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Research on the Characteristics and Functions of Grassroots Teaching Organizations in Interdisciplinary Education

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Abstract: With the continuous strengthening of the trend of knowledge integration, the importance of interdisciplinary education in the modern education system is becoming increasingly prominent. As the implementation carrier of interdisciplinary education, the characteristics and functions of grassroots teaching organizations directly affect the effectiveness of interdisciplinary education. This study provides a clear definition of the concept of interdisciplinary education grassroots teaching organization, elaborates on relevant theoretical foundations, and deeply analyzes its characteristics of diversity, comprehensiveness, integration, collaboration, and openness, as well as its functions of talent cultivation, knowledge innovation, resource integration, and social services. At the same time, the issues of disciplinary integration, teaching facilities and environment, teaching resource allocation, management and evaluation system in the development of the organization were discussed, and corresponding optimization strategies were proposed to provide theoretical basis and practical guidance for improving the quality and effectiveness of interdisciplinary education grassroots teaching organizations.

Keywords: Interdisciplinary Education; Characteristics of Grassroots Teaching Organizations; Grassroots Teaching Organizational Functions

Introduction

In the current era of globalization and rapid development of the knowledge economy, various problems faced by society are becoming increasingly complex and diverse, such as climate change, public health events, and a series of ethical and social issues brought about by the development of artificial intelligence. The solution to these problems is no longer limited to the scope of a single disciplinary knowledge, but requires the integration of knowledge, methods, and technologies from multiple disciplinary fields. Interdisciplinary education is an educational philosophy and model developed to meet this demand. It aims to break down the boundaries between traditional disciplines and cultivate students' comprehensive literacy and interdisciplinary problem-solving abilities.

Grassroots teaching organizations play a fundamental role in the education system and are the direct organizers and implementers of educational and teaching activities. In interdisciplinary education, grassroots teaching organizations bear the important task of transforming interdisciplinary educational concepts into practical teaching activities. Its operational status, organizational characteristics, and functions not only affect the smooth implementation of interdisciplinary education, but also have a profound impact on the quality of education and the effectiveness of talent cultivation [1]. However, the current research on grassroots teaching organizations in interdisciplinary education is not deep and systematic enough, and there are also many problems that need to be solved in actual educational practice. Therefore, conducting in-depth research on the characteristics and functions of grassroots teaching organizations in interdisciplinary education, identifying existing problems, and proposing optimization strategies have important theoretical and practical significance. This study will conduct a comprehensive and in-depth analysis of grassroots teaching organizations in interdisciplinary education, providing useful references for the development of interdisciplinary education.

1. Characteristics of Grassroots Teaching Organizations in Interdisciplinary Education

1.1 Diversity

Interdisciplinary education grassroots teaching organizations exhibit diversity in subject backgrounds and teaching resources. It gathers teachers and students from different disciplines such as computer science, urban planning, sociology, environmental science, etc. In teaching organizations engaged in smart city research, there are personnel from these different professions. This diverse disciplinary background is a rich source of knowledge exchange and integration. Teachers from different disciplines can integrate their unique theories, methods, and tech-

nologies into the teaching and research process, and students can also broaden their thinking horizons through exposure to interdisciplinary perspectives. Due to the diverse disciplinary backgrounds of its members, teaching resources also present diversity. In addition to traditional textbooks and laboratory equipment, databases, academic journals, industry reports, etc. from different disciplines are also included [2,3]. For example, in cross medical and engineering teaching organizations, medical anatomy models The case database and engineering design software, manufacturing equipment, etc. in the field of engineering jointly build a rich teaching resource system, providing diverse materials for interdisciplinary teaching and research.

1.2 Comprehensiveness

One of the characteristics of grassroots teaching organizations in interdisciplinary education is comprehensiveness, which is reflected in both teaching objectives and curriculum systems. The teaching objectives are not limited to imparting knowledge from a single subject, but focus on cultivating interdisciplinary knowledge and skills. For example, when designing a sustainable urban transportation system, the teaching objectives should cover road planning, vehicle flow control, and other knowledge in transportation engineering, as well as energy-saving and emission reduction requirements in environmental science and analysis of residents' travel needs and behaviors in sociology. Through such goal setting, students' ability to comprehensively solve urban transportation problems can be cultivated [4,5]; In terms of curriculum system, it also breaks the boundaries of traditional subject courses and constructs comprehensive courses, such as the "Biology Chemistry Physics Comprehensive Experiment" course. This course integrates the research of biomolecules in biology, the principles of substance reactions in chemistry, and physical measurement methods in physics into one experimental course, allowing students to experience the comprehensive application of multidisciplinary knowledge in one course.

1.3 Collaboration

Collaboration is a significant characteristic of interdisciplinary education grassroots teaching organizations, which is reflected in both teacher and student groups. In terms of teacher collaboration, teachers from different disciplines need to work closely together to develop teaching plans, develop interdisciplinary courses, and conduct teaching research[6]. For example, in a teaching organization that spans literature and art history, literature teachers and art history teachers collaborate to design course content. Literature teachers explain the artistic descriptions in literary works, while art history teachers interpret the artistic styles in works from the perspective of art history [7]. Through this collaboration, teaching quality is improved. In terms of student collaboration, students also need to collaborate in interdisciplinary projects and course learning. Students from different professional backgrounds form teams to leverage their respective strengths and work together to solve interdisciplinary problems. For example, in a project on campus sustainable development planning, students majoring in environmental science provide advice on ecological protection, students majoring in architecture are responsible for campus building layout planning, and students majoring in engineering think about issues such as energy utilization and facility construction, and collaborate to complete project tasks.

1.4 Openness

Interdisciplinary education grassroots teaching organizations continuously absorb new disciplinary knowledge and cutting-edge research results. With the development and cross integration of disciplines, new disciplinary knowledge continues to emerge, such as the knowledge in the field of intelligent medicine generated by the intersection of artificial intelligence and medicine. Teaching organizations should promptly incorporate these new knowledge into teaching and research content, maintaining the openness and cutting-edge nature of the knowledge system. At the same time, interdisciplinary education grassroots teaching organizations maintain close contact with external enterprises, research institutions, and other universities. For example, collaborating with enterprises to carry out industry university research projects, introducing the actual needs and market information of enterprises into the teaching and research process; Collaborate with research institutions to share research resources and carry out joint research projects; Exchange and cooperate with other universities, draw on advanced interdisciplinary education experience, and broaden one's own development perspective.

2. The Function of Grassroots Teaching Organizations in Interdisciplinary Education

2.1 Talent cultivation function

Interdisciplinary education grassroots teaching organizations integrate knowledge systems and research methods from different disciplines to encourage students to break the mindset of a single discipline. For example, in an artificial intelligence related teaching organization that integrates physics, mathematics, and computer science, students need to combine model building thinking in physics, logical reasoning thinking in mathematics, and algorithmic thinking in computer science during the learning process. This collision and integration of interdisciplinary thinking helps cultivate students' ability to analyze and solve problems from multiple perspectives, enabling them to flexibly apply different disciplinary thinking methods to deal with complex real-world problems [8]. In terms of curriculum design, interdisciplinary courses and projects will be arranged. If designing a course on the integration of biology and information technology, students need to think about how to simulate and analyze biological phenomena using information technology in order to develop interdisciplinary thinking skills.

Students can be exposed to knowledge, culture, and values from multiple disciplinary fields in interdisciplinary education grassroots teaching organizations. For example, in a cross-cultural research and communication teaching organization, students not only need to learn about the connotations and characteristics of different cultures, but also master the theories and methods of communication studies. This helps broaden students' horizons, enhance their cultural tolerance and cross-cultural communication skills, and improve their overall literacy. The interdisciplinary practical activities organized by the organization, such as the combination of international cultural exchange projects and communication strategy development, enable students to enhance their abilities in comprehensive application of knowledge, communication and coordination in practice.

2.2 Knowledge innovation function

Teachers and students from different disciplinary backgrounds gather in grassroots teaching organizations, providing a platform for the integration of disciplinary knowledge. For example, in the teaching and research organization at the intersection of nanotechnology and medicine, the knowledge of material preparation in nanotechnology is integrated with the knowledge of disease diagnosis and treatment in medicine. Teachers and students can jointly explore innovative applications of nanomaterials in medical imaging, drug targeted transportation, and other fields, thereby generating new knowledge and technological achievements [9,10]. Interdisciplinary research projects are often an important avenue for knowledge innovation. For example, the implementation of the "Sustainable Development Project Integrating Environmental Science and Economics" may lead to the emergence of new environmental economics theories and methods through research on the economic value assessment of environmental resources and the economic impact analysis of environmental policies.

Grassroots teaching organizations in interdisciplinary education encourage interdisciplinary exploration of cutting-edge issues in the field. For example, in the interdisciplinary field of quantum computing and cryptography, members of grassroots teaching organizations can jointly study the challenges of quantum computing to traditional cryptography and the construction of new quantum cryptography systems. This interdisciplinary exploration helps to achieve new breakthroughs in cutting-edge fields and promote the development of related disciplines. Internal academic exchange activities within the organization, such as interdisciplinary seminars, academic lectures, etc., can timely convey cutting-edge information of disciplines, stimulate members' innovative thinking, and provide impetus for promoting the development of cutting-edge disciplines.

2.3 Resource integration function

Interdisciplinary education grassroots teaching organizations can integrate teaching facilities, textbooks, faculty and other resources from different disciplines. For example, in a teaching organization that spans art and engineering, art studios and exhibition facilities can be shared with engineering laboratories, engineering equipment, and other teaching facilities. At the same time, the content of textbooks from different disciplines can be integrated to develop textbooks suitable for interdisciplinary teaching. Teachers from different disciplinary backgrounds can also collaborate with each other and leverage their respective teaching strengths. By utilizing modern information technology,

such as establishing an online teaching resource platform, integrating electronic books, teaching videos, online courses, and other resources from various disciplines, it is convenient for teachers and students to access and use them.

In terms of scientific research, interdisciplinary education grassroots teaching organizations can integrate research projects, funds, equipment, and other resources from different disciplines. For example, a grassroots teaching organization involving materials science, physics, and chemistry can integrate research projects undertaken by each of the three disciplines to achieve resource sharing and collaborative research. Integrate research equipment from various disciplines, establish shared laboratories, and improve the utilization rate of research equipment. At the same time, integrating research funding sources from different disciplines, allocating funds reasonably, improving the efficiency of fund utilization, and promoting the output of scientific research results.

2.4 Social service function

Modern society is facing many complex problems, such as climate change, urban traffic congestion, and unequal distribution of healthcare resources, which require interdisciplinary knowledge and methods to solve. Interdisciplinary education grassroots teaching organizations can provide intellectual support for solving these social problems by cultivating interdisciplinary talents and conducting interdisciplinary research. For example, members of the organization can apply knowledge from disciplines such as traffic engineering, urban planning, sociology, etc. to propose comprehensive solutions to urban traffic congestion problems, such as optimizing transportation network layout, adjusting urban functional zoning, and guiding residents to change their travel modes. Collaborate with government departments, social organizations, etc. to carry out social projects and apply interdisciplinary research results to solve practical social problems. For example, collaborating with environmental protection departments to carry out environmental pollution control projects and utilizing interdisciplinary knowledge to develop effective control plans.

Members of grassroots teaching organizations in interdisciplinary education come from different disciplinary backgrounds and may also have different cultural backgrounds. By conducting interdisciplinary teaching, research, and communication activities, it is possible to promote communication and integration between different cultures. For example, in an international interdisciplinary education grassroots teaching organization, teachers and students from different countries participate in projects together. In this process, the cultures, values, and other aspects of different countries exchange and influence each other, which helps promote global cultural exchange and integration. Carrying out interdisciplinary projects related to social culture, such as combining cultural heritage protection with tourism development, not only protects cultural heritage, but also promotes the dissemination and exchange of culture, enhancing the cultural vitality of society.

3. Optimization Strategies for the Development of Grassroots Teaching Organizations in Interdisciplinary Education

3.1 Strategies for promoting interdisciplinary integration

3.1.1 Building a common knowledge framework

Identify the core concepts and key connections between different disciplines, and based on this, construct a common interdisciplinary knowledge framework. For example, in interdisciplinary teaching of environmental science and economics, the concept of "resource scarcity" holds significant importance in both disciplines. Environmental science focuses on the impact of scarce natural resources on ecosystems, while economics studies resource allocation and value assessment in situations of resource scarcity. Taking "resource scarcity" as the starting point, constructing a common knowledge framework that includes environmental resource assessment, environmental policy and economic analysis, etc., can help students understand the inherent connection between the knowledge of the two disciplines.

Conduct interdisciplinary foundational courses aimed at introducing fundamental concepts, theories, and methods in interdisciplinary fields. For example, offering the course "Introduction to Interdisciplinary Research Methods" to teach students how to integrate research methods from different disciplines, such as combining experimental design methods in physics with survey research methods in sociology, laying the foundation for in-depth interdisciplinary learning and research. The specific integration process of physics and sociology research methods is shown in Figure 1.

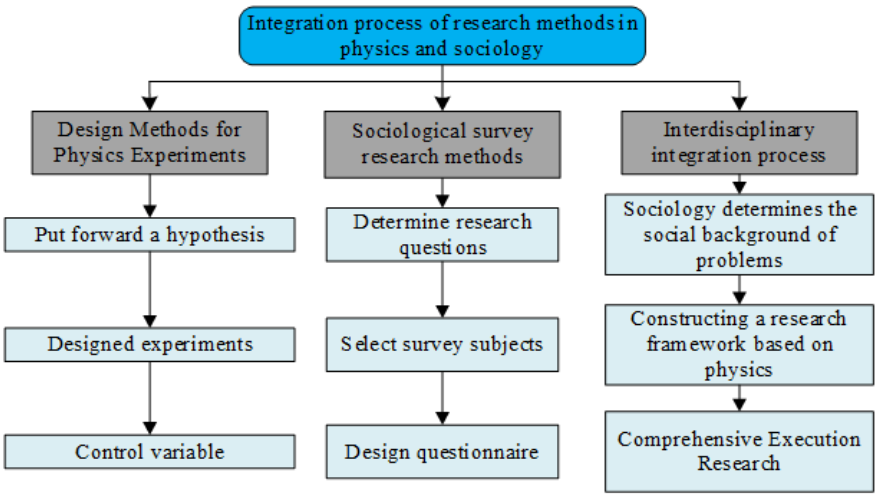

Figure 1 Integration process of research methods in physics and sociology

3.1.2 Strengthen cultural exchange among disciplines

Organize interdisciplinary academic and cultural activities, such as subject culture lectures, academic salons, etc. In these activities, teachers and students from different disciplines can share their academic traditions, research paradigms, and evaluation criteria. For example, holding a lecture on "Cultural Differences and Integration between Natural Sciences and Humanities and Social Sciences" allows teachers and students to understand the characteristics of empirical research and precise quantification in natural sciences, as well as the emphasis on theoretical construction and qualitative analysis in humanities and social sciences, promoting mutual understanding and respect.

Establish interdisciplinary collaborative project teams, allowing teachers and students to experience the collision and integration of different disciplinary cultures in project practice. For example, in a project on urban sustainable development, members from disciplines such as engineering, environmental science, sociology, etc. participate together. Engineering students can learn about the way sociology focuses on the needs of residents, and sociology students can also understand the technical means of engineering in solving practical problems, gradually integrating different disciplinary cultures through this approach.

3.2 Strategies for teaching facilities and environment

3.2.1 Optimizing Teaching Space

Renovate the existing classroom by removing some movable partition walls to increase the flexibility of the space. For example, in some comprehensive universities, adjacent small classrooms can be connected and quickly arranged into different functional areas according to different interdisciplinary teaching needs. When conducting interdisciplinary courses in environmental science and engineering, a portion of the classroom can be set up as a theoretical lecture area, with tables, chairs, and multimedia equipment placed; The other part is set up as a simple experimental operation area, where some small environmental monitoring instruments and engineering model making tools are placed. Shared teaching spaces can also be established and reserved for use according to different subject needs. For example, schools can set up a large multifunctional teaching space, equipped with movable experimental equipment, tables and chairs, etc. When interdisciplinary teaching of computer science and art is conducted, this space can be arranged with a computer equipment area on one side for displaying programming and digital art works; On the other side is the art creation area, where painting tools and handmade materials are placed.

Integrate teaching space resources from different disciplines and break down spatial barriers between disciplines. For example, integrating the laboratory of science and engineering with the seminar room of humanities, and setting up a small seminar area next to the laboratory. In interdisciplinary courses of chemistry and history, when explaining the role of chemistry in ancient civilizations, one can first demonstrate the reproduction of ancient chemistry experiments in the laboratory, and then conduct in-depth historical and cultural discussions in the adjacent discussion area. Adopting time-division multiplexing to improve the utilization of teaching space. For example, during the day, classrooms can be used for theoretical and experimental teaching in science and engineering; At night, it can be transformed into a venue for

humanities seminars and lectures. For some special interdisciplinary courses, such as Astronomy and Literature (which describe astronomical phenomena in ancient literature), astronomical observations can be conducted at night using an astronomical observatory, and then returned to the classroom (which is simply arranged into a seminar room) for analysis and discussion of literary works.

3.2.2 Equipment and software compatibility planning

Schools or interdisciplinary grassroots teaching organizations should actively promote the standardization of technical equipment and software across different disciplines. For example, in the interdisciplinary field of computer science and biology, a standard format for data transmission and storage can be developed, requiring imaging equipment in the field of biology and data processing software in the field of computer science to follow this standard. This can ensure that the data generated by biological imaging equipment can be smoothly recognized and processed by computer software.

Develop intermediate interface software or hardware devices to solve compatibility issues. Taking interdisciplinary teaching of engineering and art as an example, if engineering drawing software and art graphic design software are not compatible, an intermediate conversion interface can be developed. This interface can convert precise structural data in engineering drawing software into a format that art graphic design software can recognize, and vice versa, thereby achieving smooth data exchange.

3.3 Strategies for optimizing the allocation of teaching resources

3.3.1 Developing interdisciplinary textbooks and course resources

Establish an interdisciplinary textbook writing team composed of experts from different disciplines. For example, when writing textbooks that integrate art and technology, teachers from disciplines such as art, computer science, and electronic engineering are invited to participate together. During the writing process, emphasis is placed on using actual interdisciplinary projects or cases as clues to organically connect knowledge from different disciplines, such as using the creative process of digital art as a clue, integrating artistic creativity, computer graphics processing technology, electronic device operation, and other knowledge.

Integrate internal and external curriculum resources of the school. Schools can establish interdisciplinary curriculum resource sharing platforms internally, integrating experimental equipment, internship bases, online courses and other resources from different disciplines to achieve resource sharing. At the same time, actively cooperate with external units such as enterprises and research institutions to obtain more interdisciplinary course resources. For example, collaborating with technology companies to conduct interdisciplinary practical courses using their advanced technological equipment.

3.3.2 Balanced allocation of teaching resources

The school leans towards interdisciplinary grassroots teaching organizations in resource allocation policies. Establish a special fund for interdisciplinary education to purchase special equipment required for interdisciplinary teaching and support the development of interdisciplinary courses. For example, for a newly established teaching organization that spans medicine and engineering, the school provides special funding to purchase biomedical engineering experimental equipment to support the organization in carrying out related courses and research projects.

Establish a resource sharing mechanism to break down resource barriers between disciplines. Through resource sharing, it is possible to improve the efficiency of resource utilization and promote the development of interdisciplinary education. The specific content of interdisciplinary resource sharing is shown in Table 1.

Table 1 Inter disciplinary Resource Sharing

Provide resource disciplines	Share resources	Interdisciplinary organizations that receive resources
Physics	Physics laboratory (open every Monday, Wednesday, and Friday morning)	Interdisciplinary Research Group of Materials Physics
Chemistry	Chemical reagent library (some basic reagents)	Interdisciplinary Teaching Team in Biochemistry
History	Historical Literature Database (related to archaeological research at our university)	Archaeology History Interdisciplinary Project Team

Computer Science	High performance computing cluster (off peak hours)	Interdisciplinary Laboratory of Bioinformatics and Computer Science
Art theory	Art Exhibition Hall (during specific exhibition periods)	Cultural Industry Art Interdisciplinary Course Group
Economics	Macroeconomic Data Statistics Platform (Annual Data)	Interdisciplinary Research Group of Sociology and Economics

According to Table 1, different disciplines share their unique resources with relevant interdisciplinary organizations under certain conditions. Physics opens specific time periods of physics laboratories to interdisciplinary research groups in materials physics, which helps the research group conduct relevant experimental research and combine the theory of physics with practical applications in materials science. Chemistry provides some basic reagents to the interdisciplinary teaching team of biochemistry, providing a material basis for teaching experiments related to biochemistry. The historical literature database of history provides important research materials for the interdisciplinary project team of archaeology history, which helps to deeply explore the historical and cultural connotations behind archaeology. The high-performance computing cluster of computer science is used by interdisciplinary laboratories of bioinformatics and computer science during off peak hours, which can meet the needs of large-scale data processing in bioinformatics. The art exhibition hall of art studies is open to the interdisciplinary course group of cultural industry art studies during specific exhibition periods, providing rich artistic resources for the course group and helping to analyze and develop art works from the perspective of the cultural industry. The macroeconomic data statistics platform of economics provides annual data for interdisciplinary research groups in sociology and economics, enabling them to study socio-economic phenomena from the perspective of the intersection of economics and sociology. This resource sharing mechanism can effectively integrate disciplinary resources, avoid resource idleness and waste, and provide strong support for the development of grassroots teaching organizations in interdisciplinary education.

3.4 Strategies for improving management and evaluation systems

3.4.1 Innovative Organizational Management Model

Establish a management model guided by interdisciplinary projects. Flexibly allocate resources such as personnel, equipment, and funding according to the needs of interdisciplinary projects. For example, in an interdisciplinary project on the research and development of new energy vehicles, personnel and resources from disciplines such as mechanical engineering, electrical engineering, and materials science are involved. The project oriented management model can arrange the work tasks of personnel from various disciplines and optimize resource allocation according to different stages of the project, such as design stage, experimental stage, and production stage.

Build an interdisciplinary communication and coordination platform, and use information technology to improve communication efficiency within the organization. For example, establishing a dedicated online communication platform for interdisciplinary education grassroots teaching organizations, where members can exchange information such as teaching plans, project progress, research results, etc., and promptly solve communication problems.

3.4.2 Building a reasonable evaluation system

Develop comprehensive interdisciplinary teaching evaluation indicators. In addition to assessing students' mastery of various subject knowledge, attention should also be paid to evaluating their interdisciplinary thinking ability, ability to apply knowledge comprehensively to solve problems, teamwork ability, and so on. For example, in the assessment of interdisciplinary courses, group project assignments are set up to evaluate students' interdisciplinary comprehensive abilities based on their performance in the project.

Establish research evaluation criteria that are suitable for interdisciplinary research. Consider factors such as the innovation of interdisciplinary research results, the degree of integration of interdisciplinary knowledge, and contributions to interdisciplinary fields. For example, when evaluating a research result that integrates physics and biology, one should not only consider its value in the respective fields of physics and biology, but also its driving effect on the cross disciplinary integration of the two disciplines.

4. Conclusion

Interdisciplinary education grassroots teaching organizations play an irreplaceable role in the modern education system. Through in-depth research on its concept, characteristics, functions, existing problems, and optimization strategies, we have a clearer understanding of

the enormous potential of this organizational form in addressing complex social needs and cultivating innovative talents. Despite facing many challenges in the current development process, with the continuous updating of educational concepts, gradual improvement of management systems, optimization of teaching facilities and environments, and curriculum construction, interdisciplinary education grassroots teaching organizations will continue to mature and lay a solid foundation for the vigorous development of interdisciplinary education. In the future, further attention needs to be paid to the interactive relationship between interdisciplinary education grassroots teaching organizations and the external environment, exploring how to better integrate social resources, expand their social service functions, and adapt to constantly changing social needs. At the same time, with the rapid development of technology, how to integrate emerging technologies into the teaching and management process of interdisciplinary education grassroots teaching organizations is also a direction worthy of in-depth research.

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