

Exploration on the Industry-education Integration Mode of Statistics Major in Applied Universities

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Abstract: Industry-education integration, is a teaching practice mode integrating talent training, scientific research and social service. In order to serve the orientation of high-level applied university in the statistics major of North China University of Technology, we have put forward 4 dimensions of industry-education integration in practical teaching, namely, curriculum teaching practice, practical teaching links, school-enterprise cooperation projects, and statistical discipline competitions. Further, the process of providing service products for society by statistics specialty is divided into four stages, that is, opportunity identification, product design, product launch and product evaluation, which corresponding to the four dimensions of industry-education integration respectively. Finally, the time-space association among the four dimensions is analyzed, and a benign and orderly operation mechanism of industry-education integration is constructed.

1 Introduction

Industry-education integration is a deep cooperation between universities and industry enterprises to improve the quality of talent training. It is a teaching practice mode that integrates talent training, scientific research and social services. Industry-education integration is the need for win-win cooperation between on campus and off campus (enterprises, government, scientific research institutions, etc.). On the one hand, it solves the practical teaching problems of colleges and universities, exercises the practical ability of students, and realizes the purpose of education serving the society at the same time. On the other hand, industry-education integration makes the channel of all-round "collaborative education" more unblocked, makes the pattern of "San Quan" education of universities more perfect, and creates more opportunities for employers to participate in the education link of colleges and universities. The supply and demand sides of talents work together to create "talent products", so that the talents we cultivate can better meet social needs, which can greatly improve students' professional quality and employment competitiveness.

The school running orientation of North China University of Technology is a high-level applied university. Cultivating excellent applied talents who serve the capital is our talent training goal. In the era of "big data", the development of "cloud computing" and artificial intelligence has brought not only broader application prospects to statistics, but also unprecedented challenges. So, the industry-education integration is the general trend. First of all, government statistics

departments are engaged in major periodic census activities such as census and economic census, and organize regular sampling surveys, which require a large number of part-time or full-time statisticians. Secondly, due to the development of daily business, enterprises and institutions have an increasingly strong demand for data analysis professionals; Thirdly, the marketing research and consulting industry, as a sunrise industry, has shown a trend of vigorous development. As a basic statistical practice, statistical research has penetrated into almost all fields. In economy, society, natural science, politics, culture, and even people's daily life, the ideas of "speaking with data", "seeking truth from facts" and "no voice without investigation" have become the basic principles or starting points of all our work. Statistical research has gradually become a necessary method or means to insight into and serve the society. These characteristics have brought historical opportunities for the industry-education integration in statistics, which has become an inevitable product driven by the two wheels of industry and education.

2 4-dimension space for the industry-education integration in Statistics

In order to solve practical teaching problems effectively, we have been adhering to the teaching concept of "student-centered and ability training oriented", and gradually condensed five application abilities that students majoring in statistics need to be cultivated, namely, data collecting and processing, data analysis,

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report writing, organizing ability, and leadership ability. The five abilities are gradually advanced with the growth of grade, and finally form a "pagoda" of ability. In order to cultivate students' five application abilities, we start from the 4 dimensions of practical teaching, including curriculum teaching practice, practical teaching links, school-enterprise cooperation projects, and statistical

discipline competitions. Each dimension has different degree of industry-education integration, and cultivates the five professional application abilities respectively, thus forming a "4-dimension space" for industry-education integration, presenting a "4-dimension pagoda". The schematic diagram is shown in Figure 1.

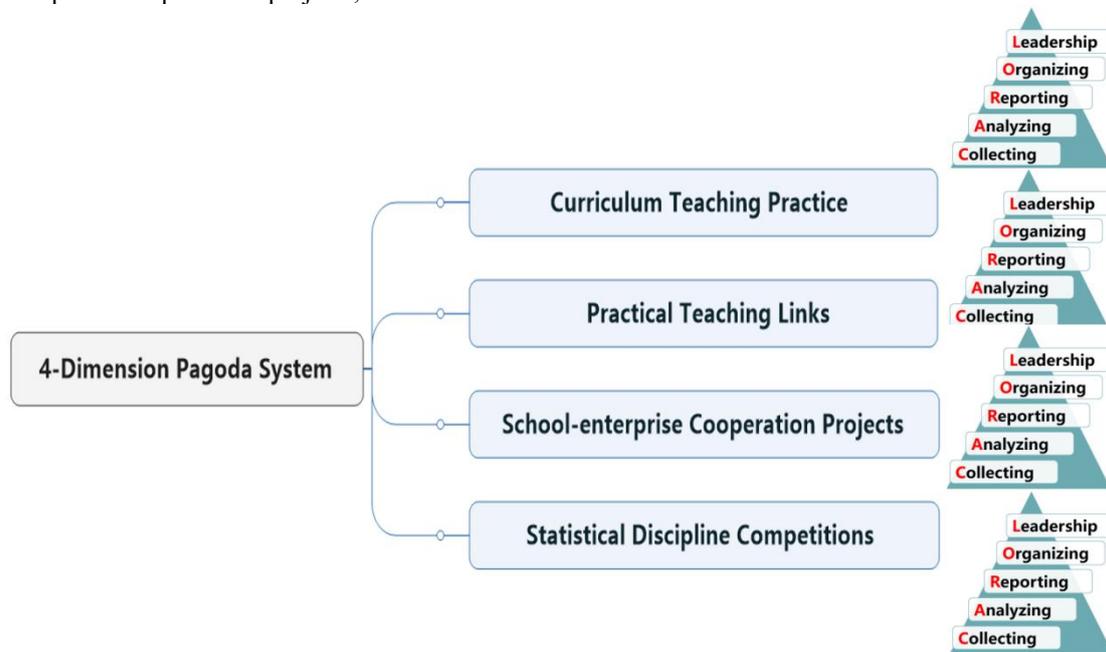


Figure 1 "4 dimension pagoda" of the industry-education integration in Statistics

(1) Curriculum teaching practice

Curriculum teaching is the main battlefield of "preaching, teaching and dispelling doubts". On the one hand, teachers lay a solid professional foundation for students through theoretical teaching. On the other hand, they need to consider how to guide students to put theory into practice. Some statistical methods courses, such as "Market Research Methods", are of more distinct practical features, so it is easier to integrate industry and education in course teaching.

Firstly, attach importance to case teaching. Real enterprise cases are widely embedded in the course teaching. Rich case teaching can broaden students' horizons and help students identify "business opportunities" in the field of statistical research. At the same time, the "flipped classroom" teaching mode can stimulate students' autonomous learning and practical ability, guide them to master the practical technology of marketing research, and increase their perceptual understanding of the statistical research industry. In class, we should guide students to explore and discover actively, create a classroom atmosphere for discussing, sharing and solving problems, and provide students with opportunities for independent thinking and space for self-development. After class, students should discuss the problems they usually face in different stages, such as scheme design, implementing research, data analysis, report writing, etc. Students are required to form a group of 3-5 voluntarily. Each group can be regarded as a "research project department", and the team leader of each group acts as the project manager. In sequence,

"scheme and questionnaire design→field research→data analysis→report writing→group displaying", each group should complete their assignment in a semester. Each link of the assignment is connected with the course progress. At the end of the term, each group should submit a research report, and finish the class presentation. In group work evaluation, we emphasize process evaluation, allow students to participate in depth, and standardize the links of students' self-evaluation and mutual evaluation, which can play the dual dynamic role of teachers and students. This kind of assignment not only cultivates the students' research and practice ability, but also greatly improves students' teamwork ability. Case teaching enables students to fully feel the working mode, professional characteristics, cutting-edge technical methods and application scenarios in the field of statistical research, and look forward to their career future.

Secondly, invite the off-campus experts into classroom. In the teaching of "Market Research Methods", we usually invite the experts from the enterprises, research & consulting industry, Bureau of Statistics, and other fields into the classroom for 1-2 times, introducing the cutting-edge theories and methods in statistical research, or sharing classic cases to make students feel the presence and vision of the workplace in the classroom, so as to achieve better teaching results.

(2) Practical teaching link

Around the five application abilities of statistics major, we design four consecutive "one-stop" practical

teaching links, that is, cognition practice→curriculum design→professional practice→graduation thesis. With the growth of grade, the training ability of each practical link is gradually enhanced. The ability training items of each link are shown in Table 1.

Table 1 Practice link ability training items

Grade	Practice link	Ability training items
Freshman	Cognition practice	Data collecting
Sophomore	Curriculum design	Data analysis, report writing
Junior	Professional practice	Data analysis, report writing, organizing, leadership
Senior	Graduation thesis	Data collecting, data analysis, report writing, organizing, leadership

At the same time, the "1+2+2" student practice team mode (1 juniors+2 sophomores+2 freshmen) and the "mentor coherent system" are introduced to implement the "one-stop" practice link. Junior students are required to absorb lower grade students to form a practice team according to the "1+2+2" mode. Some students with

strong ability are encouraged to actively explore off-campus cooperation to serve the society, taking advantage of the network resources of their own, and seeking opportunities for industry-education integration. The school needs to provide sufficient funds to constantly improve the software and hardware experimental environment for practical teaching. Under the guidance of teachers, students make full use of the statistical research practice training platform in the school to complete the team's research tasks according to the actual needs of society. Each student's professional practice and graduation thesis are arranged with the same tutor for guidance. About 20% of the students' professional practice topics continue to be upgraded to graduation thesis, which can effectively improve the quality of dissertations.

This "one-stop" practical teaching link not only exercises the organizing and leadership ability of senior students, but also improves the lower grade students' understanding of statistics. More importantly, it improves students' market sensitivity and enhances their ability to penetrate and serve the society. Students in different grade undertake different level of labor division according to the "ability pagoda". The specific division is shown in Figure 2.

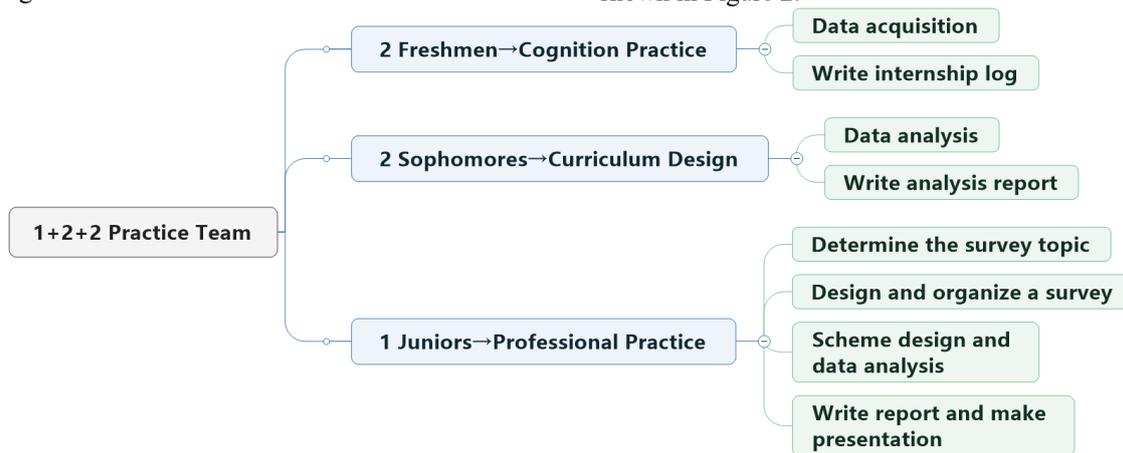


Figure 2 "1+2+2" student practice team mode and labor division diagram

(3) School-enterprise cooperation projects

We pay close attention to the actual needs of the society, expand the industry-education integration space actively, strengthen cooperation with government, enterprises, scientific research institutions, relying on teachers' projects, "college students' innovation and entrepreneurship practice" projects, practical training programs, national major census activities, and so on. We will appropriately increase the proportion of "project-based" practical teaching and create more opportunities for students to participate in social projects in depth, so that students can experience real social topics, better integrate the knowledge they have learned, exercise themselves, serve the society, and achieve the purpose of collaborative education between on-campus and off-campus.

Led by the school-enterprise projects, we will further drive the industry-education integration with multiple subjects of government, industry association, school and

enterprise. For the enterprises or institutions with relatively mature cooperation, we can further develop and cultivate off-campus internship bases to establish a long-term collaborative education mechanism. In the past five years, our students have accomplished more than 60 projects cooperated with the Chinese Academy of Social Sciences, Beijing Bureau of Statistics, the Poverty Alleviation Office of the State Council, Beijing Tongrentang Group, Shijingshan District Government and other units. Every year, about 30% students participate in the projects, which greatly meets the students' individual orientation, and improves their professional quality and employment competitiveness.

(4) Statistical discipline competition

"National College Students' Market Research and Analysis Competition"(CRA) is a statistical discipline competition hosted by the China Association of Business Statistics. It has been successfully held for 12 times and included in the ranking list of the National College

Students' Competition for 4 consecutive years, which has formed a great influence nationwide. We have participated in the event for 10 years since the 3rd session, and achieved very remarkable results. Led by CRA, we constantly improve the competition management system and introduce incentive mechanisms to create more opportunities for "integration of industry and education".

First, the competition organization is gradually standardized. We have set up two student academic associations, "Horizon Statistical Survey Society" and "Big Data Club", both of which are organized and managed by professional teachers or students. The main task is to organize students to participate in various discipline competitions, which not only plays an important role in competition publicity and guidance, but also continuously builds and expands a platform for industry-education integration in terms of the promotion of competition works.

Second, the competition incentive mechanism is becoming perfect gradually. At present, the results of the discipline competitions are linked to the teaching performance and professional title evaluation of tutors. Students can use award certificates to replace the credits of professional practice or electives, and the awards contribute to graduate student exemption and scholarship evaluation. More and more, teachers and students actively participate in the competitions and tend to choose enterprise proposition, so the industry-education integration is further promoted. It has formed an obvious benign effect of promoting "teaching, learning, reforming and constructing" through competitions.

3 4-dimension time-space association of industry-education integration

The main goal of college education is to export talents with professional knowledge and skills to the society, so as to achieve the ultimate goal of serving the society. In practical teaching, we will answer such a question for students: how can we provide the best "service products" to the society? If placed in a dynamic market demand environment, the industry-education integration can be regarded as the R&D process of "service products". Then, the four dimensions of industry-education integration have established an organic space-time association.

(1) Curriculum teaching practice (Opportunity identification→What can we sell?)

Through the course teaching, the theory and practice are highly integrated, so that students can feel that what we can do after learning statistics, what the employment market of statistics is, what the advantages of our major are, and what kind of service products we can provide for the society. In a short words, "Out of school, what can we sell?"

In the curriculum teaching practice, we use rich cases of enterprises to run through theoretical teaching, and invite off-campus experts to bring cases into the class from time to time. The case teaching can better help students correctly identify "product" opportunities in the future workplace, and feed back into the theoretical

teaching, so as to promote us to improve the course system.

(2) Practical teaching link(Product design→What specific products do we sell?)

The "one-stop" practical teaching link is equivalent to the product line we designed, from cognition practice to curriculum design, then to professional practice, and finally to graduation thesis. Through this product line, students are guided to clearly understand the concept of service products and truly realize how to design the service products provided by statistics to the society. That is, "What specific products do we sell?"

In the product line, the practice team of "1+2+2" mode acts as "human resources". Facing the actual needs of society, we encourage students and tutors to use the network resources, create tailor-made "research products" for society or enterprises, and accurately "sell" research plans or reports to the "customers", strive for the support of relevant departments, such as enterprises, government or institutions to seek further cooperation opportunities. In the "one-stop" practical teaching link, industry-education integration plays an extremely important role, which determines whether the "products" we design and develop really meet the social needs.

(3) School-enterprise cooperation project (Product launch→How to sell our products?)

Products recognized by the society can be regarded as "product launch". Similar to goods, service products will also face channel and publicity problems. Once the school-enterprise cooperation project is approved, it means that the industry-education integration is achieved, so the school-enterprise cooperation project can act as the best channel for industry-education integration, which will directly test our service products and decide "how to sell our products?" At present, with the continuous deepening of the industry-education integration, our school provides students with more and more opportunities for school-enterprise cooperation. The practical projects from Beijing Municipal Education Commission, the bidding projects of the government or enterprises, and the social projects undertaken by teachers can attract students' deep participation, so that students can experience how our service products can be launched in a real social environment, and how to sell our products. Doing real projects and making great efforts can not only improve students' practical ability, but also benefit enterprises and serve the society.

(4) Statistical discipline competition (Product evaluation→Does our product sell well?)

The statistical discipline competition provides students with an excellent platform for "product display and evaluation". Still taking CRA as an example, the annual competition jury is very strong, with a certain proportion of professors in the field of market research, senior executives of market consulting enterprises, business executives of government statistics departments and other experts. In recent years, the enterprise track opened by CRA can allow students to experience the original marketing research, and have the opportunity to stand on the stage of the national competition and accept the guidance and evaluation of experts in academia,

business or government statistics. Therefore, it is favored by students, and students' enthusiasm to undertake enterprise propositions has increased year by year. Under the premise of the industry-education integration, the discipline competition is no longer only a "test", but a "real battle" to test our products. For 4 consecutive years, every year, we all have a student team that is exempt from the provincial competition and is directly selected to enter the national finals, because of undertaking enterprise proposition and its works is rated as excellent works. It is worth mentioning that some excellent players have been chosen by famous research and consulting companies with their achievements of the national competition, who have won higher platforms and directly obtained satisfactory jobs.

4 Industry-education integration operation mechanism in Statistics

For the students, in different teaching stages, there will be different emphasis on the 4 dimensions of industry-education integration, the order of time is emphasized. While for the teachers, they are simultaneously faced with students of different grades in 4 dimensions, the coexistence of space is emphasized. Therefore, as far as the whole teaching system is

concerned, the 4-dimension of industry-education integration is an orderly interwoven operation mechanism of time and space. For each grade of students, in the orderly process of the "opportunity identification", "product design", "product launch", and "product evaluation", tutors and students will have deep exchanges with enterprise product managers, salesmen, off-campus cooperation tutors, competition judges or other off-campus experts for many times. At the end of each cooperation project or competition, the network resources formed in the cooperation will not be cut off, and the excellent cases formed will not be sealed. We will summarize in time, supplement the teaching case set, and enrich the expert base. We will seize opportunities to invite the off-campus experts, such as product managers, into the classroom, bringing vivid and interesting enterprise cases back to the origin of teaching, or seek further opportunities for school-enterprise cooperation, employ enterprise executives to concurrently serve as off-campus tutors for practical teaching links or training projects, and directly enter the links of "product design" or "product launch", so that the industry-education integration can form a benign and orderly space-time operation mechanism. The space-time operation mode is shown in Figure 3.

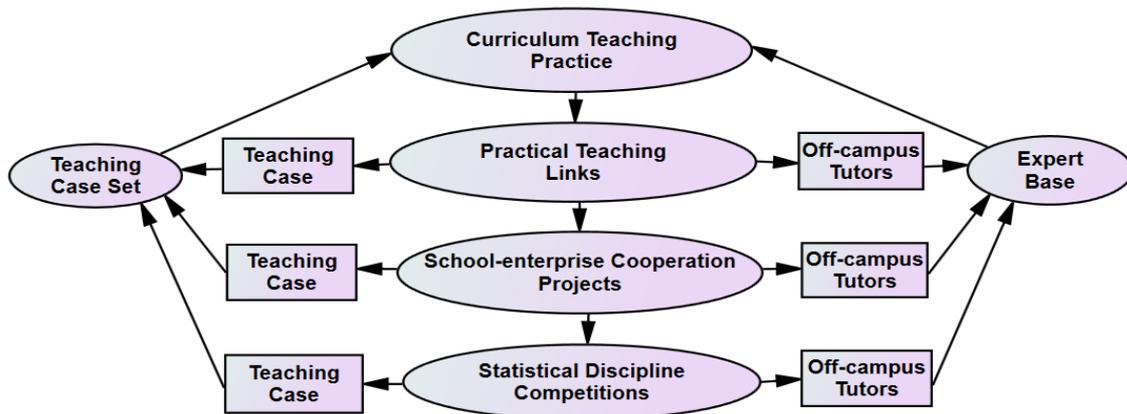


Figure 3 Space-time operation mode of industry-education integration

After years of statistical teaching practice, the talent training quality of statistics major in our school has been continuously improved, and our service products have been evaluated and recognized by more experts and peers, thus creating more opportunities for further deepening the school-enterprise cooperation and promoting the industry-education integration. Our professional education has gradually changed from the unilateral education by the school to a diversified collaborative education pattern composed of schools, enterprises, government, scientific research institutions and other units, which will provide students with more abundant educational resources and growth paths. So the long-term mechanism of industry-education integration will be gradually improved, the supply of training high-level applied talents is increasingly matched with the demand of industry talents, and a good atmosphere of collaborative education in the whole society has been initially formed.

5 Conclusions

To sum up, we outline the industry-education integration mode of statistics major in applied universities. The conclusions are as follows.

First, students majored in statistics need to be cultivated five kinds of application abilities, namely, data collecting and processing ability, data analysis ability, report writing ability, organizing ability and leadership ability. The five abilities are advanced step by step to form a "ability pagoda".

Second, we start from the 4 dimensions of practical teaching, such as curriculum teaching practice, practical teaching links, school-enterprise cooperation projects, statistical discipline competitions, and cultivate students' five abilities respectively, thus forming a 4-dimension space for the industry-education integration, and

presenting a "4-dimension pagoda".

Third, if the industry-education integration in practical teaching can be regarded as the R&D process of "service products", then among its 4 dimensions there is an organic space-time association.

Finally, as far as the whole teaching system is concerned, the 4 dimensions of the industry-education integration are a benign and orderly interwoven operation mechanism of time and space.

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