the construction of industry-education-research bases and the construction of student practice bases should be carried out. In the process of base construction and use, the "base tutor" is screened and selected, and the responsibility system of the base tutor is established to give full play to the role of the joint tutor group.

Thirdly, Inviting scholars with a good interdisciplinary background to give special lectures, laboratory rotations and other forms can be conducted to broaden students' disciplinary horizons and cultivate interdisciplinary research interests.

Finally, with the tutor group as the core, teams of different disciplines are formed. Academic conferences of international and domestic experts, emerging technology lectures, thematic discussions, etc. can be held periodically, and activities such as interdisciplinary interest group discussions, postgraduate forums, and famous teachers lecture can be actively carried out among teams. We should create an open and inclusive interdisciplinary academic atmosphere, continuously stimulate graduate students’ research interest, activate their academic thinking, enhance their innovative capabilities, and fully tap each student’s research potential. Through continuous exchanges and continuous thinking collisions, the convergence of different theoretical systems, academic thoughts and innovative thoughts will gradually improve their own interdisciplinary knowledge structure, continuously improve individual scientific research capabilities and enhance team cooperation quality, which could lay a solid foundation for cultivating outstanding innovative talents. At the same time, it is conducive to the formation of interdisciplinary scientific research teams that can solve major scientific and technological problems, and the promotion of the development of interdisciplinary.

3.4. Build an All-round Innovation Platform with Financial and Economic Characteristics, and Strengthen the Connection Between Industry, University and Research Institute

An innovation platform should be built in an all-round way, through effective incentives, to guide graduate students to change from passive learning to active inquiry, in order to inspire the divergent thinking of graduate students and obviously improve their innovation ability. In order to better adapt to the needs of the economy and society, strengthen the relationship between academic research and production, "introduce research by industry, and guide learning by research", in order to improve the rationality and feasibility of learning and research. Through the contact of mentors and graduate students with the industry, the enthusiasm of graduate students in scientific research and innovation
activities will be improved, and their practical ability will be more suitable for the industry and social needs, guided by their independent interest in combination with social needs.

Firstly, the establishment of the experimental innovation platform is the basis for various innovation activities at all levels. Taking the School of Computer Science of Shandong University of Finance and Economics as an example, in addition to the basic open experimental platform such as the Key Laboratory of Digital Media and the Sino-US Cooperative Innovation Center, there are also the Information Visualization and Computing Economic Engineering Technology Research Center, the Financial Information Engineering Technology Research Center, and the Key Laboratory of Machine Learning and Financial Data Mining, and the Key Laboratory of Economic Operation Dynamic Simulation. Making comprehensive use of these laboratories can form a cross-innovation platform for capacity training at different levels, as shown in Figure 3. In the cross platform, it provides a kind of experimental environment without any constraints for graduate students' independent thinking and independent innovation activities, and enables them to carry out practical innovation activities in a completely independent state. At the same time, graduate students can contact more financial related problems and exercise their ability to solve related problems in an all-round way in order to achieve the training goal of serving local economic development.

In order to make full use of the composite cross-innovation platform, the platform's advantages can be used. The platform and the mentor jointly establish supportive policies, and set up some policies in the training process of graduate students to guide them to voluntarily participate in innovation activities, such as setting up funds and providing different levels of funding to encourage students with innovative ideas, providing venues, equipment and financial support for them to turn their dreams into reality. Reward students for publishing high-level research papers or completing high-level R&D projects to fully mobilize students' enthusiasm for research and innovation, so as to truly achieve the goal of cultivating high-quality applied compound talents with innovative capabilities.

![Figure 3. Innovation Platform.](image)

On this basis, we need to continue to strengthen the relationship between industry, university and research. Universities have a strong research team. Enterprises have advanced equipment and cutting-edge technology, which is a high-quality platform combining theory and practice. Enterprises provide the actual needs of the market, carry out project cooperation, resources sharing advantages complementation with schools, and jointly create a win-win situation for academics and industries in terms of technological innovation, talent cultivation, achievement transformation and enhancing their own competitiveness. After an in-depth analysis of the needs, the university’s research team makes use of their own theoretical research and development advantages to determine the research goals, research content and technical route together with the enterprise's technical personnel. In every stage, both parties must discuss together, check together, put forward
innovative ideas, and find solutions. Enterprises can set up joint laboratories in universities, provide advanced equipment, sufficient funds, send senior engineers to universities for lectures and technical exchanges, and provide opportunities for graduate students to front-line visit, research and internship in the enterprise at the same time. For some graduate students, an internal and external dual tutor system can be adopted to jointly formulate student training plans. With their own advantages, clear division of labor and coordinate guidance, the two tutors could provide a comprehensive interdisciplinary learning and practice platform for graduate students.

4. Conclusion
The vigorous development of the information industry has made society have a huge demand for compound innovative computer application professionals. The training targets of graduate students majoring in computer science and technology of finance and economics colleges are often same as or similar to those of other comprehensive colleges and polytechnics, which often makes talent training not distinctive or targeted. This paper combines the advantages of economics and management disciplines in financial institutions and discuss deeply on cross-research direction, curriculum system with financial characteristics, cross-disciplinary tutor team building and building an all-round innovation platform with financial characteristics. It makes full use of the existing resources and talents to reflect the characteristics of interdisciplinary. This training mode can be used as a reference for computer-related postgraduate training in financial and economic colleges across the country. It will also provide a model for the development of computer professional postgraduate application innovation ability in relevant colleges and universities, which is of great significance for improving teaching quality and teaching efficiency.

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