

Research on Interdisciplinary Thematic Teaching Reform of Rural Planning for Multi-disciplinary Students: A Case Study of Changsha University of Science and Technology

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Abstract: The implementation of the national strategy of rural revitalization has set off an urgent need for the training of high-level rural planners. Based on a review of literature on current interdisciplinary education and teaching in universities at home and abroad, this study takes Changsha University of Science and Technology, a local university, as an example, to analyze the characteristics of multidisciplinary backgrounds of students from two master's degree programs—architecture and architectural and civil engineering, and the interdisciplinary characteristics of rural planning studies, and delves into the teaching reform of rural planning courses in terms of organizational pattern, module setting and learning outcomes assessment. Furthermore, it supplements adaptive and effective strategies and models for modular courses to bring about interdisciplinary teaching and extends the new approaches of higher education methodology validation studies to teaching reform in the field of Architecture and Rural planning.

Keywords: Interdisciplinary; Thematic teaching; Rural planning; Multi-disciplinary students; Graduate students.

1. Introduction

Nowadays, as the national strategy of rural revitalization is advanced on all fronts and higher education increasingly stresses the integration of applied research and basic theoretical research with an emphasis on the active pursuit of interdisciplinary and cross-field dialogues to improve innovation skills in interdisciplinary fields[1], for the stage of graduate education, based on the multidisciplinary backgrounds of the students of the two master's degree programs—architecture and architectural and civil engineering at local university Changsha University of Science and Technology, the study on the reform of interdisciplinary thematic teaching of rural planning course gives consideration to systematic integration of the two dimensions: the universality of interdisciplinary education in higher education and the idiosyncrasy of professional education in generalized architecture (disciplinary cluster of urban-rural human settlements). The significance and value of the study are threefold as follows.

1.1. Interdisciplinary education as an internationally cutting-edge issue of teaching reform has its unique practical value

The concept of “interdisciplinary” was first publically used by Woodworth at Columbia University in the US in 1926. “Interdisciplinary” itself became a discipline after a succession of events, including the Unity of Science movement in the 1930s, the student movement asking for the abolishment of collegiate discipline structure in the 1960s, and the publication of the theoretical work *Interdisciplinarity: Problems of Teaching and Research in Universities* by the OECD (Organization for Economic Co-operation and Development) in the 1970s. Furthermore, it has become a

development strategy for many universities in the 21st century. Thus, over the past four decades, the most prominent academic change in higher education was the development of interdisciplinary education and research. Developed countries, represented by the US, the UK, France and Japan, focus intensely on the exploration and practice of interdisciplinary education reform. Whereas in China, interdisciplinary education, as an important part of the “New Engineering Education” in China, not only has received extensive attention but also is leading the profound reform of higher education in engineering. Therefore, at present, it is of great practical significance to pay attention to this cutting-edge issue and probe into the studies on the practice of this teaching reform in the process of educating engineering graduates and training related professionals.

1.2. Interdisciplinary competencies are a must-have for high-level talents in the field of rural planning and are of key strategic importance

The rural area is a complex system that involves a number of elements, including space, society, economy, resources and environment. It is an inevitable trend to conduct interdisciplinary research, build a comprehensive analytical framework and accelerate the continuous development of rural area studies. Meanwhile, rural areas in China are experiencing unprecedented transformation and development. Vast swathes of rural areas are crying for cross-departmental and interdisciplinary collaboration to provide “localized, set, participatory, full-process” rural planning and design, construction, consultation and service models. These new trends in the theoretical studies and practices have triggered an urgent need for the training of rural planners at different levels, especially interdisciplinary and versatile talents who can solve complicated engineering problems and have the

traits of “being able to raise questions in unknown fields of knowledge and practice and think outside the box, having developed the habit of critical questioning, being capable of identifying needs with irrelevant information and views, having developed their own opinions on problems, being an active learner, circumspect thinker, and good collaborator.” Hence, the research on the reform of interdisciplinary thematic teaching carried out in this study is of unique strategic significance to the problem about how to educate the “talents” who can put the findings about diversified rural settlements into the spatial carriers of ekistics and architectural studies and address complicated and intricate problems for rural revitalization planning.

1.3. Interdisciplinary thematic teaching is an effective path to help graduate students from different disciplinary backgrounds transfer learning and develop innovative thinking, and is of significant practical value

The foundation and starting point of the current interdisciplinary teaching is the discipline-based teaching widely adopted in universities in response to the realistic need to solve complex problems that are beyond a single discipline. Hence, the organization of interdisciplinary thematic teaching should give full consideration to the knowledge structure, mode of thinking and research methods already required by students under the framework of discipline-based teaching and instruct them to transfer knowledge and settle complex problems. Currently, in light of the students of the school of architecture, the diversified discipline knowledge structures, modes of thinking and research methods acquired by graduate students from different disciplinary backgrounds have laid a sound foundation for interdisciplinary thematic teaching of rural planning courses. In turn, courses of “problem”-centered interdisciplinary thematic teaching make it easier for graduate students from different academic backgrounds to integrate and link new knowledge and required knowledge in real-world situations, enhance their understanding of the views of different disciplines and their connections, develop critical thinking from multiple perspectives, reinforce epistemic beliefs and metacognitive skills, and achieve self-construction.

2. Literature References

2.1. Developed countries have been following interdisciplinary education for a long time, with more holistic studies of teaching than curriculum reform practices

Interdisciplinary education overseas is large in scale and highly mature, and their studies on interdisciplinary education are at higher levels. As early as 1997, the IGERT program initiated by the National Science Foundation (NSF) in the US focused on training high-level and innovative talents with interdisciplinary competencies in research training of interdisciplinary collaborative research [2]. Earlier researchers emphatically discussed the factors that influence interdisciplinary team teaching and their influencing mechanisms, and they claimed that the diversity and compatibility of cooperating teachers in many dimensions such as discipline skill, research perspective and gender, the interactive environment of the classroom, and the dialogues

and interactions between teachers, students and disciplines all play an important role in interdisciplinary teaching. Among them, at the stage of curriculum planning, how cooperating teachers coordinate the different teaching modes is also crucial. Siedlok. F and Hibbert. P[3] dissected the organizational model of interdisciplinary teaching on the basis of the integrated innovation theory. Vereijken Mayke W.C et al. [4] argued that the field of higher education should shift to a more open interdisciplinary approach and it is vital to further tap into the potential of the multidisciplinary, cross-disciplinary and interdisciplinary reform to make students become the professionals needed by society. It is thus clear that earlier studies conducted by foreign scholars in developed countries mostly chose to delve into the factors that influence interdisciplinary education and their influencing mechanisms, then gradually shifted to the practical research of interdisciplinary talent training and education with an emphasis on the summarization and elevation of theories, and summed up a number of universal education and teaching models for reference. Nonetheless, in terms of research contents, there are only a few practical researches concerning the micro reform of the interdisciplinary curriculum.

2.2. China focuses on the comparisons between China and foreign countries in the macro narrative of interdisciplinary education, but local micro practical research lacks depth

Chinese Professor Liu Zhonglin was early to pay attention to interdisciplinary education and claimed that the division of disciplines must be removed and integrated interdisciplinary teaching should be conducted. J.Tian, et al.[5] pointed out and reflected on the misconceptions about interdisciplinary teaching and clarified the relationship between interdisciplinary teaching and discipline-based teaching in an attempt to impel university curriculum and education to return to the path they ought to take. From the perspective of comparative education, X.Y.Li[6] discussed the trends of the reform of interdisciplinary education and talent training in universities in the US, the UK, France and Japan. In recent years, Chinese scholars have focused on drawing on experience from foreign countries for interdisciplinary talent training in China. By extracting and summarizing the training modes for interdisciplinary graduate students of research universities in the US, Z.B.Pei and H.R.Shao et al.[7] proposed the strategy to improve interdisciplinary education for graduate students in China in four ways: clarifying the concept of interdisciplinary training, broadening the channels for talent training, reforming the management system, and improving the quality assessment system. J.K.Cheng et al.[8] specially analyzed interdisciplinary major’s setting background, training objectives, curriculum characteristics and operating mechanisms of several world-class universities in the US and summed up their characteristics, thereby putting forward suggestions for graduate education and interdisciplinary professional development of Chinese universities, especially research universities. Besides, G.Z.LYU et al. [9] discussed the original intentions, model construction and operating mechanism of interdisciplinary education at the University of Tokyo in Japan, and provided suggestions for “Double First-Class” universities in China to improve their ability of training.

Assuredly, scholars have also paid some attention to relevant problems indigenous to China. R.S.Yu et al.[10] carried out a survey on interdisciplinary education for graduate students in China. Besides, based on an investigation into the practices of interdisciplinary talent training by eight “Double First-Class” universities in Beijing and a summary of their models, S.Chen and Y.C.Cui[11] provided useful suggestions for Chinese universities to further innovate transdisciplinary talent training and strategize for interdisciplinary education in higher education in the future. In addition, L.Hao et al.[12] proposed their viewpoints and conducted research on the development of an interdisciplinary curriculum for the New Engineering Education. It follows that Chinese scholars prefer theoretical contemplation, their perspectives are mostly macro narration and experience summarization, and their research contents focus on the model of interdisciplinary talent training, but few have conducted in-depth research on interdisciplinary teaching or curriculum reform from a micro perspective.

2.3. What disciplinary development and industry demand changes trigger focus only on the top level of undergraduate rural planner training

On the whole, over the past ten years from 2008 when the Urban and Rural Planning Law was enacted to incorporate rural planning and village planning into the urban and rural planning system to 2018 when the strategy of rural revitalization was implemented and it was proposed to enhance the training of rural planners, most of those who focused on the training of rural planners and the studies of mode adjustment against the background of the development of urban-rural planning discipline and the changes in the demand for related professionals were scholars at leading universities. It includes two layers: first, holistic studies based on urban-rural planning education, S.W.Zhang, J.S.Li, F.Luan et al.[13] pointed out the necessity and urgency of the transformation of professional urban-rural planning education in China, and explored how to develop professional qualities of urban-rural planners in the new era and how should planning education respond and change in several dimensions such as educational system planning and main course type; second, reflections on the scarcity of rural planners, for example, H.Leng [14], Y.Wang [15], S.W.Zhang, Z.W.Peng, D.G.Duan et al[16], Z.Q.Wu, M.Zhao et al. [17] claimed that universities should add more contents about rural epistemology and planning methodology throughout rural planning education in response to the needs of rural planning and construction, and they made highly exemplary explorations on strengthening interdisciplinary cooperation and building rural planning education knowledge systems and models with Chinese characteristics.

However, in the face of the demand for interdisciplinary and innovative rural planning researchers in the new era, there is still a lack of effective responses to the realistic characteristic that graduate students in this field generally have multidisciplinary backgrounds in terms of training concepts, modes and teaching methods, and there are precious few related theoretical and practical studies, unable to effectively guide the practical reform of the training of professionals and satisfy the need of the implementation of the rural revitalization strategy for high-level and innovative talents.

3. Practical Research on The Teaching Reform

3.1. Research on the adaptive curriculum organization model of interdisciplinary thematic teaching of rural planning

The curriculum organization model which integrates “teaching-research-competition” and engages “double-professionally-titled teachers” is built. When teachers responsible for this course are instructing students to complete practical projects, teaching contents are organized in three steps: field investigation, classroom instruction, and theory teaching (thematic teaching). On the one hand, the practical researches on courses choose topics with students’ research preferences and disciplinary backgrounds and the problems found in field investigation as the starting point, and integrate innovative research activities, such as innovative graduate project proposal, paper writing and design competition, to organize course teaching, achieving the combination of “teaching + research + competition”. On the other hand, a teaching model that integrates “government, industry, university and research” is built, and each course will invite outstanding alumni in the realms of rural development or planning design to return to school to share their experience with the co-guidance of intramural “double-professionally-titled teachers” (certified planner and university teacher) and rural bases’ villager tutors, village leaders, entrepreneurs and extramural tutors. Participants in teaching from diversified backgrounds furnish the teaching team with multidisciplinary knowledge and expertise. The building of such an interdisciplinary teaching team not only guarantees rich teaching contents and diverse methods, but also provides students from different disciplinary backgrounds with a wider range of research perspectives and a platform for communication. Moreover, it furnishes rural revitalization efforts with important intellectual support.

3.2. Research on the module design and implementation of interdisciplinary thematic teaching of rural planning

Interdisciplinary teaching is not to identify the universally recognized core of knowledge but to research and learn in the face of real and complex problems. Based on this, a major training objective of interdisciplinary thematic teaching for graduate students is to develop their integrated academic thinking and metacognitive skills. Therefore, for rural planning courses as a type of modular course, the setting and practice of problem-oriented integrated teaching modules inside and outside the classroom are at the core of interdisciplinary thematic teaching of rural planning. Centering on “constructive learning”, chapters of courses are modularized, a knowledge map is constructed, “problems” are assembled, learning topics are orchestrated, and balanced didactical activities are designed. This study has strengthened inquiry-based learning of students in the process of setting and implementing the modules of interdisciplinary thematic teaching. Problem scenarios are designed to lead students to think and explore on their own initiative and develop their problem-solving ability and innovation capability. Local Logic: Spatial Congruence Between Talent Supply and Demand.

3.3. Research on assessment methods of innovation capability of interdisciplinary thematic learning of rural planning

The original intention and purpose of interdisciplinary thematic teaching of rural planning is to improve students' comprehensive research skills and practical abilities to solve complicated and realistic rural planning problems that are beyond a single discipline. The criteria and methods for learning outcomes assessment for interdisciplinary thematic teaching of rural planning are built on, after interdisciplinary learning, “① whether students are able to understand the overall framework of thematic studies on “rural space”, including the features and functions of each component submodule and the relations between modules, and methods and paths of inputting and outputting; ② whether they can

cognize, comprehend and give full play to the disciplines they have learnt before in the whole system and framework and their strengths and weaknesses; ③ whether they are well acquainted with other disciplines related to thematic studies on “rural space”, and able to communicate and collaborate with classmates and teachers from other disciplines in others' disciplinary contexts; ④ whether they are able to comprehend the coupling between different disciplines in thematic studies on “rural space”; ⑤ whether they are able to propose innovative optimization solutions or research reports”, and other aspects of the teaching outcomes assessment for innovation capability training to build a learning assessment indicator system and set relevant criteria (Tab.1). Furthermore, on this basis, a dynamic feedback mechanism is formulated, to verify teaching outcomes and adjust assessment criteria.

Table 1. Interdisciplinary innovation capability assessment indicators and methods

Assessment dimensions	Assessment Indicators	Definitions of indicators	Assessment methods	Assessment tools
Innovative personality	Inquisitiveness	Curious, good at identifying realistic problems in a field investigation, willing to actively probe into the causes behind those problems, and have the desire to explore the problems per se.	Self-assessment Peer assessment	Self-report inventory, peer response
	Thinking ability	Good at thinking, able to propose relatively unique research perspectives or ideas.		
Innovative thinking	Divergent thinking	Break through the fetters of research thoughts, concepts, theories and methods of former disciplines, seek differences among common points, think in multiple dimensions, and propose opposite views.	Assessment of process	Classroom interaction, inquiry-based learning and discussion, participation of academic activities
	Logical thinking	Have a complete knowledge of things, capable of analyzing, generalizing and deducing interdisciplinary problems; the result is presented fluently with clear thinking.		
Innovative learning	Autonomic learning	Learn new knowledge of different disciplines in a planned way according to their own and team's interests or needs, then conclude and reflect	Assessment of process	Classroom interaction, inquiry-based learning and discussion, participation of academic activities
	Knowledge transfer	Master basic knowledge of at least two disciplines based on a good command of interdisciplinary concepts and innovative approaches, have formed a holistic knowledge structure, and can transfer and apply to different situations; analyze and interpret design achievements or practical cases about rural space in depth, have the ability to estimate varied information, and provide scientific and reasonable evaluation and conclusions.		
Innovative skills	Problem raising	Able to find problems in complex situations from different perspectives and articulate the problems with academic language.	Assessment of process	Classroom interaction, inquiry-based learning and discussion, participation of academic activities
	Problem solving	For complex problems, able to dispassionately analyze, make proper plans and use interdisciplinary knowledge and techniques to solve problems.		
Innovative achievements	Artistry	The expression of result is complete, artistic and highly readable.	Evidence-based assessment	Result rating scale
	Novelty	Creative means of expression are used, or design work per se is novel to a certain degree, or the formulation of research report is novel to a certain degree.		
	Process	Multidisciplinary knowledge and methods are used in design or research report while in the making, with complete and logically rigorous deduction.		
	Value	Design or investigation report can solve realistic problems in rural development and planning, or provide ideas and inspirations for future interdisciplinary conundrums.		

4. Conclusion

Based on local universities, for the collective and individual characteristics of graduate students majoring in generalized architecture (disciplinary cluster of urban-rural human settlements) from different disciplinary backgrounds, this study focuses on the paths and approaches of the interdisciplinary teaching reform, responds to the new need of the full implementation of the national rural revitalization strategy for training research-oriented and innovative high-level talents who are able to solve major and complicated rural development problems and possess interdisciplinary competencies, gives full consideration to the interdisciplinary characteristics of rural planning studies, and probes into interdisciplinary thematic teaching reform of rural planning course. The teaching reform this time follows the intrinsic requirements of the law of disciplinary development: on the one hand, it reflects on the efficacy of talent training of higher education in light of the related need, builds the curriculum organization model for interdisciplinary thematic teaching of rural planning and teaching module and adaptive paradigms for teaching module cluster; on the other hand, learning outcomes assessment criteria for interdisciplinary thematic teaching are studied proceeding from the connection between talent training and industry development, and the new approaches of higher education methodology validation studies are extended to the teaching reform in the field of Architecture and Rural planning.

Through the above mentioned reform implementation process, this study has yielded a series of empirical results. This study innovates and upgrades the teaching of rural planning through the interdisciplinary thematic teaching reform of rural planning for students from a variety of disciplines. The process of implementing the reform and the empirical results show that the participation of multidisciplinary students diversifies the contents and methods of teaching, and the use of inquiry-based learning approaches improves the learning outcomes and innovative research skills of students, and the construction and application of innovation capability assessment system further improves the practice of the whole teaching reform through the assessment, creating a complete closed loop of course teaching: "teaching design - process organization - process evaluation". These innovations and empirical experience provide new ideas and practical foundations for the coordinated development of rural revitalization and professional education.

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