

# Research on the university-enterprise joint training mode of master of applied Statistics major—Based on the Perspective of "Synergistic Effect"

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**Abstract:** Taking the joint training base of universities and enterprises as a platform, promoting the close interaction between the training of applied statistics talents and economic and social development is an important way to cultivate statistical applied talents with comprehensive application ability. This paper aims to discuss the ways to effectively establish the school-enterprise joint training base and puts forward countermeasures and suggestions from the perspective of synergistic effect, and puts forward practical decision-making reference and basis for the joint training of the master of applied statistics major.

**Keywords:** master of applied statistics; university-enterprise joint training base; long-term mechanism; synergistic effect

## 1. The question is raised

The master's degree of Applied Statistics (MAS) was officially approved by the Ministry of Education of China in 2011. This major is a master's degree to adapt to the development of statistics, improve the training system of applied statistics talents, innovate the training mode of applied statistics talents, and improve the quality of applied statistics personnel training. The traditional training of master of applied statistics mainly focuses on the training mode of "on-campus training + knowledge construction + in-campus tutor". How to break through the "two skins" of school education and social demand and build the application of applied talents of master of applied statistics has become an important problem to be solved urgently.

As is known to all, professional master degree is a type of graduate training that highlights the application and professionalism requirements. It is different from academic graduate students who focus on theory and academic research, and aims to cultivate senior professionals with specific professional background. Therefore, "the orientation of professional needs, focusing on the cultivation of practical ability, and the approach of the combination of production and education" is the basic direction and goal of the reform and development of professional degree education. In order to improve the training quality of professional degree graduate students, the Ministry of Education and The General Office of the State Council proposed the mechanism of integration of science and education and integration of industry and education, and advocated the construction of a joint training base combining theoretical learning and practical activities. At present, there are five modes of university-enterprise joint training for professional master students: joint training based on projects, joint establishment of talent training bases, introduction of high-end talents from enterprises as graduate tutors, university-university center and customized training of graduate students commissioned by enterprises<sup>[1]</sup>. to this end, The state has issued a series of documents, Such as "about deepening the reform of professional degree graduate student training mode opinion" (research [2013] 3), on strengthening the construction of professional degree graduate case teaching and joint training base opinion "(research [2015] 1),<sup>[2]</sup> the State Council general office on deepening several opinions of teaching fusion (state hair [2017] 95)," <sup>[3]</sup>about accelerating the new era of the development of graduate education reform " (research [2020] no. 9,<sup>[4]</sup> The promulgation of these documents has pointed out the direction for the joint university-enterprise training of master's degree in applied statistics. Many colleges and universities have built the graduate practice education base jointly trained by schools and enterprises,<sup>[5]</sup> and have achieved good results However, the joint training of master of applied statistics is often a formality, and it is difficult to carry out lasting practical cooperation. How to construct the school-enterprise joint training mechanism and ensure the continuous and effective operation of school-enterprise joint training has become a concern of universities.<sup>[6]</sup>

## **2. Construct the theoretical support of the long-term effective mechanism of school-enterprise joint training**

School-enterprise joint training base refers to the talent training platform jointly built by schools and enterprises, and is an important carrier of the combination of industry, university and research. Baidu Encyclopedia defines school-enterprise association as: making use of two different educational environments and educational resources of schools and enterprises, and adopting the educational method of organically combining classroom teaching and students' participation in practical work. The construction of graduate joint training base refers to the stakeholder organization jointly built between universities and enterprises that award professional degrees, which has the characteristics of cross-border and inter-organization cooperation<sup>[7]</sup>. Through the school-enterprise joint training base, schools and enterprises can jointly formulate courses, provide practical opportunities, share resources, and provide students with internship and employment opportunities. The advantage of the school-enterprise joint training base is that it can better meet the needs of the society for talents and closely combine the education and career needs. In this mode, students can be exposed to the real working environment and projects to enhance their practical ability and professional quality. At the same time, enterprises can also participate in the process of talent training, understand and participate in the education reform. The school-enterprise joint training base can promote the deep cooperation between schools and enterprises, and strengthen the interaction and communication between the two sides. Through joint efforts, high-quality talents in line with the market demand can be cultivated, and the integrated development of industry and education can be promoted. In short, the school-enterprise joint training is an innovative talent training mode, which is conducive to improving the quality of education, promoting the combination of industry, university and research, and providing more opportunities for students to find smooth employment.

In 1976, German physicist Hermann Haken proposed and systematically discussed the theory of coordination, believing that although different systems have different properties, they influence and cooperate in the whole environment. The core of the synergy theory is "synergy effect", which means that multiple subsystems in complex open systems interact with each other to form the overall effect, changing the system from disorder to order. School-enterprise joint training is an open management system, which should be supported by the theory of "synergistic effect". In the process of joint training application statistics master, colleges and universities and enterprises is synergistic effect, according to their own actual needs, seeking for their own partners, mutual respect and cooperation, objective follow the elements of cooperation interaction, give full play to the synergistic effect of joint training, to achieve the real cooperation, from disorderly to orderly. In conclusion, synergy theory provides a conceptual framework for this study, and provides ideas for exploring the dilemma and breakthrough path of comprehensive talent training of master of applied statistics majors.

## **3. Analysis of the dilemma of university-enterprise joint training base for master of Applied Statistics**

In the era of big data, the training of master majoring in applied statistics has entered a new stage of development. The dilemma of joint training of master of applied statistics can be summarized in several aspects.

**(1) School-enterprise joint training, base management and coordination mechanism.** Most of the university-enterprise joint training for the master of applied statistics adopts the cooperative method to create bases. Because the enterprises aim for profit, the school aims to complete teaching tasks, and the students take employment as the direction, their respective goals are inconsistent, and sometimes it is difficult to coordinate and unify. The cooperation foundation of school-enterprise joint training is relatively weak, and there are differences and conflicts in interest demands, cooperation motivation, cooperation costs and other aspects. In the absence of specialized management institutions, the related business of university-enterprise joint training is mainly within the departments of universities, making it difficult to carry out top-level design and comprehensive coordination of the work. The problems encountered are as follows: 1) Make practical teaching plan, enterprise mentor allocation, school-enterprise exchange activity arrangement and other base tasks, adopt the "school + school + major" three-level management responsibility system or "school + major" is appropriate? 2) Does the whole process of the base operation need to accept the leadership and supervision of the graduate school and the graduate department of the school?

**(2) Practical teaching content.** At present, the theoretical education in colleges and universities is

decoupled from the technology research and development of enterprises, which affects the establishment of a long-term mechanism. According to the professional characteristics of master of applied statistics, it is necessary to highlight the training of practical operation ability of statistics, and pay attention to the cultivation of analytical ability and creative ability to solve practical problems. The problems in the practice process have the following aspects: 1) Practice form: must students participate in the enterprise practice or can participate in the mentor project? 2) Practice time: Based on the specific projects and work of the co-construction unit, students will deeply participate in it and carry out practical teaching in the form of undertaking specific tasks. How many days is the appropriate time? 3) Practical teaching courses: The school and the enterprise jointly design and carry out a practical teaching course according to the strengths of both sides, including two levels of theoretical knowledge and practical skills. What is the theme to carry out practice? 4) Practice assessment: Is the practice assessment based on the practice report or is it evaluated by the tutor outside the school? 5) Academic exchange activities: The university will invite relevant researchers from enterprises to make relevant reports on the cutting-edge problems and the development trend of the industry. How to solve the cost?

**(3) Construction of joint training and instructors.** The construction of joint cultivation instructor team should be based on the guideline of "the main instructor of the school, highlighting the role of off-campus enterprise instructor guidance", but in the actual day-to-day management, due to the lack of incentives and assessment mechanism of the school for the guidance of the off-campus instructor, or the school instructor seldom penetrates into the internship base to take charge of joint cultivation of the business work, which leads to the communication between school and enterprise is not smooth enough, and does not coordinate and optimize the resources of the two sides, and even the school and enterprise instructors don't know each other, and there will be a case of "two no matter what".

The problems to be solved are as follows: 1) How to hold regular seminars on campus and off-campus tutors to communicate students' experiences and problems encountered in the process of joint training? 2) How many core enterprise personnel are invited to give academic reports every year? 3) How to jointly design and develop a practical teaching course? 4) How to carry out activities related to practical teaching? 5) Is it necessary for the enterprise tutor to participate in the students' recruitment interview, opening defense and graduation thesis defense?

**(4) Conditions and construction and resource sharing.** The government has not formulated a sound supporting policy system and laws and regulations to promote the sharing of resources among the subjects. There are the following problems in terms of condition construction and resource sharing: 1) Can the co-construction enterprises open the necessary places and equipment to teachers and students in the school base according to the needs of practical activities and scientific research cooperation? 2) For the co-construction enterprises, does it need to set up appropriate teaching sites and provide necessary teaching equipment according to the needs of the cooperation content? Who should bear the cost of adding the equipment? 3) Will the school open the relevant teaching facilities to the co-construction units according to the needs of the cooperation content?

#### **4. Construction of the long-term mechanism of university-enterprise joint training for the master of applied Statistics major**

At present, there is more and more cross-fertilization between applied statistics and artificial intelligence, big data and other specialties. We must closely focus on the needs of the society, based on the talent cultivation concept of "mastering the basic ideas, theories and methods of statistics, having the ability to skillfully apply computer software to deal with statistical data, understanding the knowledge of a related application field, and having the ability of comprehensive application of statistical application". It actively explores the new mode of "on-campus + off-campus" cultivation, forms a long-term mechanism of collaborative cultivation between schools and enterprises for the master's degree in applied statistics, and makes efforts to promote the construction of postgraduate education in applied statistics.

(1) Focusing on the needs of society and building a "whole process, multi-dimensional" training system. In order to meet the needs of the economy and society for talents specialized in applied statistics, students need to be well trained in related fields and establish a training system that is seamlessly connected with the needs of the society. A joint training base management committee can be set up to coordinate and promote the construction of the joint training base. Clearly define the cultivation objectives and segment participation requirements. In the enrollment process, tutors from off-campus bases participate in enrollment publicity and reexamination, etc. In the cultivation process, tutors from off-campus bases participate in guiding students' dissertations, participate in the dissertation defense, and

integrate into the cultivation process by offering applied courses, participating in special lectures, practical teaching, etc., so that the students are provided with as much training as possible for the direction of statistical modeling and data analysis, the direction of economic and financial statistics, the direction of resource and environment statistics, the direction of big data analysis and artificial statistics, and the direction of statistics of big data analysis and artificial environment. As far as possible, we will match students of different research directions, such as statistical modeling and data analysis, economic and financial statistics, resources and environment statistics, big data analysis and artificial intelligence, and intelligent biocomputing and data mining, with more suitable and high-quality enterprises. The educational institution should strengthen the requirements of practical assessment by adopting monthly project progress reports, adding the needs of today's and society's and local development, so that the content of the assessment is close to the actual needs. Such assessment is conducive to the school's "personalized" cultivation of students, increasing the match between cultivation and application, and strengthening the orientation of teaching practice and market demand through joint cultivation between schools and enterprises; in the employment link, several bases set up employment alliance, share information resources, carry out accurate recruitment, and promote the high-quality employment of graduated postgraduates.

(2) Driving common input, improve the "school-enterprise joint training" guarantee system. No matter how good the system is, no matter how good the method is, it is useless without an effective guarantee system. Therefore, it is necessary to improve the system and deepen the collaborative management of school-enterprise joint cultivation of master's degree in applied statistics. The relevant authorities should clearly define the responsibilities, obligations, and management attributions of universities, enterprises, students, governments, and industries in school-enterprise cooperation and co-construction. They should also optimize the legal environment and ensure that the construction of school-enterprise joint cultivation bases has a legal basis [8]. Furthermore, the assessment and evaluation process should be further optimized. Regularly conducting classified assessment and evaluation of school-enterprise cooperation bases in terms of organizational structure, system construction, school-enterprise tutors, student management, condition guarantee, and practice effectiveness will enable dynamic adjustments of the school-enterprise joint cultivation bases through the elimination mechanism. During the practice period in the base, the master's degree students of applied statistics are given the dual status of students and employees, and the management departments of the university and enterprises, business entities, instructors and managers collaborate in guiding and managing the postgraduates. The relevant institutions should establish a two-way condition guarantee mechanism for graduate students' practice, study, life, and safety. They should also develop an interactive graduate student base management information system to effectively solve the problems of a large number of bases, wide geographical distribution, and facilitate two-way communication between teachers and students. Additionally, it is important to purchase accidental injury insurance for each graduate student and provide work allowances to base instructors and management personnel. Furthermore, efforts should be made to promote the base entity to pay graduate students' work subsidies and provide the necessary support. The government has also promoted base units to pay postgraduate students' work subsidies and provide necessary office space, equipment and living conditions.

(3) To achieve the multi-party win-win goal and build a "long-term" collaborative education community. It is necessary to clearly understand the particularity of the joint training base of applied statistics, which is neither pure university behavior nor pure enterprise construction, but a "synergy" with the characteristics of diversified subjects, both goals, more investment in the early stage and long production cycle. In terms of talent training, we should adhere to the "double mentor" guidance system. The campus tutor is responsible for the cultivation of professional knowledge and professional skills, using case teaching, simulation teaching and field teaching to consolidate the training of practical operation and professional quality, arrange a 6-12 months "post practice" to go deep into the enterprise, investigate and analyze the development strategy, operation environment, business data, to exercise the modeling and analysis of enterprise projects. In terms of teaching staff, schools can appoint teachers directly to enterprises and institutions for short-term visits to constantly improve their own practical ability. At the same time, the enterprise employs campus tutors as expert consultants to help the development and improve the overall innovation strength of the enterprise. In terms of scientific research, the university and the enterprise jointly build a data modeling and simulation laboratory, jointly carry out project research and scientific and technological breakthroughs, promote the university-enterprise collaborative innovation and achievement transformation, and constantly improve the innovation ability of both sides. Schools should actively cooperate with enterprises, hold targeted various professional competitions, or invite enterprise mentor to guide students in statistical competition, such as the national college students statistical modeling competition, national data mining challenge, the national graduate

mathematical modeling competition, the national college students market survey and analysis competition, national applied statistics professional degree graduate case contest, in the tutoring to enhance students' practical ability, (ancient rainbow) students through the game with a sense of accomplishment can drive students autonomous learning knowledge.

## 5. Conclusion

With the rapid development of the field of data analysis and data mining, applied statistics will play an increasingly important role. The practice shows that the joint training of master students in applied statistics plays an irreplaceable role in improving the quality of postgraduate training. However, there are still some problems in the process of joint training of master of applied statistics. We should improve the existing deficiencies at any time, and constantly think about and explore the ways and methods to solve these problems, so that the trained master of applied statistics can be more applicable to the needs of the society.

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