Innovation and Entrepreneurship Talents Cultivating: Systematic Implementation Path of "Knowledge Interface and Ability Matching"

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Abstract—Systematic matching failure problems have emerged in the very process of integrating innovative and entrepreneurial ability cultivation into college teaching system. These problems included, firstly, innovative and entrepreneurial education mismatch with professional education and disconnect with practice. Secondly, educators' inadequate awareness and single teaching method results in weak pertinence and effectiveness of innovative and entrepreneurial education. The lack of practice platform and insufficient guidance and support can be the final one. Concentrating on those problems above, concrete methods of integrating and promoting teaching elements and knowledge resource systems can be explored from the perspective of the combination of dynamic programming and knowledge software interface. An optimized achievable path of achieving training objectives in a teaching system can be analyzed through a dynamic programming method. Five specific implementation methods including comprehensive utilization, dynamic supplement, innovative development, resource transmission, and usage services can be proposed further. The implementation effects indicate that the positive incentive response between the innovative ability and entrepreneurial strength of college students has been formed. The steady and orderly promotion of college students' innovation and entrepreneurship abilities has been praised by all parties.

Keywords—knowledge software interface; dynamic programming; system control; teaching quality; innovation and entrepreneurship

1 Introduction

Systematic matching failure problems have emerged in the integration of innovative and entrepreneurial ability cultivation into a college teaching system. These problems included mismatch between innovation and entrepreneurship education and professional education, disconnection from practice, teachers' inadequate ability to develop innovation and entrepreneurship education, single teaching method, weak pertinence and effectiveness, inefficient practice platform, and insufficient guidance and support.

According to the ideas of chaos and system theories, a college teaching system is composed of various interrelated and interactive elements that are directed at achieving certain teaching objectives. This system is a unified dynamic scheme with discrete and continuous dynamic interactions. The optimization of this teaching system can be measured in four aspects as follows: (1) effect: students are trained to form certain personality characteristics while grasping knowledge and skills to achieve the maximum potential results in improving their intelligence and non-intelligence levels, such as education and development, innovation, and entrepreneurship; (2) time: the abovementioned results are achieved in the minimum necessary time; (3) strength: the abovementioned results are obtained through the least effort in a certain period of time; (4) expenditure: the least amount of materials and funds are consumed to achieve certain results in the least necessary time. Educational resources (knowledge hardware interface) and teaching elements (knowledge software interface) of the teaching system are required to complete the optimization task through cooperation when the minimum consumption of the abovementioned four aspects is considered the optimization criterion. "Knowledge interface" is a strategy, which can guarantee the education resources for a normal operation of the teaching system and smooth development of activities, such as human resource, material resource, financial resource, and information and polity, thereby realizing the transformation of knowledge ability. "Knowledge interface" plays an important role in the three-layer model of a hybrid teaching system (discrete system, knowledge interface, and continuous system).

Congested or unsmoothed knowledge interface layer seriously affects the orderly operation of the teaching system. The method for solving the problems of innovative entrepreneurship education formalization and imperfect cooperative training mechanism by constructing knowledge interface is worthy of further study.

2 State of the art

Currently, dynamic programming has been increasingly used as a new method for studying optimization control in a multi-stage decision process to solve various complex optimization decision problems.Sun Xiaoyan[1]solved the shortest transportation path through the dynamic programming. The transportation process was divided into several stages to establish the mathematical model of the dynamic programming. The optimal strategy was selected in each stage to find the shortest path, namely, the overall optimal target of the whole process.Li Xiangjun[2] proposed an adaptive optimal control strategy for an energy storage system based on adaptive dynamic programming to compensate for the shortage in the energy storage system control methods based on slope control. Hu Zhuowei [3] suggested that teachers with innovative experience were necessary for implementing scientific and technological innovation activities among college students. Zhang Bingrong et al.[4] proposed to innovate by cultivating college students' scientific research and innovation abilities by implementing a tutorial responsibility system for undergraduate students and realize the institution construction by cultivating the scientific research and innovation abilities of college students by perfecting the construction of a scientific research platform.

Page, A. J. and Naughton, T. J.[5] approximated the solution of Hamilton–Jacobi–Bellman equation by using approximate function structure and obtained the approximate optimal control strategy through an offline iteration/online updating method to effectively solve the optimal control problem for nonlinear systems. Radhakant Padhi, Nishant Unnikrishnan [6] contended that the analysis and synthesis of the optimal control system were important research directions in the nonlinear control field. An optimal control function was found from a class of allowable control action; thus, the system motion had the optimal performance index in the process of transforming from an initial state to a specified target state.

According to the existing data analysis, the complex teaching control system in dynamic programming has not been reported. Hybrid teaching system optimization is an integration optimization problem that integrates a continuous and discrete dynamic hierarchy. The dynamic programming method in cybernetics has been successfully applied to optimal path determination and discrete system optimization. This method demonstrates advantages in solving the optimization control problem of a continuous system by discretizing a continuous system. From the perspectives of dynamic programming and knowledge soft interface, the teaching system was analyzed through the dynamic programming method to realize the optimal reachable path of the training goal and propose the specific implementation practices for innovative entrepreneurial talent training.

3 Mode of Hybrid Teaching System based on Dynamic programming

3.1 Theoretical Basis: Dynamic programming of Optimal Reachable Path in the Hybrid Teaching System

(1) Model construction

The undergraduate education stage is abstracted into a four-stage model. Figures 1 and 2 illustrate x(0) and x(N) as the initial and final states of innovation ability, respectively, when students enter and leave schools. $x_n k$ is the n innovation ability state after the kth stage. The expression of ability state can be constructed by the elements of an innovative talent training system, achievement of students, and process. The directed segment exhibits the state migration vector. Different migration paths from initial state S to final state F are assumed. The numbers (costs) marked beside the directed segment represent the quantitative teaching resources, such as class hours and resource quantity in practical teaching, which can be provided by an N-dimensional space of collection of multi-dimensional capability index constructed by knowledge software and hardware interface implementation strategies.

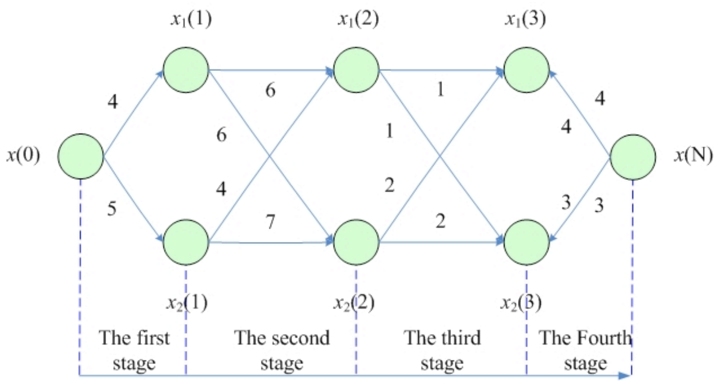

Fig. 1. Simplified schematic of the implementation path with the minimum cost in undergraduate education

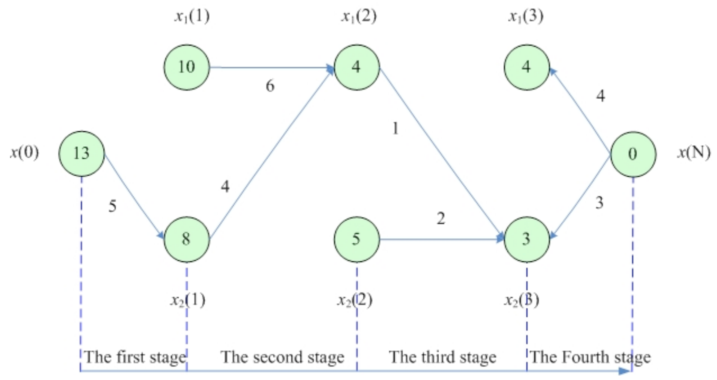

Fig. 2. Migration diagram of an innovative capability status in the undergraduate education stage

(2) Dynamic programming

The use of the dynamic programming of system cybernetics indicate that the state (effect) migration from x(k) to x(k+1) occurs under the action of control input vector (teaching resource) u(k) in the implementation stage of teaching system.

$$x(k+1) = f(x(k), u(k), k) \tag{1}$$

The corresponding cost (quantitative consumption of teaching resources) is expressed through F(x(k), u(k), and (k). From the initial state x(0) to x(1),…x(N-1) and to the final state x(N), the minimum cost J consumed in the N migrations under the action of the teaching decision set {u(0),u(1),⋯⋯,u(N-1)} during the whole teaching process can be expressed through Formula (2).

$$J = \sum_{k=0}^{N-1} F(x(k), u(k), k) \tag{2}$$

(3) Optimal path solution

The optimal solution of Formula 1-2 is solved through the dynamic programming method. First, the state migration value from k to k−1 state is obtained by the quantization value of the multi-dimensional capability index system that is constructed from the implementation policy set of knowledge software and hardware interface and is marked next to the state migration vector. Second, the cost value of each state $x_{N-1}(1) \dots x_{N-1}(M)$ from the final state to the last stage is obtained through reverse recursion and marked in the corresponding state cycle. Third, the cost value of each state in the uppermost stage can be calculated recursively from the current state of the minimum cost and marked in the corresponding state circle. Fourth, the reverse recursion is repeated until the initial state x(0). The optimal implementation path $\{x(0), x_2(1), x_1(2), x_2(3), x(N)\}$ from the initial state x(0) to the final state x(N) and the optimal strategy set {u(0),u(1),……,u(N−1)} of the minimum cost J are depicted in Figure 2.

The affair set of dynamic programming is aimed at matching educational resources, activating teaching elements, and realizing resource sharing to optimize the teaching system effectiveness. These goals not only creates the substructure of the curriculum synergetic but also provides a theoretical basis and instruction for the optimized operation of the teaching system. Two problems must be solved to find the optimal reachable path of the teaching system by using dynamic programming. These problems are (1) constructing the index system for describing an innovation capability state $x_n(k)$ and (2) constructing the index system of the minimum cost $J[x_n(k)]$ to describe the innovation state migration.

3.2 Evaluation System: Construction and Analysis of a Multi-dimensional Evaluation System of Innovation Capacity State and Minimum State Migration Cost

The innovative ability of college students reflects the comprehensive optimization of multiple factors and indexes. It contains a variety of factors and complex structure. Colleges and universities select strategies in accordance with their development orientation and scientific use of “teaching” and “learning” resources. Therefore, a scientific and accurate judgment of students’ innovation ability and the minimum cost of state transition are the key to establishing the corresponding evaluation index system from the multi-dimensional perspective.

3.2.1 Construction and Analysis of Multi-dimensional Evaluation Index System of Innovation Capacity

Combined with the objectives of training application-oriented talents in independent colleges, the longitudinal main line under the principles of comparable, measurable, and simple evaluation system is demonstrated as follows: ability training → improvement → social benefits; the horizontal main line is professional knowledge and skill quantification of learning achievement ↔ interpersonal society adaptable to quantitative developmental quality↔moral ability of quality and professional quantification ↔ physical quality of carriers. The evaluation system is composed of professional skills, innovative activities, scientific and technological innovation results, disciplinary competition, innovation benefits, and 3D culture. These systems cover all aspects of students' innovation activities in school and reflect their innovation experience, achievement, and ability improvement.

(1) Hierarchy Analysis of Innovation Ability Evaluation System

According to the design idea of evaluation index system, evaluating the college students' innovation ability is first determined as the target layer by using Analytic Hierarchy Process (AHP). Second, the six aspects of evaluation are identified as the secondary indexes (criterion layer). Finally, the indexes of the six aspects are decomposed and refined to determine the 38 tertiary indexes (control layer) and construct a three-layer students' innovation ability evaluation system model, as exhibited in Figure 3.

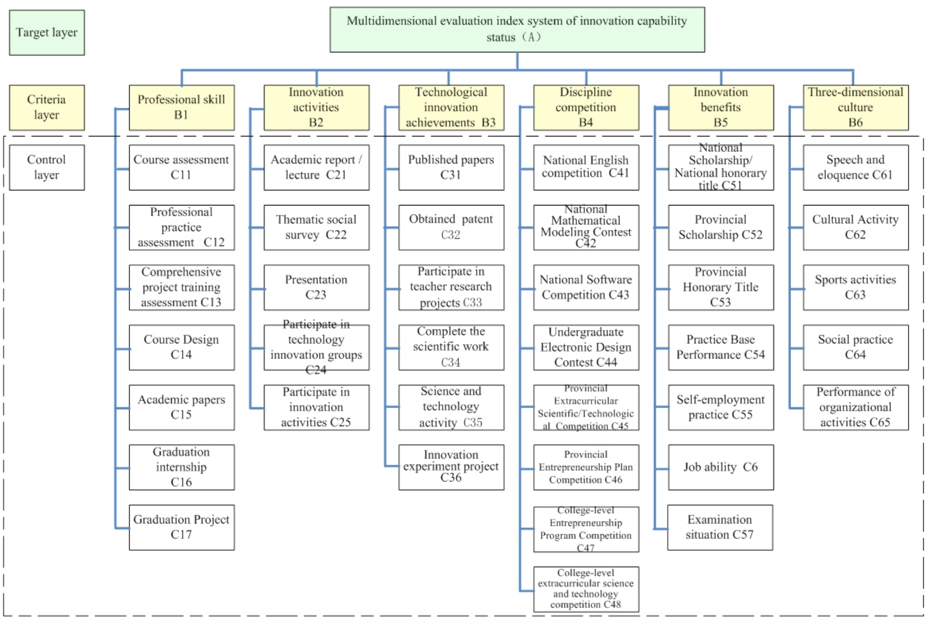

Fig. 3. Three-layer innovation ability evaluation system model

(2) Acquisition, Evaluation, and Analysis of Innovation Ability Information

1)Information acquisition

On the basis of the three-layer innovation ability evaluation system model, the AHP was used to transform the semi-qualitative and semi-quantitative problems into quantitative calculation problems in the evaluation system model to realize the decision-making analysis of multi-objective, multi-criterion, and multi-period problems in the model. The information was retrieved through questionnaires. The contents of the three-layer indexes in the index system were directly concretized into the questions on the questionnaires. To this end, 1–n questions were designed for each three-layer index in accordance with the actual situation of independent colleges. The information about freshmen, senior students, graduates, practice bases, and employing units was collected and investigated. The data obtained from the students, academic affairs office (teachers), department of students' affairs, practice bases, and employing units can objectively describe students' innovation ability.

2)Evaluation analysis

The judgment matrix was first constructed with 1–9 scales for the elements of the same layer after establishing the AHP model. The relative importance of this matrix originated from the index quantitative table in the questionnaire. Second, the maximum characteristic root and the corresponding feature vector of the constructed matrix were calculated, and the consistency test was completed. Third, the weight of each index was calculated. Fourth, the evaluation result of each student's innovation capability status was obtained through the weighted average method. The quantitative evaluation of college students' comprehensive innovation ability, that is, the above-mentioned innovation capability status $x_n(k)$ (the average value of representative student group samples), was obtained by using the yaahp software running results in the AHP model. The calculation process is not detailed here.

3.2.2 Analysis and Evaluation of the Multi-dimensional Index System for State Transition Minimum Cost

According to Barbansky's concept, the hybrid teaching system optimization is aimed at optimizing the whole teaching process, which should consider various methods so that the grasp of teaching resources and teaching elements can reflect completeness and integrity[2]. Therefore, the AHP was used again to construct the evaluation index system of the innovation capacity status transition cost with knowledge software and hardware interface as the main line. The hierarchical model is displayed in Table 1.

Table 1. Hierarchical model of the multi-dimensional evaluation index system of innovation capacity status transition cost

Target layer	Criterion layer	Control layer	Design orientation of questions in the questionnaires
Innovation ability migration implementation process cost	Knowledge hardware interface	Teaching resources	Educational policy, resource information platform, practice base, library, campus network information resource, teaching aids, laboratory, and sports facilities.
		Teaching environment/facilities	In addition to teaching material conditions, hygiene conditions, moral and psychological conditions, and environment conditions, students, teachers, data.
		Teaching materials	Teaching material content system, supporting teaching material resources.
		Teachers	Teachers, teaching attitude/contents/methods/ results.
		Students	Students' self-evaluation, practice base evaluation, job evaluation, and teaching auxiliary evaluation.
	Knowledge–software	Teaching objectives	To ensure that students' quality, education, and development reach the possible level within four years.

	interface	Organizational form	Class teaching system, differentiated learning guidance assessment, information teaching platform.
		Teaching contents	Conformity between teaching content and objectives, combination with cutting-edge technology application.
		Teaching methods	Principle/technology/operation/inspection.
		Teaching means	Theoretical , practical classroom, community/technology activity classroom/ medium forms or equipment.
		Teaching procedure	The order of cognitive activities in the four classes extends beyond the single cognitive activity.
		Teaching time	Learning degree = f (the spent time (the given×the used×the obtained)/the required time).
		Academic atmosphere	The comprehensive value orientation/thinking mode/aesthetic taste gradually formed in activities.
		Teaching evaluation	Evaluation of students' learning effects and teachers' teaching process.

The information acquisition and evaluation of the AHP model are similar to those described in Section 3.2.1. According to the yaahp software running results, the comprehensive innovation capability status transition cost $J[x_n(k)]$ was evaluated quantitatively.

4 Implementation and Effect of the Teaching System

An implementation strategy set of innovative and entrepreneurial abilities with knowledge software interface as the main line was proposed in the five aspects, namely, comprehensive utilization, dynamic renewal, innovation development, resource transmission, and service use, through the abovementioned teaching system dynamic programming.

4.1 Implementation of the Teaching System

4.1.1 Comprehensive Utilization: Establish a Multi-disciplinary Practical Teaching Platform

The cultivation of innovative practical ability must be accumulated by solving a sufficient number of complex and comprehensive practical problems. The intersection of subjects and thinking lines forms several comprehensive and complex problems, which are far beyond the scope of general curriculum study. The establishment of a multi-disciplinary practice platform provides a feasible approach to integrating the multi-disciplinary background, cultivating a holistic mode of thinking, and improving the practical innovation ability.

(1) Establish a multi-dimensional compound practical teaching system and promote the integration of knowledge

On the basis of the objectives of strengthening basic ability, engineering accomplishment, and innovative spirit, the teaching contents were reorganized and integrated to establish and perfect "basic experiment–professional practice–comprehensive practice–research innovation–social practice" teaching system, which is beneficial to breaking down the barrier of knowledge and promoting the integration of knowledge, specialties, and subjects.

(2) Develop a multi-dimensional cooperation project curriculum and ensure project quality

First, a project development team should be set up to integrate experts of different disciplines for information exchange, provide different perspectives and research methods for solving problems, and promote the emergence of new ideas and thinking. The team designed the course content and standardized the development of cooperative project curriculum. Second, resources were integrated, expanded, and exchanged through interdisciplinary cross-professional, inter-school, school–enterprise, and other multi-dimensional cooperation development mechanism to improve the quality and quantity of project curricula. Third, coordinated implementation, process control, information feedback, tracking and improvement of the cooperative curriculum projects were performed to provide an effective quality assurance by establishing a quality monitoring mechanism.

(3) Adjust management and guarantee mechanism of practical platform and optimize resource allocation

The practice platform management institutions are specifically responsible for coordinating the work of administrative departments, such as teaching, scientific research, and laboratories. High-quality resources, such as laboratory equipment, academic leaders in various disciplines, and scientific research achievements, are integrated to provide comprehensive service and guarantee to teaching and research in resource management, laboratory construction, equipment management, and maintenance and logistics services.

4.1.2 Dynamic Update: Construct a Four-Layer Integrated Discipline Competition Activity Platform

Discipline competition is an effective platform, which can strengthen the ability of solving practical problems, cultivate team cooperation spirit, expand comprehensive quality, and improve students' ability of innovation and practice. A four-layer integrated discipline competition activity platform that covered four majors of computer, namely, software engineering, network, electronics and communication, and Internet of things, were constructed. This platform has four stages and layers (department, college, province, and nation), four categories (fundamental, professional, scientific research, and innovation projects), and four abilities (basic, engineering, scientific innovation, and social practice).

(1) Combination of competition and practical teaching. Subject competition is integrated into practical teaching activities. Subject competition activities are combined with open experiments, professional curriculum design, and project courses to form the open practice teaching mode that cultivates application-oriented innovative talents

with the carrier of discipline competition. This condition not only improves the utilization rate of laboratory resources but also effectively promotes the interaction between teachers and students and achieves the goal of promoting teaching by competition, learning by competition, and training by competition.

(2) Combination of competition and scientific research. The question selection of competition project is combined with teachers' scientific research subject through students' innovative experimental project, extracurricular scientific and technological activity group, and teachers' scientific research project. Teachers transform their scientific research projects into open experimental projects for students to take elective training and competition questions, thereby effectively enhancing the research and innovative characteristics in competitions.

(3) Combination of fundamentals and specialties. Interdisciplinary comprehensive competition training, such as mathematical modeling, electronic design, and Challenge Cup extracurricular scientific and technological works, can effectively promote the integration of fundamental and professional knowledge among students and realize the integration of interdisciplinary knowledge, systematic integration of professional knowledge, and inter-curriculum knowledge. This condition is conducive to popularizing the teaching method of research and individualized cultivation, stimulating students' innovative thinking and consciousness, and improving students' innovative ability.

4.1.3 Innovative Development: Extend the Innovation Practical Platform of School–Enterprise Cooperation

School–enterprise cooperation is an effective approach to solving problems, such as the disconnection between engineering talent training and enterprise demand, sharing of superior resources, and introduction and training of teachers. This approach can improve the utilization of external resources of innovative practice platform.

(1) Establish a win–win mechanism and search for the integrating point of mutual benefit and win–win situation

The foundation of establishing a new mutual benefit and win–win cooperation mode between schools and enterprises is finding the common interests of both sides. Enterprises can locate the expected profit in future demanded talents and students' creative thinking formed in studying cooperative projects. Colleges and universities should position the expected profit at achieving high-level engineering talents training. Schools and enterprises can maintain a solid and long-term cooperative relationship based on mutual benefit and win–win situation and grasp the ability of sustainable development. Standard management system, complete organization system, and all-round communication and coordination mechanisms are formulated through the special organization of colleges, such as an information experiment demonstration center, to realize the long-term and stable organization and system guarantee ability of the cooperative education between schools and enterprises.

(2) Integrate co-construction plan and complementary advantage resources

Colleges and enterprises should jointly plan to establish a practical teaching model that combines professional skill training and practical experience to realize the sharing of high-quality educational resources for the following reasons: 1) To satisfy the demands for college teachers' engineering practical ability training by using enterprise and practical training environment to satisfy the requirements of students' practical ability training; 2) To meet the requirements of training the engineering practice ability of university teachers to pave the way for teachers to be approximate to the engineering practice, acquire engineering experience; grasp the frontline information, technology, research results, and new techniques of discipline production; and obtain profound professional knowledge and exquisite vocational skills; 3) To provide continuing education and professional theoretical and technical training for enterprise staff through the high-quality teachers in colleges and universities; 4) To cooperate in developing an integrated engineering project practice course. Enterprises provide product design and development and technological process improvement projects. Teachers and enterprise experts adjust the difficulty and scale of projects to satisfy the requirements of the project curriculum and improve students' ability to solve practical engineering problems.

4.1.4 Resource Transmission: Construct a 3D Integrated Scientific Research and Interactive Teaching Platform

(1) Management dimension: adjust innovation system and promote interaction between scientific research and teaching

1) Relax teacher employment system. The energy and time of teachers are limited. Teachers will attend to one activity and lose another under heavy teaching or scientific research tasks. a. Engage professors/associate professors in abundant teaching and research experience. Teachers can devote more energy to teaching activities and participate in guiding students' scientific research than young and middle-aged teachers with heavy scientific research tasks. b. Employ graduate students as teaching assistants of undergraduate courses to share the pressure of lectures. c. Assign teaching assistants to teachers with heavy scientific research tasks to train the teaching and scientific research ability of young teachers.

2) Implement staggered academic holiday system. Establish flexible teaching and research personnel flow mechanisms, encourage teachers to engage in scientific research activities and scientific research personnel to undertake teaching tasks, and promote the win–win situation of scientific research and teaching. a. Provide teachers with time to specialize in research to temporarily separate teaching and research from each other. b. Dispatch scientific research personnel with special teaching time, and introduce the latest results to students to improve classroom teaching quality. The temporary separation of teaching and research can ease the contradiction and facilitate the accumulation and achieve interaction at a high level.

(2) Dimension of Teachers: reform teaching and evaluation model and promote interaction between scientific research and teaching

1) Reform the experimental teaching mode and broaden the freedom of experimental teaching

Independent and open experimental teaching activities demonstrate considerable randomness and contain opportunities for discovery. Only in the fully open state can the experimental subject seize the opportunity and effectively activate innovative thinking. Students should be provided with adequate free space in teaching. First, students perform independent experiments on the subject. Students also independently design the experimental scheme, select the equipment, correct the data, summarize the experimental conclusions, analyze the problems that exist in the experiment, and provide suggestions for improvement in accordance with their interests and abilities. Second, students should conduct experiments with questions. Questions, the premise for students to contemplate, are the starting point of discovery and creation. Problems can be provided by teachers. In most cases, students find and propose questions in experiments. They verify and solve questions through experiments. Third, students share the experimental results in groups, especially in the process of finding and solving problems and reflection after experiments.

2) Increase scientific research and guidance task, and train students' science research ability

Teachers attract students to directly participate in their scientific research projects or divide the subject contents to assist students in project design and graduation topic selection through appropriate guidance and strengthen the interaction between teachers and students in scientific research teaching.

3) Implement classification evaluation and assessment, and improve teacher performance evaluation system

Teachers are evaluated using different indexes and standards in accordance with their positions (research, research teaching, teaching research, and teaching). Professors with outstanding teaching and research achievements are treated equally. The tendency of "attaching importance to science but ignoring teaching" or "attaching importance to teaching but ignoring science research" is eliminated, teachers are guided to achieve a balance between teaching and scientific research, and teachers' enthusiasm is improved by encouragement and evaluation mechanisms.

(3) Student Dimension: promote the interaction of scientific research and teaching through pluralistic evaluation system

1) Guide students' learning approach, and cultivate students' basic scientific literacy

The scientific research and training tasks should be included in talent training plan, and students are instructed to engage in scientific research activities in accordance with their aptitude. Students that major in information science should be encouraged to read original classical textbooks in foreign languages to absorb the advanced technology of information and carry out reading guide education. The establishment of student academic journals and addition of academic columns at the academic level provide a platform for students to publish scientific research results and conduct academic exchanges. Comprehensively understanding students, discovering their potential, developing their strengths, circumventing their weaknesses, and teaching them in accordance with their aptitude have become feasible by evaluating students from various aspects.

2) Implement dynamic multi-dimensional assessment methods, and improve the evaluation system

Situations, such as emphasis on content and ignorance of ability, single assessment method, emphasis on finality and ignorance of process, single evaluation subject, and imperfect practical teaching evaluation, must be changed. The pluralism of examination and evaluation, that is, evaluation object, evaluation method, evaluation content, evaluation site, and evaluation basis pluralisms, must be upheld.

4.1.5 Use of Services: Expand and Collaborate Radiation Platforms for Social Service

(1) Construct and optimize reasonable professional structure, and cultivate talents required for regional economic development

Independent colleges should find their position and adjust the structure of discipline and specialty to satisfy the requirements of regional development and cultivate professional talents. 1) Strengthen superior discipline, support characteristic discipline with strong vitality, develop interdisciplinary discipline, and gradually construct the academic subject groups to provide service for the technological innovation of the regional superiority pillar industry. 2) Based on sufficient investigation on the training of similar professionals in colleges and universities at home and abroad, the corresponding superior disciplines are constructed. 3) Invite experts, scholars, and technical personnel from enterprises, institutions, and relevant industry to participate in professional construction seminars and guide the output of professionals. These measures can not only effectively guarantee the rationality of professional structure, specialty characteristics, and advantages but also avoid the phenomenon of professional talent training convergence.

(2) Actively promote the cooperation of industry, university, and research, and improve the service ability of coordinated regional development

The scientific research management institutions of colleges formulate key scientific research implementation plan, establish the scientific research guidance objectives, and reduce teachers' "blindness" in scientific research in accordance with the direction of tackling local science and technology problems; these institutions must also advocate to concentrate on the advantages to set up scientific research and innovation teams, strive to undertake local economic development and technological transformation projects, guide teachers to analyze regional development planning, economic development direction, and local resource conditions, and identify service interfaces. The teaching department organizes teachers to access the production line, understand the current situation and development trend of enterprises, cooperate with enterprises and other colleges to tackle the key problems, and improve the practicability of the subject. The department must also organize scientific research backbone to visit industrial entities and industrial parks/bases for inspection and exchange, establish multi-level, multi-directional, multi-channel scientific research cooperation with local authorities, and promote the integration process of production, education, and research. Moreover, the teaching department is responsible for establishing college-level scientific information service platform and creating instant conveniences for universities, enterprises, and the government to understand the feedback information. The department must also collect the information of market development, release the achievements of scientific research in colleges and universities, communicate with local scientific and technological information centers, and accelerate the transformation and industrialization of scientific and technological achievements

(3) Establish social service function organizations and perfect the guarantee social service mechanism

Social service mechanism is the guarantee for colleges and universities to fulfill and expand their social service functions. 1) Social service should be included in the planning of colleges and universities, and special institutions of social service should be established to plan and arrange the implementation at the college level. 2) Social service duties that should be fulfilled by teachers must be clearly stipulated, and the actual situation of social service must be included in the teacher evaluation index system. 3) Social service work incentive mechanism must be set up, and the teachers who develop outstanding social service achievements must be rewarded. 4) Combined with professional teaching and practice, students are organized to participate in various social service activities to cultivate their awareness and ability for social service.

The combination of social service-oriented industry and industry and research provides a stable economic support to colleges and universities and enables local enterprises to obtain technical support, which can realize the “1+1+1>3” triple-win effects of universities, enterprises, and the government with complementary advantage resources.

4.2 Implementation Effect

The cultivation of innovative and entrepreneurial talents is a systematic educational reform project. Based on the viewpoint of system theory, the dynamic programming method is used to formulate the training plan of talents with the core of technical and technical innovation and entrepreneurship and optimize the theory and practice teachings by maintaining the information that is unblocked inside and outside the system. The three major systems of quality management have constructed the following five platforms: interdisciplinary practice, subject competition four-level fusion, school–enterprise cooperation and innovation practice, scientific research and teaching interactive, and cooperative social service radiation platforms. The training of innovative entrepreneurship runs through the whole process of talent training to guarantee the comprehensive use, dynamic supplement, innovative development, resource transmission, and service of teaching system.

The implementation of the teaching system has achieved clear results, which are mainly reflected in the following six aspects:

1) Approve provincial “college student network, innovation, creativity, and entrepreneurship platform” construction project. On the basis of the advantages of the five disciplines and majors in the information institute, resources are integrated into the implementation of the strategy for the third year of provincial “college student network, innovation, creativity, and entrepreneurship platform” construction project.

2) Establish a provincial “information network experimental teaching demonstration center.” In the second year of strategy implementation, the information network experimental teaching center is successfully applied for a provincial experimental

teaching demonstration center, which provides a demonstration for the practice teaching of similar colleges and universities.

3) Improve social recognition. The construction of other experimental projects in the whole college, which not only improves the level of experimental teaching but also mobilizes students' interest, has been promoted through provincial high-quality experimental projects and experimental teaching demonstration centers. The effects of cultivating innovative entrepreneurial talents have been recognized by the society.

4) Construct a national university student innovation and entrepreneurship team. The national "Xiaoping Science and Technology Innovation Team" has been approved since the implementation of the project. At present, innovative projects, such as "bicycle power generation system," "anti-drinking driving system," "intelligent switch," and "automatic watering system," developed by the team have been successfully applied for national practical patents.

5) Organize and train students to participate in provincial/national competitions. Satisfactory results have been achieved by establishing the cultivation model of diversified innovative practical ability and promoting the cultivation of students' comprehensive practical and innovative abilities. Provincial entrepreneurship plan competition award-winning cases include the following: National bronze award–"Wo Mai Good"; provincial first award–"Touch Future Home Decoration Design Co., Ltd.," "Puro Series Bluetooth Headset," and "Lefeng Network." Provincial second award–"printing platform combined with Internet cloud service online Dada clouds," "Bus self-service coin sorting and counting machine and book register." "Wo Mai Good" and "Lefeng Network" brought earnings to the students involved in the program.

6) Achieve results in conjunction with teacher research projects. On the basis of "Internet + Alzheimer's Disease Patient Safety Protection" and the implementation of the integrated research (16YJAZH040), teachers guide students to participate in the National College Student Electronic Design Competition. The work "Single-Phase Appliance Analysis and Monitoring Device" won the national second prize. At present, the project has been applied for the national practical patent.

5 Conclusions

In summary, the integrated utilization of teaching elements and resources, synergistic innovation, integration, and ensemble force were investigated from a new perspective of knowledge interface. The controllable factors in teaching were analyzed through the cybernetics method, which provided an accessible path for the formation of "continuous process in four years" of the innovative and entrepreneurial ability training program and achieved remarkable results. The achievements are mainly reflected in the following aspects:

(1) The implementation of scientific research and teaching interactive platform has inspired the inherent scientific research innovation ability of college students and enhanced their knowledge application and practical abilities.

(2) An open educational environment has been formed by implementing the cooperative social service radiation platform. The individualized and diversified education

has strengthened, and students' enthusiasm for active inquiry learning has been enhanced.

(3) The sharing of teaching resources inside and outside the school, which provides the students with the real-project working environment and various kinds of skills training, has been realized by extending the cooperative innovation practice platform between schools and enterprises. Therefore, students' ability to solve practical engineering problems has been improved.

(4) The multi-discipline intersecting practical teaching platform trains students' multi-subject background and the entire concept. Students' ability to solve comprehensive and complex problems has been enhanced.

(5) The implementation of subject competition activity platform enhances students' ability to solve practical problems, fosters their team cooperation spirit, and improves their innovative practical ability.

6 Acknowledgment

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7 References

[1] Sun Xiao-yan.The dynamic programming applied to solving the shortest-path of transportation problem, Machinery Design & Manufacture,2010, vol. 15(02), pp. 45-49.
[2] Hu Zhuowei.Construction and Implementation of Training System for "Five Mutual" College Students' Practical and Creative Ability, Journal of Capital Normal University (Social Sciences Edition),2017, vol. 3(10) ,pp .28-31.
[3] Zhang Bingrong. Exploring and Practicing of Training about College Students' Research and Innovation Capacity, Modern education management,2014, vol. 21(06) ,pp . 37-40.
[4] Page A J. &Naughton T J. Parallel,2005.Proceedings.19th IEEE International,2005,PP. 49-52.
[5] Radhakant Padhi,.A single network adaptive critic (SNAC) architecture for optimal control synthesis for a class of nonlinear systems , Neural Networks ,2006, vol. 12 (10),pp.57-60. https://doi.org/10.1016/j.neunet.2006.08.010

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