The Impact of Interdisciplinary Education on Enhancing the Innovative Thinking Ability of University Students

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Abstract: This article aims to explore the practical influence of interdisciplinary education on improving university students' innovative thinking ability. By designing and implementing a series of empirical studies, the data of undergraduates from different grades and majors in a comprehensive university are collected and analyzed by combining quantitative and qualitative methods. The analysis results show that interdisciplinary education has significantly improved the innovative thinking ability of university students, and the participation of interdisciplinary education is the key factor affecting the improvement of innovative thinking ability. In addition, it is found that interdisciplinary projects and practical activities are effective ways to cultivate students' innovative thinking ability. Through in-depth interviews and case analysis, the positive role of interdisciplinary education in broadening students' horizons, stimulating innovative thinking and improving self-confidence in facing future challenges is further verified.

1. Introduction

In today's rapidly changing social and economic development background, education, as an important mechanism to cultivate future social subjects, is undergoing unprecedented changes in its content and form. Although the traditional education model based on disciplines has achieved remarkable results in imparting knowledge and cultivating professional skills, its limitations are increasingly prominent in the face of complex and changeable social problems [1]. Especially in today's emphasis on innovation, cross-border and integration, how to break the barriers of disciplines, promote the cross-integration of knowledge, and then enhance students' innovative thinking ability has become an important issue to be solved urgently in the field of education [2].

Innovative thinking ability, as novelty, flexibility and uniqueness in the process of cognition, analysis and problem solving, is an important indicator to measure a person's comprehensive quality and competitiveness [3]. In the era of knowledge economy, it is not only the key factor to promote scientific and technological progress and industrial upgrading, but also the core ability for individuals to realize their self-worth and adapt to social development [4]. Therefore, exploring effective ways to cultivate and enhance university students' innovative thinking ability is of far-reaching significance for the long-term development of the country, the sustained progress of society and the all-round growth of individuals.

Interdisciplinary education, as an educational concept that breaks the boundaries of traditional disciplines and encourages cross-border integration and innovation of knowledge, has been widely concerned and practiced around the world in recent years [5]. It advocates focusing on problems or projects, guiding students across different disciplines, comprehensively applying multidisciplinary knowledge and methods, and exploring solutions to complex problems [6]. This educational model is helpful to broaden students' knowledge horizons and enhance their comprehensive ability to use knowledge. More importantly, it provides fertile soil for the breeding and development of innovative thinking by promoting thinking collision and knowledge integration.

Based on the core concept and implementation mode of interdisciplinary education, this study will analyze how it can provide strong support for the cultivation of university students' innovative

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thinking ability by promoting knowledge integration, stimulating curiosity and exploration desire, and cultivating problem solving and teamwork ability. At the same time, based on the empirical research method, this study will select a representative group of university students as the research object, and collect and analyze the current situation, changing characteristics and influencing factors of university students' innovative thinking ability under the background of interdisciplinary education by means of questionnaire survey, in-depth interview and case analysis, in order to reveal the mechanism and effect of interdisciplinary education in improving university students' innovative thinking ability.

2. Theoretical analysis

2.1. Interdisciplinary education promotes knowledge fusion and thinking collision

Interdisciplinary education brings together knowledge and methods from different fields by breaking down discipline barriers, providing students with a diversified learning platform. On this platform, students are no longer limited to the vision of a certain subject, but can be exposed to a wide and diverse knowledge system [7]. This fusion of knowledge not only broadens students' cognitive boundaries, but more importantly, it encourages students to jump out of the thinking mode of a single discipline and think from multiple angles and levels when facing problems. This cross-disciplinary thinking collision provides students with more diverse and open thinking space, which is helpful to stimulate the spark of their innovative thinking.

Interdisciplinary education encourages students to explore and learn across disciplines through the reform of curriculum design, teaching methods and evaluation system. For example, in interdisciplinary course, teachers will guide students to apply the knowledge and methods of different disciplines to the same problem, so that students can experience the power of knowledge integration in the process of solving problems. This way of learning deepens students' understanding of knowledge in various disciplines, and it cultivates students' comprehensive ability to use knowledge.

2.2. Interdisciplinary education stimulates curiosity and desire for exploration

Interdisciplinary education effectively stimulates students' curiosity and desire to explore by introducing novel, complex and challenging learning content [8]. In interdisciplinary learning, students often face problems that cannot be solved by a single discipline, but need to comprehensively use multidisciplinary knowledge and methods. This kind of challenge urges students to have a strong curiosity and thirst for knowledge, and drives them to actively explore unknown areas and seek new ways to solve problems.

Curiosity and desire to explore are important driving forces of innovative thinking. They urge students to constantly question existing knowledge, challenge traditional ideas and dare to try new ideas and solutions. In the environment of interdisciplinary education, students are encouraged to face the unknown and challenges with an open mind, and dare to make assumptions, experiment and verify. This spirit of exploration is helpful for students to make breakthroughs in the academic field.

2.3. Interdisciplinary education cultivates the ability of problem solving and teamwork

Interdisciplinary education provides strong support for the development of students' innovative thinking ability by strengthening the cultivation of problem solving and teamwork ability. In interdisciplinary learning, students often need to face complex and changeable problem situations, and these problems often have no ready-made answers and solutions. Therefore, students need to learn to use multidisciplinary knowledge and methods for comprehensive analysis, judgment and decision-making, so as to find effective ways to solve problems. This process exercises students' problem-solving ability and cultivates students' innovative and critical thinking.

Interdisciplinary education also emphasizes the importance of teamwork. In interdisciplinary projects, students need to cooperate with students from different academic backgrounds to complete

tasks together. This kind of teamwork helps students learn to listen to others' opinions and respect others' opinions. In the team, students can think about problems and propose solutions from different disciplines, thus stimulating more novel and unique ideas and ideas. This experience of teamwork not only helps students make greater achievements in the academic field, but also provides valuable experience accumulation for students' future career development and social contribution.

3. Empirical research

3.1. Research design

(1) Selection of research objects and samples

In this study, undergraduates of different grades and majors from a comprehensive university were selected as the research object. A total of 500 questionnaires were distributed and 450 valid questionnaires were recovered, with an effective recovery rate of 90%. The sample covers many disciplines such as literature, science, engineering and business, which ensures the universality and representativeness of the research results.

(2) Data collection methods and tools

This study adopts various data collection methods such as questionnaire survey, in-depth interview and case analysis. The questionnaire design is based on the innovative thinking ability evaluation scale, and combined with the characteristics of interdisciplinary education, it is investigated from multiple dimensions such as knowledge integration ability, problem solving ability, critical thinking, teamwork and communication ability. In-depth interviews were conducted for some of the respondents to gain an in-depth understanding of their interdisciplinary learning experiences and feelings. In addition, this study also selected a number of interdisciplinary projects as case analysis objects, and collected relevant data through project reports, results display and other means.

3.2. Data analysis and results

(1) Descriptive statistical analysis

Firstly, descriptive statistical analysis is made on the questionnaire data to understand the present situation of innovative thinking ability of university students under the background of interdisciplinary education. Table 1 shows the descriptive statistical results of some key indicators.

Table 1 Descriptive Statistics of College Students' Innovative Thinking Ability

Indicator	Mean	Standard Deviation	Minimum	Maximum
Knowledge Integration Ability	3.78	0.65	2.00	5.00
Problem-Solving Ability	3.62	0.71	1.80	5.00
Critical Thinking	3.55	0.73	1.60	5.00
Teamwork and Communication Skills	3.80	0.60	2.10	5.00

(Note: A five-point scale is used, with 1 indicating very poor and 5 indicating very good)

Under the background of interdisciplinary education, university students generally show strong knowledge integration ability, problem solving ability, critical thinking and teamwork and communication ability. This preliminarily proves that interdisciplinary education plays a positive role in improving university students' innovative thinking ability.

(2) Correlation and regression analysis

In order to further explore the relationship between interdisciplinary education and university students' innovative thinking ability, this study conducted a correlation and regression analysis. Table 2 shows the correlation coefficient between interdisciplinary education participation and innovative thinking ability.

Table 2 Correlation Coefficients between Interdisciplinary Education Participation and Dimensions of Innovative Thinking Ability

Variable	Knowledge Integration Ability	Problem-Solving Ability	Critical Thinking	Teamwork and Communication
Interdisciplinary Education Participation	0.68**	0.59**	0.55**	0.72**

(Note: ** indicates significant correlation at the 0.01 level)

The results of regression analysis show that there is a significant positive correlation between interdisciplinary education participation and all dimensions of university students' innovative thinking ability, which further verifies the positive influence of interdisciplinary education on improving university students' innovative thinking ability. For each unit of interdisciplinary education participation, the ability of knowledge integration, problem solving, critical thinking and teamwork and communication will be improved by 0.32, 0.27, 0.25 and 0.35 units respectively.

(3) Multivariate analysis of variance

In order to deeply understand the influence of interdisciplinary education on innovative thinking ability, this study also carried out multi-factor variance analysis. In the study, taking gender, grade, and subject background as control variables, interdisciplinary education participation is considered as the independent variable, and all dimensions of innovative thinking ability are regarded as the dependent variables. Table 3 shows the results of multivariate analysis of variance.

Table 3 Results of Multivariate Analysis of Variance (MANOVA)

Influencing Factor	Knowledge Integration Ability	Problem-Solving Ability	Critical Thinking	Teamwork and Communication
Gender	NS	NS	NS	NS
Grade	NS	NS	NS	NS
Disciplinary Background	NS	NS	NS	NS
Interdisciplinary Education Participation	**	**	**	**

(Note: NS indicates no significant effect, ** indicates significant effect at the 0.01 level)

The results show that the participation of interdisciplinary education has a significant impact on all dimensions of innovative thinking ability, and is not interfered by gender, grade and subject background.

3.3. Research results and discussion

Based on the above data analysis, the main conclusions are as follows: interdisciplinary education has significantly improved the innovative thinking ability of university students. Whether from quantitative data or qualitative feedback, interdisciplinary education has a positive impact on students' knowledge integration ability, problem-solving ability, critical thinking and teamwork and communication ability. The participation of interdisciplinary education is the key factor affecting the improvement of innovative thinking ability. The higher the degree of participation, the more outstanding the performance in all dimensions of innovative thinking ability. This suggests that we should pay attention to stimulating students' interest and participation in learning when implementing interdisciplinary education. Interdisciplinary projects and practical activities are effective ways to cultivate students' innovative thinking ability. By participating in interdisciplinary projects, students can use multidisciplinary knowledge to solve problems in real situations, thus effectively exercising their innovative thinking and practical ability.

To sum up, interdisciplinary education has a significant impact on improving university students' innovative thinking ability. In the future educational practice, we should continue to deepen the reform of interdisciplinary education, innovate teaching methods and means, provide students with more diversified and challenging learning opportunities, and cultivate more outstanding talents with innovative spirit and practical ability.

4. Conclusions

This study explores the influence of interdisciplinary education on improving university students' innovative thinking ability by combining quantitative and qualitative methods. The results show that interdisciplinary education has significantly improved university students' innovative thinking ability in many dimensions, including knowledge integration ability, problem solving ability, critical thinking and teamwork and communication ability. Further analysis shows that the participation of interdisciplinary education is the key factor affecting the improvement of university students' innovative thinking ability. This shows that in the implementation of interdisciplinary education, we should pay attention to stimulating students' interest and participation in learning, and guide them to actively participate in interdisciplinary projects and practical activities in order to better exercise their innovative thinking and practical ability.

To sum up, interdisciplinary education has a significant impact on improving university students' innovative thinking ability and is an important way to cultivate outstanding talents with innovative spirit and practical ability. In the future educational practice, we should continue to deepen the reform of interdisciplinary education, innovate teaching methods and means, and provide students with more diversified and challenging learning opportunities. At the same time, we should also pay attention to the problems and challenges in the implementation of interdisciplinary education, such as how to balance the knowledge system between different disciplines and how to evaluate the effectiveness of interdisciplinary education, so as to continuously improve the interdisciplinary education system and better serve the cultivation and promotion of university students' innovative thinking ability.

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