International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 9 Issue 6, Nov-Dec 2025 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Research on the Reform of Talent Training for Interdisciplinary Innovation in Systems Science

Huang Yuyi

Beijing Wuzi University, Beijing, China

ABSTRACT

This paper takes the course Applied Multivariate Statistical Analysis as a starting point to explore the path of training reform. It optimizes the curriculum system by integrating systems science knowledge points into the teaching of statistical methods and adding cutting-edge practical content. It innovates teaching methods by adopting models such as "dual-case comparison", "full-cycle project-driven learning", and online-offline hybrid teaching. It also strengthens practical teaching by building a progressive scientific research path and a competition coordination mechanism.

KEYWORDS: *Interdisciplinary Talent Training; Systems Science; Curriculum Reform.*

How to cite this paper: Huang Yuyi "Research on the Reform of Talent Training for Interdisciplinary Innovation in Systems Science" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-9 | Issue-6, December 2025, pp.515-518, URL: www.ijtsrd.com/papers/ijtsrd99901.pdf

IJTSRD99901

INTRODUCTION

The Data Science and Intelligent Systems specialisation of the Master's Program in Statistics at Beijing Wuzi University. This direction is based on theories and methods from multiple disciplines, such as statistics, systems science, mathematics, and computer science and technology. It strengthens the organic intersection and integration of "logistics, data, algorithms, intelligence, and innovation". To facilitate the intelligent upgrade of the circulation industry and achieve intelligent data analysis and decision-making, this direction focuses on cultivating practical talent. The cultivation of interdisciplinary talents in systems science has also become a crucial component in the chain of master's programs in statistics. Multivariate statistical analysis, an essential tool in statistical analysis, is widely applied in economics, finance, biomedicine, and numerous other fields.

1. The Main Issues in Current Talent Development

Currently, China's postgraduate education is at a critical juncture, transitioning from a phase of scale expansion to one of quality leap. The new round of technological revolution and industrial transformation is intertwined and evolving, with torrents of data and complex problems emerging in an overlapping manner. Therefore, the country is in urgent need of high-end statistical talents who can gain insights into the correlations between variables in interdisciplinary fields and real-world social contexts. In 2022, systems science was listed as a first-level discipline under the multidisciplinary category. With the rapid development of emerging technologies such as big data and artificial intelligence, systems science, as a highly integrated and interdisciplinary discipline, is gradually becoming a key force in promoting scientific and technological innovation and social development.

Beijing Wuzi University does not have an independent first-level discipline related to systems science. The cultivation of interdisciplinary talents in systems science is mainly carried out within other first-level disciplines, such as statistics, management science, and engineering. Currently, the cultivation of cross-disciplinary innovative talents in systems science at our university still faces challenges, including insufficient innovation ability and a lack of cross-disciplinary literacy, which hinder its ability to meet the demands of national strategy and industrial development. Therefore, exploring the model of cultivating interdisciplinary innovative talents in systems science has become an essential topic in the current reform of higher education.

The traditional talent cultivation model is often confined within the framework of a single discipline. There are widespread problems in postgraduate training, such as the disconnection between theory and practice and insufficient cultivation of innovation ability, resulting in students having a single knowledge structure and being unable to adapt to the demands of interdisciplinary research. For example, the traditional postgraduate training model in statistics employs a methodological linear logic: teachers instruct on model assumptions, parameter estimation, test statistics, and software implementation, following a rigorous sequence of mathematical derivations. Meanwhile, students focus on theoretical derivations and often neglect practical applications. While this approach guarantees the efficiency of knowledge transfer, it inadvertently severs the organic links between methods and problems, models and mechanisms, and data and systems, thereby widening the gap between classroom learning and real-world scenarios in research, industry, and society.

Additionally, the field of systems science requires a high level of innovation and practical expertise. In the current cultivation of interdisciplinary talents in systems science, there is an overemphasis on theory at the expense of valuable applications, resulting in a significant deficiency in innovative, practical capabilities among students. The current cultivation process is unable to produce interdisciplinary innovative talents in systems science.

2. The main measures to solve the problem

A. Optimise the curriculum system

The curriculum system is the core carrier for cultivating interdisciplinary innovative talents. It is necessary to break down the disciplinary barriers between statistics and systems science and construct a curriculum content system of "knowledge integration, clear modules, and collaborative support" to ensure that students can both master solid multivariate statistical analysis methods and develop systems science thinking.

1 Integrate knowledge of statistics and systems science

Starting from the core chapters of the course on applied multivariate statistical analysis, break down the theories and methods of systems science into "knowledge modules" and embed them in the teaching of corresponding statistical methods to achieve simultaneous transmission of "statistical methods + systems thinking". In the "Cluster Analysis" section, incorporate the concept of "emergence" from complex systems theory: taking "urban traffic congestion area classification" as an example, let students first use the K-means clustering algorithm to divide the city into "severely congested areas", "moderately congested areas", and "smooth areas" based on statistical indicators such as traffic volume, average vehicle speed, and road density; Then, through the explanation of complex systems theory, guide students to think about "whether there is systematic emergence in the formation of congestion areas" - that is, how the congestion of a single road section (local feature) forms regional congestion (overall feature) through the interaction between road sections, and guide students to modify the clustering results in combination with the topological structure data of the traffic network, To make the classification results more in line with the overall operational rules of the urban traffic system. In addition, in sections such as "Principal Component Analysis" and "Discriminant Analysis", "the overall optimisation idea of systems theory" and "the feedback regulation principle of cybernetics" are respectively embedded to form a content pattern where "each section has systems science knowledge points, and each statistical method has system application scenarios".

2 Add frontier and practical content

In response to the problem that the course content lags behind industry demand, it will be updated from three dimensions: the introduction of cutting-edge methods, the supplementation of real-world cases, and the design of practical tasks. In terms of frontier methods, several new machine learning methods have been added, including modules such as "Dimensionality reduction and System Analysis of High-dimensional Data" and "Multivariate Statistical Methods for Network Structured Data." When explaining network structure data, methods such as network node clustering and community detection are introduced. Taking "social network user behaviour analysis" as a case, students are guided to identify user groups through clustering analysis methods, such as DBSCAN, and then apply the "small world network" theory from systems science to explain the information transmission paths and system evolution characteristics among user groups.

In terms of practical task design, the course practice hours have been increased from the original 12 hours to 24 hours, with one "method application + system analysis" practical task for each chapter. By formulating rules through discriminant analysis and identifying key elements that affect system functionality, based on the principle that the whole of system science is greater than the sum of its parts, and in combination with the classification results of discriminant analysis, the elderly care resources of the 20 communities are coordinated and optimised.

B. Innovation in teaching methods

Break through the limitations of traditional lecture-based teaching, and build a teaching method system of "case-driven, project-led, and blended interactive" to stimulate students' initiative and creativity.

1 Application of the case-based teaching method

A case teaching model of "double case comparison + stratified guidance" is adopted, with each statistical method accompanied by a "traditional statistical case" and a "systems science case" to deepen students' understanding of interdisciplinary applications through comparative analysis. Take factor analysis teaching as an example. First, based on presenting the traditional statistical case, show the system science case of regional ecosystem health evaluation, providing data such as air quality, water resources, biodiversity, and human activity intensity in a specific area, allowing students to independently use factor analysis to extract the main factors of ecological health first, and then through the teacher's guidance, combined with the structure of the ecosystem, Analyse the systematic correlations among the main factors, such as how the "water resource quantity" factor affects the "biodiversity" factor, and modify the factor extraction results to make the evaluation results more in line with the overall health standards of the ecosystem.

In the case of the teaching implementation process, the "question stratified guidance method" is adopted. The first layer is the method application layer, which asks, "How to use factor analysis to process data?" What are the steps?" The second layer is the system analysis layer, asking "What is the system structure in the case?" What are the roles of each variable in the system?" The third layer is the innovation and optimisation layer, asking, "How can systems thinking be combined to improve the application effect of statistical methods?" Gradually develop students' ability to move from "using methods" to "using methods with systems thinking" through three layers of guidance. In addition, establish a case teaching feedback mechanism by distributing "case comprehension questionnaires" after each class to collect students' opinions on the difficulty of the cases and the connection of systematic knowledge points, and dynamically adjust the case content and guidance strategies accordingly.

2 Project-driven teaching method

Design "full-cycle, interdisciplinary" project tasks and have students complete the entire process from project initiation to outcome presentation in teams of 3 to 5 people. Project themes are divided into two categories: "research-oriented" and "industry-oriented." Research-oriented projects combine teachers' research topics, such as "Research on Carbon Emission Prediction Based on Complex Systems", students need to collect regional carbon emission data, economic development data, energy consumption data, use regression analysis, principal component analysis and other methods to identify key drivers of carbon emissions, and then construct system dynamics models to simulate the evolution trend of carbon emissions. Provide policy recommendations for the "dual carbon" goals. The project implementation process is divided into three phases: The first phase is project planning and data preparation, where teachers guide each team to clarify research goals, break down task divisions, and assist students in obtaining data; The second stage is method application and system analysis. The review panel, composed of university teachers and enterprise representatives, scores them from three dimensions: "method correctness", "depth of systems thinking", and "feasibility of the plan". The project score accounts for 30% of the total course score, ensuring that students devote sufficient energy.

3 Blended teaching model

Based on "online learning platform + offline interactive classroom", construct a blended teaching process of "pre-class preview - in-class inquiry - after-class extension". During the pre-class preview stage, teachers post pre-class learning packages on Chaoxing Learning Pass and WeChat groups. Set up preview quizzes, and students need to complete the test before entering the classroom to ensure the previewing effect.

During the inquiry stage in class, the class time is divided into three parts: "Problem Discussion", "Case Practice", and "Outcome Review". In the "Problem Discussion" section, the teacher organizes group discussions on common problems found during previewing, guiding students to propose solutions in combination with systems thinking. In the "Case Practice" session, students complete pre-class case tasks in the laboratory, and the teacher provides guidance, focusing on whether students can effectively integrate systems science knowledge into the analysis process. In the "Outcome Review" session, 2-3 groups of students are selected to present their practice results. The teacher provides comments on the application of statistical methods and the depth of system analysis, and invites other students to offer suggestions for improvement, creating an interactive learning atmosphere.

C. Enhanced practical teaching

Practical teaching is a key link in cultivating students' interdisciplinary application ability. Through "project design, research collaboration, competition", a practical system of "real scenarios, real data, real problems" should be constructed.

1 Encourage students to participate in research projects

Build a research ability development path of "research entry - research advancement - research independence", and guide students to combine multivariate statistical analysis methods with systems science research. In the introductory stage of research, organise "academic lectures on Research topics" and invite teachers from both within and outside the university in the fields of statistics and systems science to introduce research topics related to their research fields, allowing students to understand the research directions and methods of interdisciplinary research; An elective course on "Introduction to Research Methods" is offered to teach basic research skills such as literature retrieval, data processing, and paper writing to help students build research awareness. In the advanced stage of research, a mentorship system is implemented to encourage students to join the teacher's interdisciplinary research projects: guide students to use multivariate statistical methods to solve problems, students undertake specific tasks in the projects such as data cleaning, model building, and result visualisation, and the teacher holds regular research group meetings to provide targeted guidance and help students accumulate research experience.

2 Subject competitions contribute to the cultivation of applied talents

Build a growth platform through competition synergy mechanisms and integrate resources to accelerate talent cultivation. The core of systems science is "solving cross-disciplinary problems from a systems perspective", and subject competitions often require participants to combine methods from multiple disciplines such as statistics, computer science, and management. At the advanced stage of research, a dual-mentor system is implemented to encourage students to participate in the teacher's interdisciplinary research project. For example, in a teacher's project of "Evaluation of Regional Ecosystem Health", students can be included in the "Multivariate Statistical Analysis of Ecological Data" section to guide students to use multivariate statistical methods for ecological monitoring data and extract health evaluation indicators. Students undertake specific tasks in the project, such as data cleaning, model building, and result visualisation. At the same time, teachers hold regular project group meetings to provide targeted support.

3. Conclusion

Through the implementation of the aforementioned reform plan, we have achieved remarkable results in cultivating interdisciplinary, innovative talents in systems science. First, students' interdisciplinary literacy and practical abilities have been significantly enhanced. Second, the multidisciplinary literacy and functional skills of teachers have been effectively improved. Third, the research level and teaching quality of the school have been significantly improved. Fourth, students' employability and career prospects have improved considerably. For example, in the past five years, the rate of postgraduate students pursuing doctoral studies in our college has reached 72.6%. More than 30 awards have been won, including the Excellent Paper Award at the China Logistics Academic Annual Conference, as well as first and second prizes in national competitions for "Statistical Modelling" and "Market Research and Analysis." Good results have been achieved in cultivating interdisciplinary and innovative talents in systems science.

Acknowledgments

This text is a stage achievement of the Beijing Wuzi University 2025 Postgraduate Curriculum Ideological and Political Project and Educational Teaching Reform Project: Research on the Reform of Interdisciplinary and Innovative Talent Cultivation in Systems Science - A Case Study of the Course "Applied Multivariate Statistical Analysis".

References

[1] Wang, Y. F. (2019). A study on the connotation of interdisciplinary science and the practical path of interdisciplinary talent cultivation [Dissertation]. Hefei: University of Science and Technology of China, (8): 34-36.

[2] Zhang, Y., Chen, L. H., & Guo, Z. J. (2025). Exploration and practice of feasible paths for cultivating innovative talents in chemistry and life interdisciplinary disciplines [Journal Article]. University Chemistry, (11): 5-8.

[3] Wang, F. (2025). Study on the cultivation path of top-notch innovative talents in colleges and universities from the perspective of new-quality productive forces [Journal Article]. Journal of Innovation and Entrepreneurship Theory Research and Practice, (8): 129.

[4] Li, L. G., & Chen, X. Y. (2025). Exploration and improvement strategies of the cultivation mode for top-notch innovative talents in colleges and universities [Journal Article]. Beijing Social Sciences, (1): 99-108.