

Research on the Model of Cultivating Higher Innovative Talents with the Direction of Human Capital and Powerful Country

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Abstract

Innovative talents are the core elements in building a strong country of human capital. Colleges and universities are the main positions for cultivating innovative talents. However, there are still many problems and deficiencies in the talent training mode of colleges and universities in China, which restricts the cultivation of innovative talents in China. Therefore, in order to cultivate innovative talents, it is necessary to reform and innovate the innovative talent training mode of colleges and universities. Based on years of research, this paper proposes a professional innovative talent training model centered on "discovering problems and solving problems" and a composite innovative talent training model combining "interdisciplinary and PBL", in order to provide reference for the training of innovative talents in Colleges and universities.

Keywords

Higher education, professional, compound, innovative talent, training mode.

1. Introduction

The 21st century is the century of knowledge innovation, but also the century of education innovation. The report of the 19th National Congress pointed out: "Innovation is the first driving force for development and the strategic support for building a modern economic system." The National Medium- and Long-Term Science and Development Plan (2006-2020) and the National Medium- and Long-Term Education Reform and Development Plan (2010-2020) all propose the strategic goal of China entering the ranks of innovative countries and realizing resource powers by 2020. Since the reform and opening up 40 years ago, China has gradually narrowed its technological gap with developed countries through technology introduction and market-oriented reform, from imitation innovation and integrated innovation to independent innovation, and has reached the forefront of world technology in the fields of high-speed railway, communication and Internet. In this situation, in order to prevent China from achieving technological catch-up, developed countries will certainly strengthen the technical blockade against China to maintain its technological leadership. Therefore, only by taking the road of independent innovation and relying on innovation-driven development, can China break through the technology monopoly of foreign countries in key areas and finally achieve comprehensive technological catch-up.

Innovation-driven development requires a large reserve of innovative talents as the support, but the current higher education system cannot afford the task of independent innovation. For colleges and universities, it is necessary to further promote innovation education, continuously enhance students' innovative spirit, innovation consciousness and innovation ability, and provide talent and intellectual support for national innovation-driven development [1]. Since the General Office of the State Council issued the "Implementation Opinions on Deepening the Reform of Innovation and Entrepreneurship Education in Colleges and Universities", innovation and entrepreneurship education in colleges and universities has gradually

transformed from employment activities aimed at improving the employment rate of graduates to comprehensive education activities aimed at cultivating students' innovation and entrepreneurship consciousness [2]. Therefore, the construction of innovative talents training mode in colleges and universities will help to improve the educational model of innovative education in colleges and universities, help to cultivate students' creative thinking ability, for our country's independent innovation and development to provide a steady stream of talent support, it will help China to gain talents in the competition among countries and realize the Chinese dream of the great rejuvenation of the Chinese nation.

Based on this, combined with the author's many years of research, this paper summarizes the current situation of the construction of higher innovative talent training mode, and then constructs the professional innovative talent training mode and the compound innovative talent training mode.

2. Organization of the Text The Status Quo of the Construction of Higher Innovative Talent Training Model

As the main base for the cultivation of innovative talents in China, undergraduate colleges and universities have gradually adopted innovative talent training as the main goal of running colleges and universities in the past 20 years, especially, a large number of universities that have passed the "211 Project", "985 Project" and "Quality of Higher Education" have continuously explored innovative talent training models, the quality of innovative talent training has been continuously improved, the level of scientific research and the number of scientific research achievements have been greatly improved, and colleges and universities have made their due contributions to the construction of innovative countries. However, due to the late start of the whole, there is still no university in China to carry out in-depth and systematic research on the cultivation of innovative talents. There are still certain problems in the cultivation of innovative talents in universities.

2.1. Section Headings the Achievements of the Construction of Higher Innovative Talent Training Model

Under the background of "double innovation", colleges and universities have set up innovation and entrepreneurship centers and innovation and entrepreneurship colleges. The dual-innovation education has been carried out in China. Some colleges and universities have successively launched their own innovative talent training models, achieving outstanding results in the cultivation of college students' innovation and entrepreneurship ability. For example, Peking University proposes to establish a talent training system that integrates general education with professional education, strengthen the construction of the core curriculum system of general education, and realize students' free transfer of majors within the ministry and free course selection within the whole school [3]. At the same time, the mode of classified training for academic and professional postgraduates will be implemented, and fully implement the "application-assessment" system for doctoral students enrollment, and cultivate top-notch innovative talents. The innovation and entrepreneurship education of Nanjing University implements the concept of the integration of general education and individualized training, and integrates into the entire "three-three system" talent training model, which runs through the entire undergraduate education process, and constructs the "five-in-one" innovation education mode, which focuses on innovation courses, classes, training, competitions and results incubation. South China university of technology has broken the traditional closed talent cultivation mode of "teacher and classroom as the center", transformed the "small classroom" of classroom teaching into the "big classroom" with "three combinations" inside and outside the class, inside and outside the school, and at home and abroad, and implemented the open talent cultivation mode. Zhejiang University adheres to the educational

philosophy of “people-oriented, integrated training, seeking innovation, and pursuing excellence”, and builds a four-in-one (KAQ2.0) talent training system of “knowledge-ability-quality-personality” to cultivate high-quality innovative talents and leaders with comprehensive development and global competitiveness in morality, intelligence, physique, aesthetics and labor.

The practice of innovative talents training mode in colleges and universities mainly relies on the entrepreneurial parks, entrepreneurial incubators, and science parks to provide students with entrepreneurial simulation bases and entrepreneurial practice fields, and provides entrepreneurial consultation and guidance. At the same time, through the establishment of college students' academic science and technology competitions and community activity platforms, students are encouraged to participate in various extracurricular scientific research activities and competitions organized by the state, provinces, and schools to promote the transformation of innovative and entrepreneurial projects into industries. The school and the government gradually increase support and reward, which plays a catalytic role in cultivating students' innovation and entrepreneurship ability [5].

2.2. Problems in Higher Innovative Talent Training Model

From the perspective of training objectives, China's training goal is to cultivate innovative talents with comprehensive development of "morality, intelligence, physique, beauty and labor" and "broad foundation, strong ability and high quality", but they cannot be well implemented in educational practice. In the process of cultivation, it neglects the individualized cultivation of students and the free development of students, and violates the educational concept of "people-oriented".

From the perspective of the curriculum system, although China has begun to attach importance to general education and interdisciplinary education, compared with foreign universities, the curriculum of innovation and entrepreneurship education in China is still in the downstream stage, which is not reasonable enough. According to the survey, innovation and entrepreneurship courses in universities are still optional modules, and the development and design of innovation and entrepreneurship courses are scattered and limited. In addition, there is a lack of mutual penetration between courses in different disciplines; the number of theoretical courses and practical courses is very small, and even if there are related courses, the number of courses is very small [6].

From the perspective of teaching methods, colleges and universities generally adopt classroom teaching methods, emphasizing the systematic teaching of knowledge, and the requirements for students are limited to memory. This kind of “cramming” knowledge-infused teaching hinders the development of students' independent thinking ability, neglected the student personality characteristics, is not conducive to the formation of students' innovative undertaking consciousness. Practical courses are generally demonstrated by teachers, imitated by students, and impart a kind of experiential procedural knowledge. Students generally only imitate and copy the teacher's movement skills, rarely break through stereotypes or try other methods to solve the same problem, and lack the spirit of questioning, which objectively limits the development of students' innovative thinking and creativity [7].

From the perspective of professional settings, from a vertical perspective, the professional trend is more and more detailed, and the caliber is narrow, which leads to the lack of systematic and comprehensive knowledge of students, and it is impossible to obtain extensive knowledge in various fields, which directly affects the comprehensive quality training of students. From the horizontal perspective, it is difficult to coordinate various subjects and majors, and it is difficult to integrate disciplines, which leads to the narrow knowledge of students and the lack of basic quality.

From the perspective of teaching environment, China's colleges and universities are not equipped with perfect hardware equipment, lack of quality teachers, undergraduate students can not directly communicate with outstanding scholars to discuss problems; Most of the teachers' teaching methods are traditional and cannot be well applied to the teaching of innovative education methods. In the campus atmosphere, most colleges and universities cannot create a good academic atmosphere and lack the atmosphere of free academic discussion, and most students just want to complete the course requirements.

From the perspective of the teaching system, most of the colleges and universities in China implement the credit year system. Under the credit system, there are many compulsory courses, fewer elective courses, and lack of flexibility. Students cannot choose courses of interest independently. Under the academic year, students cannot complete their studies ahead of time and cannot graduate in advance. This kind of teaching system has affected the cultivation of students' personality to some extent.

From the perspective of evaluation methods, the evaluation criteria of colleges and universities in China are hard and simple, lacking flexibility in the evaluation process, and the evaluation based on "scores" ignores the evaluation of students' innovation ability. Many pass exams have made students lose the opportunity to learn independently, explore and innovate.

Therefore, to train students into an innovative and entrepreneurial force to build a strong human capital, it is necessary to integrate the dual-innovation education into higher education, reform and improve the existing model of higher-level innovative talents, and inspire students' innovative consciousness in the process of training. Cultivate students' innovative thinking, set up and develop relevant courses that can stimulate students' creativity and train students' innovative thinking; Heuristic, topic discussion, investigation and research and open teaching mode are adopted. Use brainstorm method, case analysis method and role playing method to carry out teaching activities; the new teaching method of "student-centered and teacher-guided" should be constructed.

3. Professional Innovative Talent Training Model

In real life, the premise of solving problems is to discover the roots and essence of the problem. However, people often cannot or dare not find problems. Based on the characteristics of professional innovative talents and the analysis of the existing deficiencies of the training model, this section draws on innovative ideas and attempts to build a professional innovative talent training model that aims to identify problems and solve problems, in the hope of apparatus of innovative talents cultivation model for the future to build and implement provide reference.

TRIZ is an innovative method. In the process of learning and practice, the application of TRIZ can help people find the essence of the existence of problems, quickly understand and explore the direction of problems, and also help people break through the existing thinking, expand thinking, and find solutions to problems. Therefore, the promotion of TRIZ theory in colleges and universities can help students use this method for innovation and creation, and improve students' ability to find problems and innovate.

3.1. Traditional Teaching Model for Professional Talents

At present, the teaching mode of most colleges and universities still adopts the teacher-centered transfer and acceptance teaching. The basic teaching procedures of this mode (as shown in figure 1) is: teaching new lessons—students listening—students' memory—homework—course exam—evaluating students. In this teaching mode, teachers' teaching and guidance are dominant, students are disciplined in their usual learning, according to the teacher's teaching rhythm, completing the learning tasks according to the teacher's requirements, and completing the homework and course examinations after memorizing the

book knowledge. The performance of students in this process is the main basis for teachers to evaluate students' abilities.

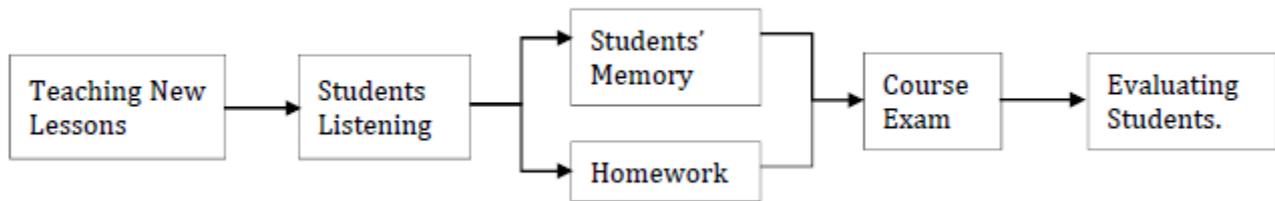


Figure 1. Traditional teaching mode

In this whole teaching mode, students can hardly understand the information they receive, and they cannot understand and apply the knowledge they have learned flexibly. They can only cultivate a single, modular personality. This is not conducive to cultivating students' ability to independently explore problems and solve problems, and it is not conducive to cultivating students' innovative thinking and innovative ability.

3.2. Construction of Professional Innovative Talent Training Model

Professional innovative talents refer to the ability to discover problems and contradictions and create new knowledge while mastering profound professional knowledge. The TRIZ theory is used to cultivate students' ability to find problems and solve problems. Therefore, this section will draw on TRIZ's ideas to construct a professional talent training model centered on problem finding and problem solving, as shown in Figure 2. TRIZ's innovative theory can be fully integrated into teaching. On the one hand, the teacher takes the curriculum as the carrier and allows the innovation education to run through the whole learning process. By means of induction and inspiration, students can learn innovative methods while learning relevant knowledge and cultivate the ability to find problems. On the other hand, students can use online resources to complete pre-class preparation, understand the innovative methods of TRIZ, discover problems through independent exploration or team exploration in class, and discover problems and contradictions in students' previous cognition through teaching or practice in competitions. After discovering the root of the problem, you can solve the problem by learning knowledge, collecting materials, and teamwork. In this kind of teaching environment, students' ability to explore, discover and think problems, solve problems, communicate and cooperate and innovate will be greatly improved.

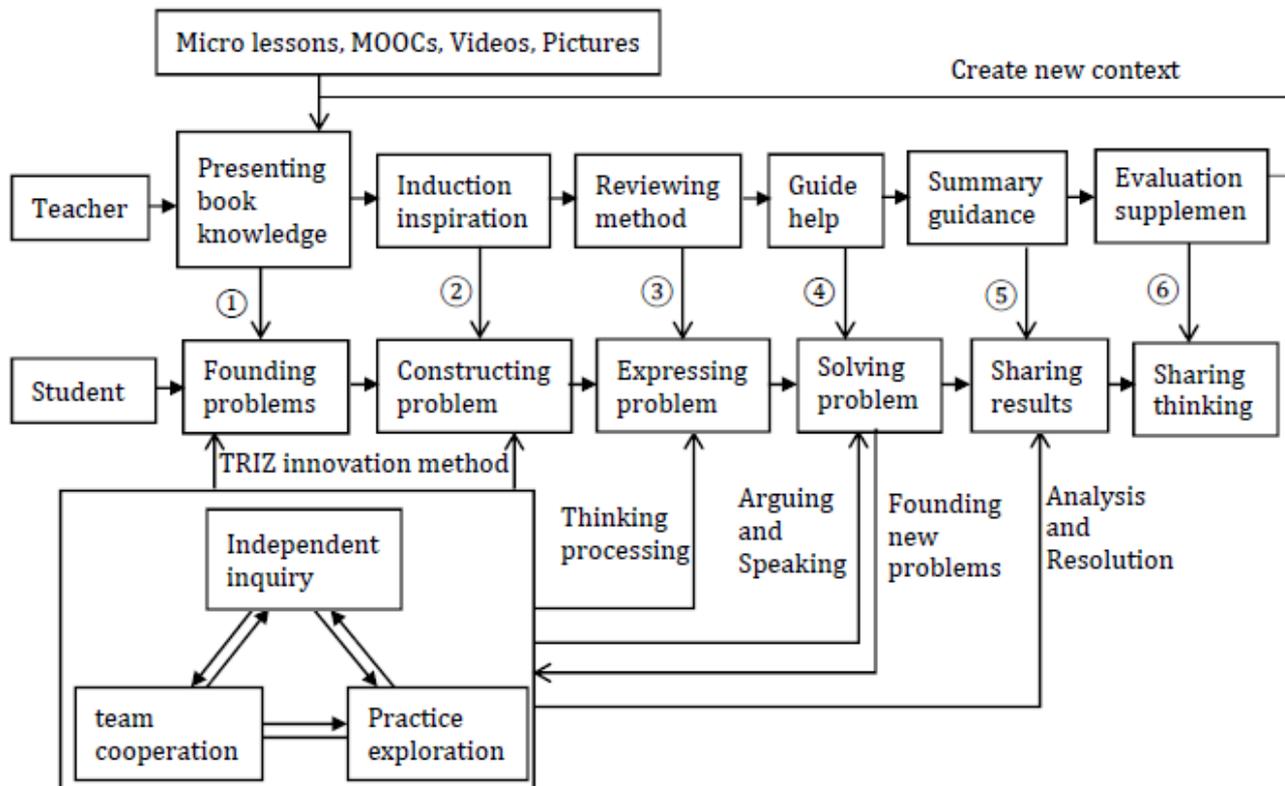


Figure 2. Professional innovation talent training model centered on problem finding and problem solving

Explanation: ①In the stage of exploring problems, teachers should use the MOOC, micro-courses, videos or pictures to create real-life situations for students, so that students can understand the learning objectives and let students explore the problem on their own initiative; ②In the construction of the problem stage, students explore problems through independent inquiry, brainstorming, practical operation, etc. Teachers should inspect, inspire, guide, encourage and guide; ③In the stage of expressing problems, students should organize and organize their thinking. Teachers should organize, demonstrate questions, evaluate, encourage, and summarize the methods used by students to discover and express problems. ④In the problem solving stage, students can find the most suitable solution by discussing and exploring. Teachers should guide and help students, and discover new problems in the process of solving problems; ⑤In the analysis result stage, students share the methods in the process of problem finding and problem solving, and the teacher evaluates the individual, team or practice results and supplements the summary to provide reference answers; ⑥In the stage of thinking sharing, the individual or the team summarizes the thinking process of finding the problem stage and solving the problem stage. The teacher summarizes the evaluation and pays attention to guiding the next situation.

The six links are interlocking and closely linked, and the six links are carried out in a cycle. Through the learning of each link, students can improve their ability to find and propose problems, strengthen their awareness of being good at finding problems, improve their ability to solve problems, and further enhance their innovation ability. This mode is divided into two teaching modes: problem-discovery-centered and problem-solving centered (as shown in figure 3 and figure 4).

1) Teaching mode centered on problem finding

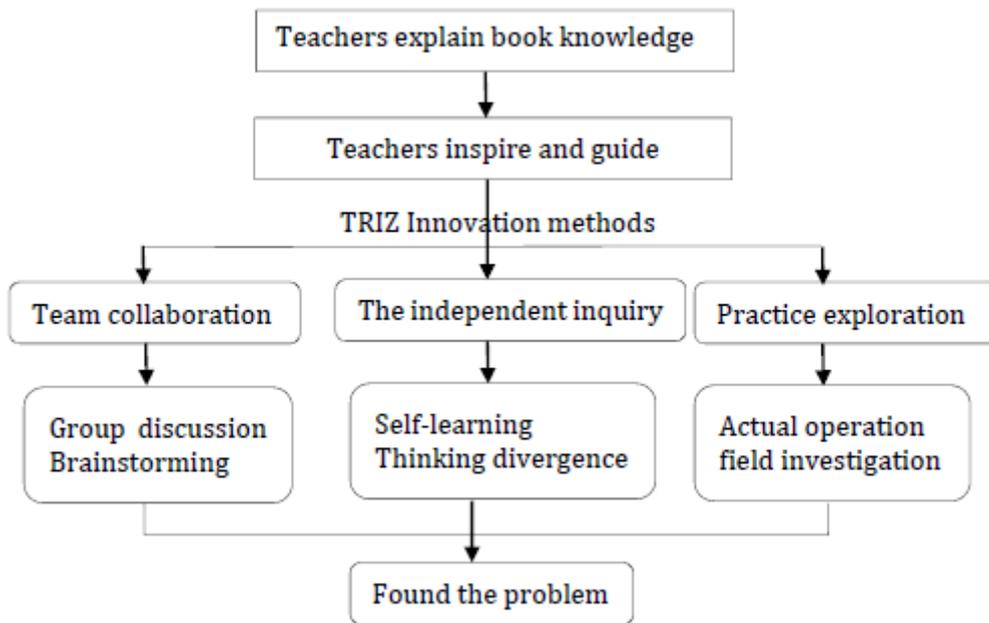


Figure 3. Flow chart of the teaching mode centered on problem finding

From the teaching model centered on problem finding, it contains three teaching scenarios. The first is that the students create a situation through the teacher's explanation of the book knowledge, stimulate the students' interest, and the students independently explore and discover the problems in the study. The second is to use the way of solidarity and cooperation to stimulate students' problem awareness by brainstorming, so as to help students find problems. The third is that students find out the contradictions and problems between the past cognition and reality through practical operation or field investigation.

2) Teaching mode centered on problem solving

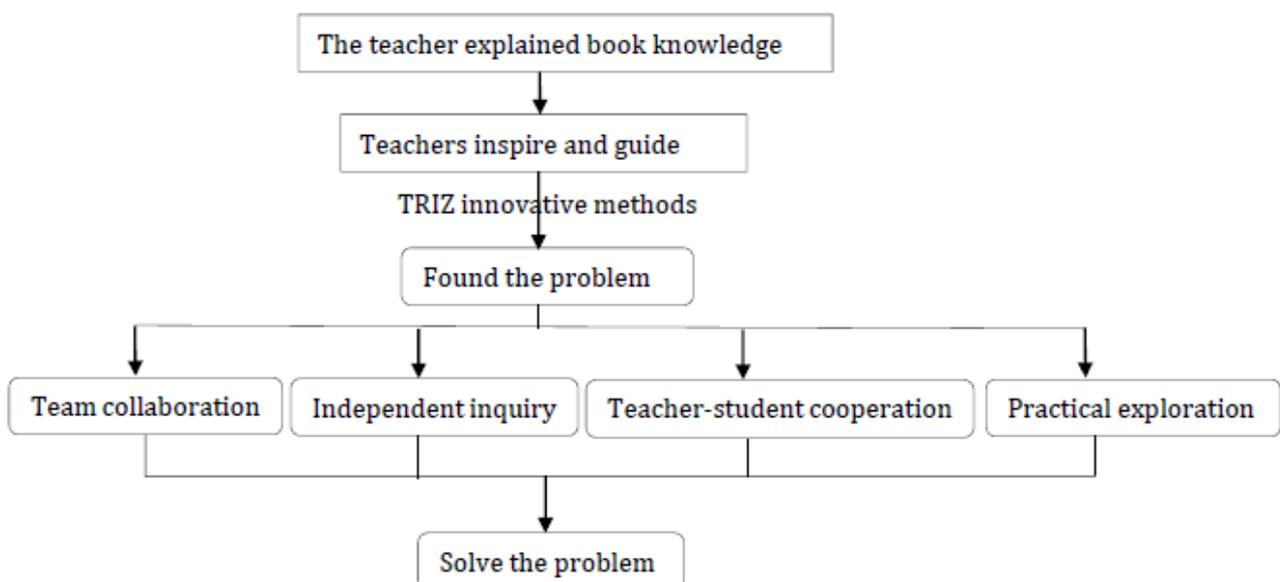


Figure 4. Flow chart of the teaching mode centered on problem solving

It can be seen from the teaching mode centered on problem solving that it contains four teaching scenarios. The first is that students encounter relatively simple problems; students

can think independently about the issues raised, solve problems independently, and expand the problem after evaluation to achieve knowledge transfer and consolidation. The second is that students encounter challenging problems; students can't solve problems through independent research, but they can solve problems through teamwork, while teachers play the role of guiding, organizing and promoting. The third is that students encounter high-level and relatively difficult problems; after students' independent research and teamwork, there are still some problems that can't be solved. At this time, teachers need to actively participate as students' partners, motivate students, give students appropriate opinions, and participate in solving problems in a democratic and equal manner. The fourth is a problem that can be solved through practical inquiry; it requires students to solve problems through self-learning, teamwork, or teacher-student mutual assistance in real projects or practices.

4. Compound Innovative Talent Training Model

In real life, solving and breaking through a specific problem requires multi-disciplinary and multi-field comprehensive cross-innovation. This feature determines that every student must have the consciousness and courage to learn knowledge to overcome professional barriers, so as to improve their comprehensive quality and skills, and become a compound knowledge, ability and thinking talent. Therefore, this paper tries to use interdisciplinary thinking to construct a training mode for cultivating compound innovative talents. While "STEAM" is an interdisciplinary education model that includes science, technology, art, engineering, and mathematics [8]. STEAM education aims to cultivate innovative talents who dare to learn across disciplines. The main learning method is Project-based Learning (PBL), which is student-centered and let the students themselves to complete their program of interest [9], in the process of problem solving according to their own need to learn different knowledge, use the interdisciplinary thinking and subject integration way to complete the project.

4.1. Traditional Training Model for Compound Talents

At present, the compound talent training mode of colleges and universities mainly includes the Unicom training system, the double degree system, the main and minor education system, the second degree system, etc. (as shown in figure 5).

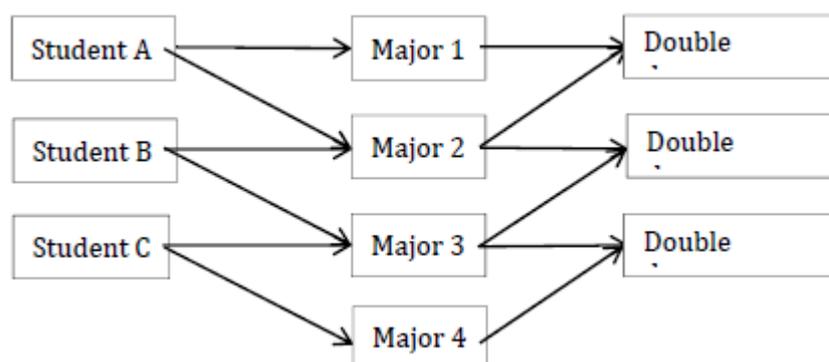


Figure 5. Traditional training model of compound talents

This kind of training mode mainly requires students to choose the second major after studying the main major. This way can't connect the knowledge they have learnt well. Students are only passive to accept knowledge, but can't actively learn interdisciplinary knowledge according to their own needs. So it is rare to cultivate innovative talents with interdisciplinary knowledge, ability, and thinking.

4.2. Construction of Compound Innovative Talent Training Model

According to the connotation of STEAM education and the characteristics of composite innovative talents, this study attempts to construct a compound innovative talent training model without professional boundaries, as shown in Figure 6.

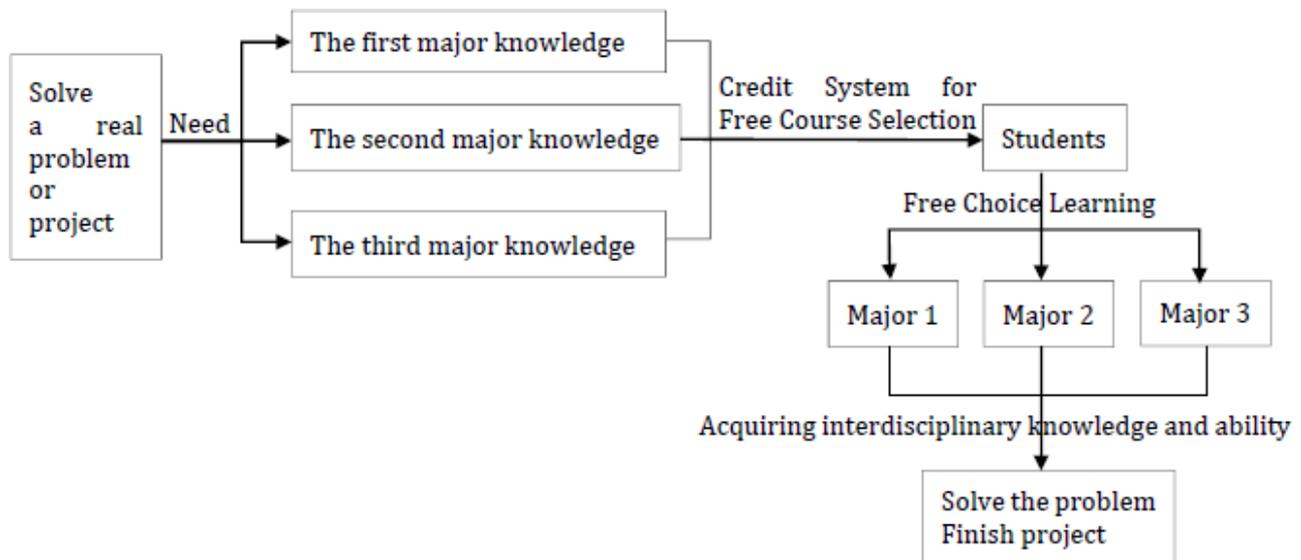


Figure 6. Compound Innovative Talents Training Model

In this model, we use the credit system of free course selection, according to the actual problems of students or the problems encountered in the project, and within the scope of the whole school curriculum, we can freely choose courses of different disciplines, so as to cultivate students' awareness and ability to actively learn knowledge from different disciplines.

In order to ensure the smooth implementation of the training of composite innovative talents, this paper constructs the PBL teaching mode under the guidance of STEAM education concept, with classroom teaching as the main place and project learning as the carrier. Students are required to actively learn the knowledge of different subjects according to their own needs during the completion of the project, and integrate the knowledge and skills of different disciplines to solve the problems encountered in the project. The model includes project preparation, project initiation (project formulation, project selection), project planning, project implementation (project exploration, work production), project completion (results exchange, project evaluation) and other steps (as shown in Figure 7).

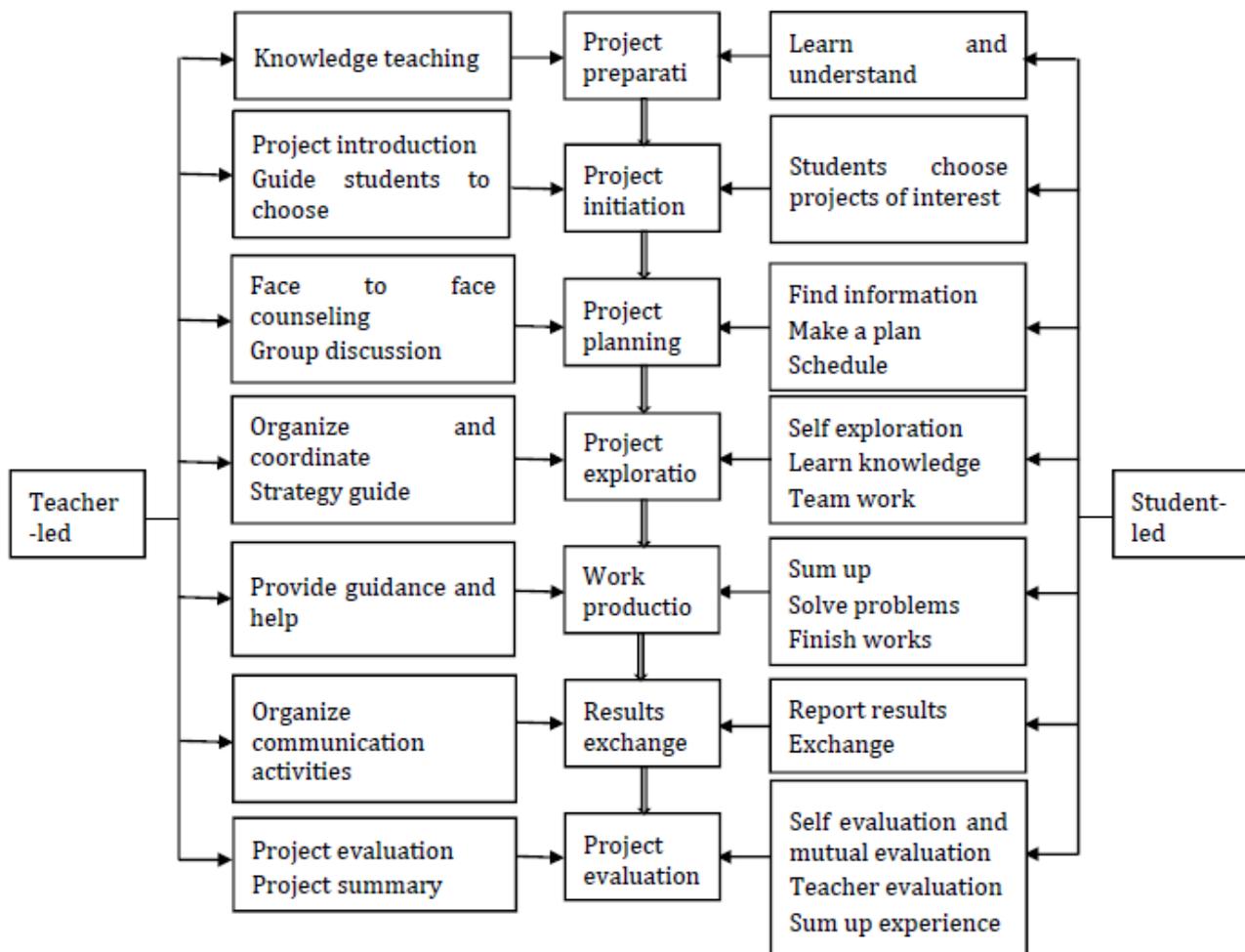


Figure 7. PBL Teaching Model

- ① Project preparation stage. Teachers' teaching and students' learning stages: Integrating the contents of science, art, mathematics, engineering and technology within the framework of STEM's interdisciplinary framework, through the course teaching, students can understand the basic knowledge, so that students can accumulate certain basic knowledge, and lay the foundation for self-exploration.
- ② Project start-up stage. Including teacher design projects and student selection projects: Teacher design projects should include a series of interdisciplinary content, which requires multidisciplinary knowledge to solve unstructured, complex and authentic problems. In the process of designing projects, students should participate in the design as far as possible, so that students can choose according to their interests.
- ③ Project planning stage. A time plan is a team member's schedule of tasks in a project. Project planning arrangement is that team members divide tasks, prepare materials, process data and so on.
- ④ Project implementation stage. Project Inquiry: Students' individual or team carry out project inquiry according to the plan, get the materials needed by project inquiry through preview, collecting information, learning interdisciplinary knowledge and technology, and timely evaluate the results of the process, and adjust the plan according to the results. Work formulation: The research results are presented in the form of research reports, physical objects, videos, pictures, data analysis or performances. The work reflects students' interdisciplinary knowledge and skills learned in the project, and can also enhance students' awareness and ability of interdisciplinary learning.

⑤ The end stage of the project. Outcome Exchange: Teachers organize students to share their learning outcomes in the form of lectures, presentations, debates and competitions, evaluate each team's work and find out advantages and disadvantages. Project evaluation: Teams conduct self-evaluation and mutual evaluation of the works. Teachers summarize and evaluate students' research results according to certain evaluation criteria and scales.

5. Conclusion

In the 21st century, the cultivation of innovative talents plays an important role in international competition. Especially on the road of building a strong human capital country, the innovative achievements of professional innovative talents and compound innovative talents are urgently needed. Therefore, through understanding TRIZ innovation theory, this paper analyses the traditional teaching mode of professional talents in most universities, points out the shortcomings of the existing training mode, and constructs the training mode of professional innovative talents in this paper. This mode focuses on cultivating students' awareness of finding problems, raising problems and the ability of solving problems. STEAM education pays attention to the cultivation of compound innovative talents. Under the background of the new era, its educational significance and value are still expanding and extending. Therefore, on the basis of summarizing STEAM's educational ideas and methods, this paper analyses the shortcomings of the existing training mode of compound talents, constructs the training mode of compound innovative talents and the PBL-based teaching mode, and focuses on cultivating students' consciousness and ability to actively overcome the obstacles of subject knowledge, to learn interdisciplinary knowledge, and to achieve the training goal of compound innovative talents.

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