



# Design and Implementation of Online First-Class Course “Innovative Thinking Methods”

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**Abstract.** Innovation thinking method course is an important carrier of college students’ innovative and entrepreneurial education. The courses is centered on student development, and motivated by social needs, oriented by results output. The course concept is that college students’ innovative spirit, creative consciousness and innovative- entrepreneurial ability will be comprehensively cultivated. Course objectives of “understanding innovation”, “innovation”, “daring to innovation” and “love innovation” are identified. Through the characteristic course design and implementation, the innovative application results with certain generalization significance and popularization value can be formed, which has important reference significance for the development of college students’ innovative education.

**Keywords:** Innovative thinking method · Innovative education · Course innovation design · Online First-class course

## 1 Introduction

Innovation is the primary driving force for development. Thanks to the painstaking efforts of generations of scientists, China has made remarkable achievements in manned space-flight, deep space exploration, quantum computing, artificial intelligence and many other fields. Entering the new era, with the changes of the international political and economic situation, many technical difficulties have been surfaced, and the process of China’s modernization is seriously restricted, so urgent solutions are required. “Independence, self-reliance” is the Chinese nation’s fine tradition of the generation, accelerating the construction of an innovative country and improving the innovation ability of the whole nation is the basic way to break the “bottleneck”, and eliminate “disorder”, to realize sustainable development, it is also an important guarantee to meet people’s yearning for a better life and their growing material and cultural needs. Higher education shoulders the important mission of cultivating morality and talents and cultivating qualified socialist builders and successors for the country. Innovation-entrepreneurship education, as an important part of university excellence education, undertakes the important responsibility of cultivating college students’ innovative spirit, creative consciousness and innovation - entrepreneurship ability. The aims of innovative thinking method course



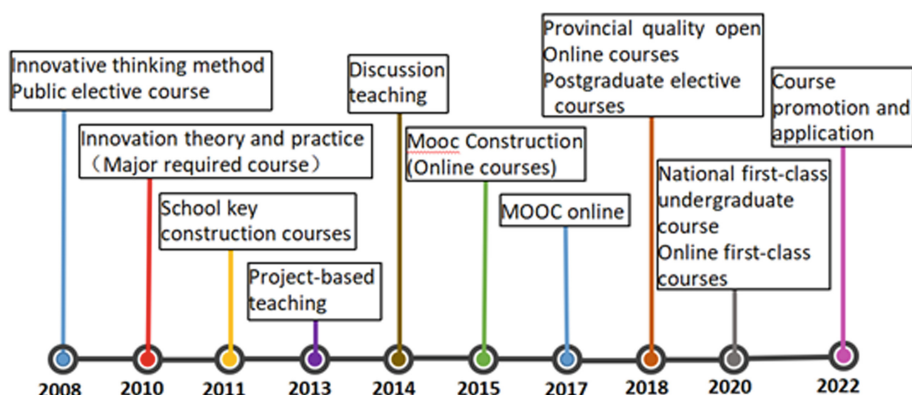


Fig. 1. Schematic diagram of course construction of innovative thinking method series

is improving the innovative ability of college students, in order to solve the problem of engineering practice. The course is oriented by results output, combined with modern information technology means, and the course reform is practiceactively carried out, after years of practice, course construction are constantly optimized, to create first-class innovation education online course with distinctive characteristics.

## 2 Basic Information of Course Construction

The course construction process of innovative thinking method series is shown in Fig. 1. As an important carrier of college students' innovation - entrepreneurship education, the course of innovative thinking method was opened for the first time at the end of 2008 for all students. In 2011, the construction of key courses is completed. In 2015, it was applied for the MOOC construction project and started the online course construction. In November 2017, it was officially put into operation online. In 2018, it was rated as provincial Excellent Online Open Course, and in 2020, it was rated as the first national first-class undergraduate course – Online First-class Course. As of press time, the course has carried out 11 lectures, with 25,687 students and over 6.8 million visits.

## 3 Innovate Educational Idea and Course Goal

Strengthening moral education and cultivate people are the basic task of higher education, and innovation education's purpose is to enhance the whole nation's quality and ability, cultivating qualified socialist builders and successors to the nation. Therefore, the innovation education must be combined with the practice of talent training and the law of technological innovation of colleges and universities to form scientific educational ideas and reasonable curriculum objectives.



### 3.1 Innovate Educational Idea

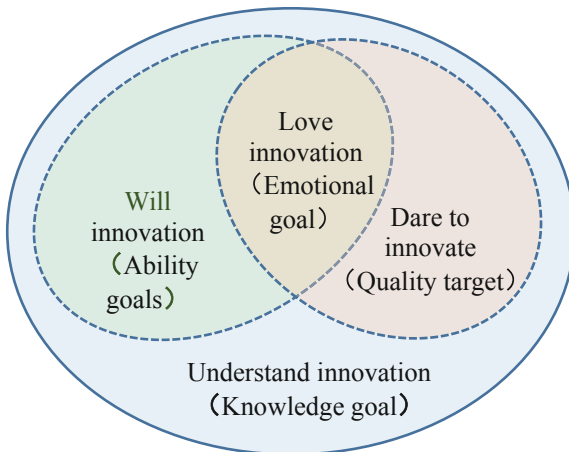
Through many years of innovation education teaching practice, this course gradually formed a unique innovation education idea, i.e., according to the development of students as the center, driven by social demand, results of output oriented, supported by innovative methods, synergy mechanism as guarantee, efforts to implement the development concept of the general secretary xi “innovation is leading the first motive force in the development”, response of the State Council “public entrepreneurship, peoples innovation” call to action, practice innovative concept of tao xingzhi “everyone is an innovator”, “innovation is everywhere” and “it’s always a time for innovation” and “Everything is an opportunity for innovation”, build innovation development community, and cultivate college students’ innovative spirit, creative consciousness and innovation - entrepreneurship ability comprehensively and comprehensively.

### 3.2 Course Goal

According to the above concept of innovative education, the course objectives are reorganized and clarified, which are divided into four dimensions, namely, knowledge dimension, ability dimension, quality dimension and emotion dimension. The diagram of four dimensional innovative course objectives is shown in Fig. 2.

#### 3.2.1 Knowledge Goal

Understanding innovation: Students are required to understand the connotation of innovation, be familiar with the application system of innovation methods, understand the process of transformation and application of innovation achievements, and form the awareness of using innovation tools to solve innovation problems.



**Fig. 2.** Schematic diagram of four dimensional innovative course objectives



### 3.2.2 Ability Goals

**Innovation:** Students are required to have ability to find innovative problems, have innovation ability to analyze functional and innovative problems, have the ability to excavate and utilize innovative resources, have the ability of solving innovative problems to resolve conflicts, improve functions and promote the evolution of technological systems, have the ability to evaluate innovative schemes with both ideal and reality as well as the combination of qualitative and quantitative methods. Students can actively recommend the transformation and application of innovative achievements.

### 3.2.3 Quality Target

**Daring to innovate:** Students are required to set up correct innovative values, cultivate the pioneering and enterprising spirit of overcoming difficulties and not being afraid of challenges, form a rigorous and serious work attitude and realistic scientific research style, have a sense of national feelings, sense of responsibility, sense of norms, environmental awareness and professional ethics, and pay attention to the harmonious development of man and nature.

### 3.2.4 Emotional Goal

**Love innovation:** Through innovation theory and innovation practice teaching, students can gain the sense of mission to solve difficult problems, the sense of responsibility of division of labor and cooperation, the sense of achievement of innovation, the pleasure of sharing experience, and the sense of achievement of achievement transformation.

## 4 Innovative Design of Course Teaching

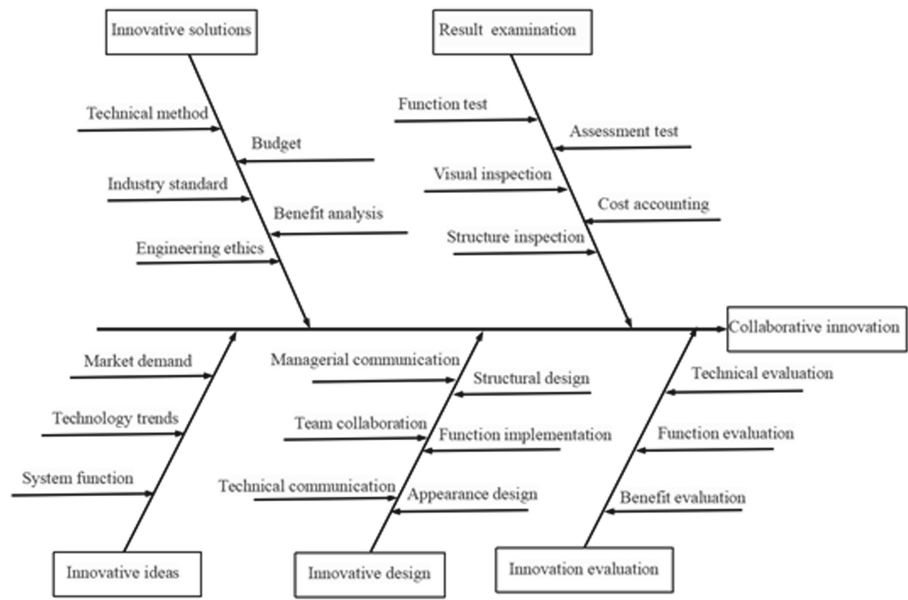
### 4.1 Systematic Analysis of Course Content

College students' innovation education is a systematic project, which involves all aspects of the whole innovation chain from market demand to the application and transformation of innovation results. Through the analysis of college students innovation practice and collaborative innovation related elements, cooperative innovation process of university students can be divided into five stages, that is, innovation topic selection, innovation scheme, innovation design, achievement inspection and innovation evaluation. Each stage includes many specific tasks. The schematic diagram of collaborative innovation process of college students is shown in Fig. 3.

### 4.2 Innovative Design of Course Teaching

As an important carrier of innovation education, under the premise of clear curriculum objective and ideological and political consideration, the course of innovative thinking method is fully deconstructed and completely designed with the help of online open course resources, including course learning objectives, teaching content, teaching methods and teaching activities, in combination with the characteristics of system and complexity of course content.





**Fig. 3.** The schematic diagram of collaborative innovation process of college students

### 4.2.1 Layers of Learning Objectives

Based on the student-centered teaching concept and the principle of teaching students according to their aptitude of all, maximized the application value of teaching resources, combined with the learners' different needs, the learning objectives of the course are set up in layers, namely cultivating innovative consciousness (level 1), grasping the method of innovation (level 2), exercising innovation ability (layer 3), different teaching contents and tasks are set combined with different hierarchy of needs. The schematic diagram of learning objective stratification is shown in Fig. 4.

### 4.2.2 Systematization of Teaching Content

The curriculum content is designed based on problem-oriented, focusing on systematic contradictions, focusing on resource mining, breaking through thinking inertia, and positively guiding innovation. The curriculum ideology and politics are focused on materialist dialectics, practice, contradiction, socialist core values, scientific outlook on development, the concept of a community with a shared future for mankind, rigorous research, professional ethics and so on. On the macro level, we attach importance to the systematization of innovation process, while on the micro level, we emphasize the fragmentation of knowledge points. On the basis of emphasizing the independence of knowledge nodes, we strengthen the complementarity between curriculum contents, and closely combine knowledge, ability, quality and emotional education elements. The knowledge atlas of innovative thinking methods is shown in Fig. 5.



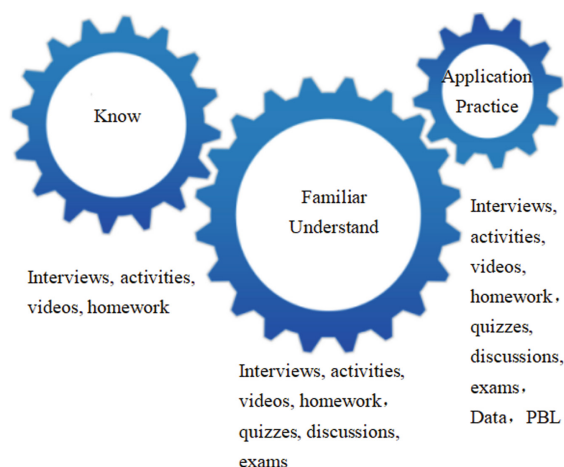


Fig. 4. The schematic diagram of learning

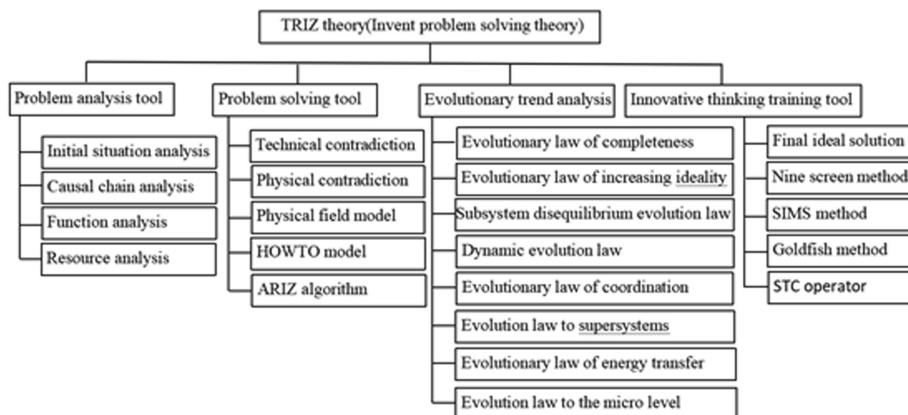
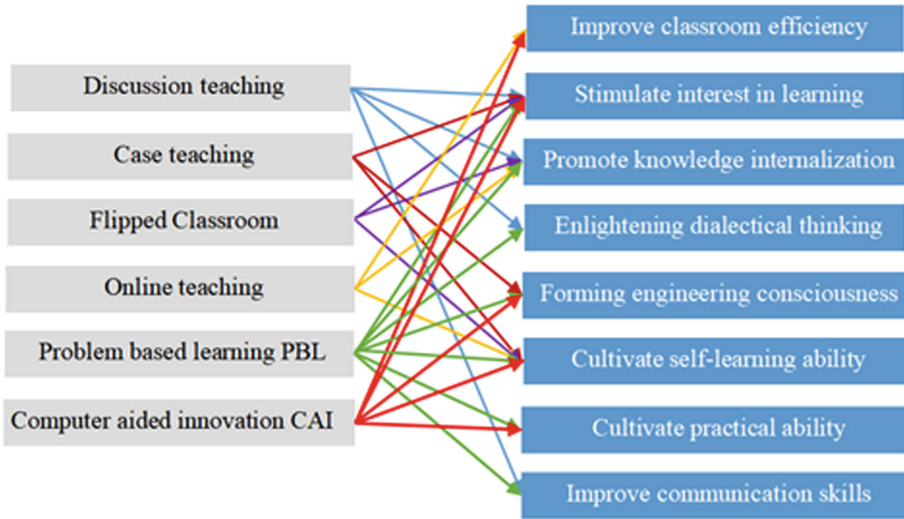


Fig. 5. The knowledge atlas of innovative thinking methods

### 4.2.3 Practical Teaching Methods

According to the learning objectives and teaching requirements of learners at different levels, the teaching effect is improved by comprehensive application of “case-based teaching”, “flipped classroom”, “discussion-based teaching”, “online assisted teaching”, “PBL”, “CAI” and other methods. The schematic diagram of teaching method application is shown in Fig. 6.





**Fig. 6.** The schematic diagram of teaching method application

#### 4.2.4 Diversification of Teaching Activities

Combined with the learning objectives and abilities of different learner groups, various forms of teaching activities are carried out, including routine task-based (video, homework, unit test, examination), interactive (discussion), independent exploration (PBL), and extended consulting (teaching materials), etc. The specific content is shown in Fig. 4.

#### 4.2.5 Target of Assessment System

The learning objectives of the course are set up different layers according to the different needs of learners, namely, cultivating innovation consciousness (level 1), mastering innovation methods (level 2), and exercising innovation ability (level 3). Specifically implemented in the course content assessment, it is divided into three aspects: understanding, familiarity and application. Assessment is carried out by setting different teaching contents and assessment tasks to establish a diversified, multi-level and multi-dimensional course assessment system. The specific methods are as follows:

First, the diversified subjective and objective assessment mechanism are established. Objective assessment is realized through the standard answer machine scoring; Subjective assessment is completed by the mechanism of teachers and students' extra points, evaluation and praise.

Second, multi-level assessment task requirements are established, it is shown in Fig. 4.

Third, multidimensional assessment content is set up, including homework, unit test, video task point, final exam, check-in, visit, discussion, group task, data collection, report, group cooperation, etc.

In addition, according to the requirements of course credit recognition and course nature management of different schools, the weight of course assessment is classified,



including non-credit recognition courses, credit recognition elective courses, innovative theory and application practice courses. The assessment weights are set according to different learning objectives.

## 5 Curriculum Implementation and Application Promotion

After years of practice, relying on the construction and implementation of the first-class online course “Innovative Thinking Methods”, teachers of the course group have continuously promoted innovative methods to teachers and students of colleges and universities, technical personnel of scientific research institutes and even the whole society, and achieved remarkable results. Since 2014, we have completed more than 80 on-site training of enterprise innovation methods, trained more than 25,000 social students, and more than 1,400 college students participated in this course. Through the implementation and promotion of the curriculum, the guiding role of innovative methods in college students’ scientific and technological innovation - entrepreneurship activities has been greatly promoted, and the goal of college students’ innovation - entrepreneurship practice and the quality of innovation results have been improved. At the same time, the promotion and application of innovative methods will further lead the collaborative innovation of industry, university and research, which not only the core competitiveness of enterprises is strengthened, but also a new mode for talent training in colleges and universities is provided. The teaching innovation has been applied in Harbin Engineering University, Bohai University, Heilongjiang Bayi Agricultural University and Shanghai Institute of Electrical Engineering, and achieved satisfactory results. At the same time, the relevant achievements of course construction have been recognized by peer experts, including research branch of technology innovation of China invention association method, innovation methods applied association in Heilongjiang province, Hunan method research institute, Daqing oilfield Co. LTD., and Harbin aircraft industry group Co. LTD., etc. Innovation personnel training mode reform in university is vigorously promoted. It has important reference significance.

## 6 Conclusion

Innovation thinking method online course is an important carrier of college students’ innovative and entrepreneurial education. Through many years of teaching practice and curriculum construction, the courses is centered on student development, and motivated by social needs, oriented by results output. The course concept is that college students’ innovative spirit, creative consciousness and innovative- entrepreneurial ability will be comprehensively cultivated. Course objectives of “understanding innovation”, “innovation”, “daring to innovation” and “love innovation” are determined, and the training tasks of innovative talents are put forward in terms of knowledge, ability, quality and emotion. Based on the comprehensive analysis of the collaborative innovation process of college students, the principles and implementation methods of the characteristic curriculum design are put forward in this paper, namely, layers of learning objectives, systematization of teaching content, practical teaching methods, diversification of teaching activities, and target of assessment system. With the help of the national first-class



undergraduate course platform, good teaching effects have been achieved through the setting of hierarchical teaching tasks, the implementation of diversified teaching activities, and the design and application of multi-dimensional assessment and evaluation mechanism. The application results of innovative methods have certain generalization significance and promotion value in the aspects of enterprise technology innovation consultation, the training of innovative talents in universities and the popularization and promotion of innovative methods, which have important reference significance for the development of industry-university-research collaborative innovation and university students' innovative education research.

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