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Mechanism Training Management of Innovative Talents in Higher Education under Liaoning Province

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Abstracts

The objectives of this research were: (1) to examine the composition factors of innovative talents training management in higher education under Liaoning Province; and (2) to propose the management mechanism of innovative talents training in higher education under Liaoning Province. This research was a mixed method study. The population is administrators, professors, instructors of 20 universities under Liaoning Province. They have many years of experience in innovation education and talent cultivation management. use Krejie and Morgan (1970) total of 280 samples using stratified sampling technique. There are five key information providers, namely experts and scholars in innovation education and talent cultivation management. Obtained through purposeful sampling. The tools used for data collection include semi-structured interview form, group discussion form. The research was divided into three processes: research plan preparation, research procedure and research report. Statistical data used for data analysis include frequency, percentage, average, standard deviation, and combination of exploratory factor analysis and content analysis. The research results showed that: (1) there were four components of Mechanism training management of innovative talents in higher education under Liaoning Province which consisted of management of innovative education process, the internal management of innovative talent training, the innovative talent training mode in colleges and universities, and the improvement of students' innovative ability; and (2) There are 14 strategies for the management system of innovative talents cultivation in colleges and universities under Liaoning Province: there were four strategies for the management of innovative education process, three strategies for the internal management of innovative talents cultivation, three strategies for the innovative talents cultivation mode in colleges and universities, and four strategies for improving students' innovative ability. The research results were aimed at promoting and improving the development of innovative talent training management system in colleges and universities under Liaoning Province.

Keywords: Innovative talent, Talent training management, Higher education under Liaoning Province

Introduction

As an academic concept, innovation was first used by Austrian American scholar Schumpeter in the Book Economic Development Theory in 1912. He believes that innovation

was to establish a new production function, that was, to realize a new combination of production factors and production conditions. (Liu S.(2012)

At the same time, with the gradual deepening of human resource management research, the development of "innovative talents" had attracted more and more attention. In the 1970s, American psychologist Gilford's creative Talent and New Theory of Creativity and Innovative Thinking made the research on innovative talents become a hot topic.

At the beginning of the 20th century, the research on innovative talents increased year by year in China, but the corresponding research on the management mechanism of innovative talents was relatively few, especially the articles published in important journals and core journals.

Innovative education had become the focus of theoretical and practical research in China's higher education. Innovative education was the objective need of building an innovative country, improving the quality of education and teaching, and alleviating employment pressure. The era of knowledge economy and the era of industry 4.0 have brought great changes to higher education, and the innovative social form advocating individuation, customization, digitalization and sharing needed a large number of innovative talents. Positions as talents cultivating in university, more need to stand at the height of service national development strategy, the significance of understanding fully to carry out the innovation education, further deepening the reform of education teaching, promote the development of innovation education, accelerate the cultivation of contemporary college students' innovation spirit and practice ability, to adapt to the economic and social development need. (Chengzhong Q. (2020)

Higher education under Liaoning Province had the innate advantages of innovative education and had established close relations with social and economic development in the aspects of innovative talent training, technology transfer and achievement transformation. Based on this background, innovation education in higher education under Liaoning Province would be coupled with professional education to form its own distinctive characteristics. However, it was also found that innovation education in higher education under Liaoning Province, especially the cultivation of innovative talents, had encountered many setbacks and challenges in the implementation process. Innovation education in higher education focused on the learning of innovative knowledge, and the integration degree between theoretical learning and practical ability was not high. The problems such as the imperfect management mechanism of innovation-oriented personnel training reflect the deficiencies of higher education under Liaoning Province in carrying out innovative education. For example: talent training mode, talent comprehensive evaluation index system, talent training mechanism, talent training reform, the influence of policy factors on innovative talent training in higher education and cultural construction and innovative talent training in higher education had certain challenges and reform space.

Research Objectives

1.To examine the composition factors of innovative talents training management in higher education in Liaoning Province

2.To propose the management mechanism of innovative talents training model in higher education in Liaoning Province.

Research Conceptual Framework

In the face of the tide of globalization and the advent of the era of knowledge economy, countries in the world pay more and more attention to the problem of talents. Compared with developed countries, the development of innovative talents in China was relatively backward and there were prominent problems such as unreasonable structure and insufficient innovation ability. Through schools to cultivate innovative talents, innovative talents through research innovative achievements and become innovative products after put into production for social consumption, and then through the social consumption of economic income into innovative talents training and scientific research activities, after such repeated virtuous cycle could form the cultural atmosphere conducive to innovation in the whole society. Innovation education quality promotion, need to build a complete management mechanism, from the results of the researchers, the process of innovation education management, internal management of innovative talent training, innovative talents training mode, improve students' innovation ability four parts was the main component of building innovation education management mechanism.

In the process of innovative education and management, we should be constantly familiar with the national policies, In particular, the policy of cultivating innovative talents, Strengthen the quality control of innovative education, strengthen the internal management system of the organization, the construction of innovative education management system, and the management of innovative education achievements; The internal management of innovative talent training was an important link of innovative education management, It was an important stage of the construction of innovative education evaluation system; Innovative university and innovative talent training mode requires colleges and universities to innovate teaching methods; Innovate the educational practice link and exercise the students' scientific research ability; Innovative talent training program, Develop professional and characteristic talents; Improve students' innovation ability, Cultivate college students' sense of innovation, Innovative ability to apply knowledge, Improve the platform for industry-university-research cooperation, Better to adapt to the development of the society, The development of talent demand.

Research Methodology

1.Population and Sampling

This research was a mixed method of quantitative and qualitative research. Through the

professional online questionnaire platform "Questionnaire Star", questionnaires were distributed to administrators, professors, and instructors of 20 colleges and universities in Liaoning Province. Randomly select administrators, professors and instructors for questionnaire survey. From 877 administrators, professors and instructors, 280 samples were taken using the technology of Krejcie & Morgan table (1970), and then the stratified random sampling method was used to select administrators, professors and instructors. The questionnaire was sent to the interviewees through the network and email, and 7 experts were used to set the appreciation of the discussion and set the optimization of innovation education management.

2. Research Instrument

The questionnaire uses a five-point Likert scale. Scale from 1 to 5. The content validity of the consistency index IOC is at the level of. 80. After five experts rated the target consistency index (IOC) of the project, a preliminary test was conducted on 30 respondents. Cronbach's alpha evaluated the validity and internal consistency reliability of the scale. The overall reliability of the questionnaire is 0.954. After the reliability test, 280 complete answers were collected and analyzed. SPSS 26.0 statistical software was used to analyze the data, and exploratory factor analysis (EFA) was used to evaluate the accuracy and effectiveness of the questionnaire. Through the comprehensive evaluation of the given data, the model fitting quantity is estimated to ensure the effectiveness and reliability of the model.

3. Data collection procedure

The researcher had three steps of data collection procedure

(1) The research used the semi-structured interview, which also provided experts with the background and perspective of talent training optimization in universities in Liaoning Province, so that they could learn in advance and then made an appointment for the interview.

(2). Conclusion: The construction of a questionnaire with content validity and Cronbach reliability was a methodology in the cultivation of innovative talents in Liaoning universities and how to optimize management. The researchers sent them to the interviewees by email, telephone and face-to-face.

(3). For the last step, the researcher set the connoisseur forum as 7 experts to discuss and summarize how to carry out innovative talent training management in Liaoning, so as to achieve the final objective.

4. Data analysis

For the first step of the research and for the first objective. The researcher used content analysis for the depth-interview. While the step of verification, arithmetic mean, standard deviation and exploratory were used, the last step was to optimize the training mode of innovative talents in Liaoning comprehensive universities

Research Results

1. Demographic information

Table 1 Shows Demographic information

Demographic information	Frequency	Percentage
1. Gender		
1.1 Female	100	35.71
1.2 Male	180	64.29
Total	280	100
2. Age		
2.1 Under age 30 years old	46	16.43
2.2 30-45 years old	165	58.93
2.3 Age of 45 years old and above	69	24.64
Total	280	100
3. Education level		
3.1 Undergraduate degree or below	7	2.5
3.2 A Bachelor's degree or an equivalent	11	3.93
3.3 A Master's degree or an equivalent	129	46.07
3.4 PhD degree or equivalent	133	47.5
Total	280	100
4. Job position		
4.1 Professor	82	29.29
4.2 Management personnel	51	18.21
4.3 Teachers	119	42.5
4.4 Others	28	10
Total	280	100
5. Experience in the teaching and management of innovative talents		
5.1 5 Years	45	16.07
5.2 10 Years	133	47.5
5.3 Over 15 years	102	36.43
Total	280	100
6. University attributes		
6.1 Key University of Liaoning Provincial Education Department	89	31.79
6.2 Liaoning Provincial Department of Education, General Universities (Public)	128	45.71
6.3 Liaoning Provincial Department of Education (Private Universities)	41	14.64
6.4 Others	22	7.86
Total	280	100

2. Exploratory factor analysis EFA

（1）.KMO-Meyer-Olkin and Bartlett's Test

Table 2 Shows KMO-Meyer-Olkin and Bartlett's Test

KMO Meyer Olkin and Bartlett		
Kaiser -Meyer -Olkin Measure of Sampling Adequacy .		.952
Bartlett's Test of Sphericity	Approx Chi -Square.	20335.573
	df	2278
	Sig .	.000

(2). Data Analysis Result on Questionnaire: Eigenvalues, Percentage of Variance, Percentage of Cumulative Variance.

According to the principle that the eigenvalue is greater than 1, the number of extracted factors is 4, and the variance contribution rates after factor rotation are 33.361%, 26.32%, 2.601%, and 2.592%, respectively. The cumulative variance contribution rate of the four main factors reached 64.874%, higher than 60%, indicating that these four factors can explain most of the information of the original data.

Table 3 Shows Data Analysis Result on Questionnaire: Eigenvalues, Percentage of Variance, Percentage of Cumulative Variance

Components	Rotation Sums of Squared Loadings		
	Eigenvalues	Percentage of Variance	Percentage of Cumulative
1	35.701	35.701	33.361
2	25.694	25.694	59.681
3	2.431	2.431	62.282
4	2.013	2.013	64.874

(3). The factor loading, variables described in each of the main components after rotating the axis.

First, researchers test the applicability of data and models to see whether the models used are reasonable. Referring to the previous research results, the goodness of fit of the research model and data in this paper is tested, and several key indicators are in line with the recommended values, indicating that the overall goodness of fit of the theoretical model in this paper is good, and the model diagram is acceptable.

Table 4: shows the components of the management of innovative education

Order	Components	Number of Variables	Factor Loading
1	Component 1	41	0.467-0.835
2	Component 2	21	0.864-0.946
3	Component 3	3	0.456-0.570
4	Component 4	3	0.419-0.540

Total	68	0.419-0.946

There are four eligible components as follows:; component 1 contains 41 variables describing components with factor load between 0.467 - 0.835; component 2 contains 21 variables describing component with factor load between 0.864 and 0.946; component 3 contains 3 variables describing component between 0.456 - 0.570; component 4 contains 3 variables with factor load between 0.419 - 0.540. The total number of variables describing the four components was 68 variables, with factor loads ranging between 0.419 - 0.946.

Table 5 Shows Components 1:Innovative process management of education

Variables	Statement	Factor Loading
VAR00044	We will continue to promote policies for cultivating and training innovative talents	0.835
VAR00030	Optimize the teaching team	0.796
VAR00043	Combine innovative education with professional education	0.789
VAR00028	Set up a reasonable major	0.778
VAR00040	The IE education mode of "Internet + Maker education" in colleges and universities	0.768
VAR00050	The university strategy of optimizing the realization form of collaborative innovation	0.762
VAR00052	Reform the structure, form and organizational mode of disciplines in universities, and cultivate scientific research and innovative talents	0.759
VAR00042	We will improve the personnel training mechanism	0.758
VAR00020	Establish a perfect innovative talent evaluation system	0.754
VAR00047	Establish a new concept of collaborative innovation	0.744
VAR00058	Deepen the reform of professional teaching, implement and improve the talent training mode of "practical platform curriculum module"	0.74
VAR00041	Build the application-oriented talent training mode	0.738
VAR00053	We will reform the system, promote the organic integration of scientific research and education, and accelerate the training of innovative personnel	0.734
VAR00037	Enhance the effectiveness of practical teaching innovation	0.731
VAR00039	Take the college system as an opportunity to reform the current training plan of innovative talents	0.730
VAR00018	We will innovate the evaluation mechanism of higher education	0.729
VAR00062	Improve students' personality	0.727

Variables	Statement	Factor Loading
VAR00066	Create an innovative spirit of the campus sports culture atmosphere	0.726

Table 5 Shows Components 1:Innovative process management of education (next)

Variables	Statement	Factor Loading
VAR00032	We will accelerate the training of innovative personnel, build an innovative country, and enhance our dynamic innovation capacity	0.723
VAR00046	The national strategy of improving the evaluation and supervision system of university collaborative innovation research	0.717
VAR00056	Optimize the formation process of innovative talent training policy in colleges and universities	0.714
VAR00027	We will improve the construction system of industry-university-research cooperative education in China	0.709
VAR00015	We will strengthen practical education	0.704
VAR00008	Improve teacher teaching	0.703
VAR00049	We will improve the evaluation index system for collaborative innovation	0.700
VAR00026	Establish an innovative talent training mechanism of industry-university-research cooperative education	0.698
VAR00068	The close combination of traditional values and the construction of innovative culture	0.692
VAR00023	Innovate the school-enterprise collaboration model	0.689
VAR00036	Build a college practice and experimental teaching team	0.684
VAR00033	Implement the "double-teacher" teaching mode	0.683
VAR00060	Form a good school spirit, style of study	0.679
VAR00063	We will promote the spirit of innovation and cultivate a sense of innovation	0.675
VAR00021	Establish the index system of innovative talent training ability in colleges and universities	0.674
VAR00031	Explore the students' personality potential	0.671
VAR00025	Construct the evaluation system of the innovation quality of college students	0.668
VAR00064	Explore and innovate the university culture construction	0.666
VAR00014	Reform teaching methods	0.657
VAR00017	We will promote the reform of the evaluation system for higher education	0.636
VAR00016	Expand the dimension of practical education	0.635

Variables	Statement	Factor Loading
VAR00032	We will accelerate the training of innovative personnel, build an innovative country, and enhance our dynamic innovation capacity	0.723
VAR00013	Traditional courses and teaching methods are combined with artificial intelligence to cultivate innovative talents	0.616
VAR00005	The content and method of constructing the innovative talent training mode in colleges and universities	0.467

Composition 1 is described by the 41 key variables. After rotating the axis, the variable factor load in the component is between 0.467 and 0.835 with a maximum eigenvalue of 35.701, which could explain 33.361% of the total variance and was found to be the highest priority compared to the variable variance of the other components, i. e., all 41 variables are the variables best combined to this component. The maximum factor load of the variable of "continuously promoting innovative personnel training and education policy" is 0.835. The minimum factor load of the variable of "the content and method of building the innovative talent training mode in universities" is 0.0.467, which the researchers named "the process management of innovative education"

Table 6 Shows Components 2:Internal management of innovative talent training

Variables	Statement	Factor Loading
VAR00051	Increase the investment in scientific research in institutions of higher learning	0.946
VAR00010	The integration of industry and science is an important way for the university to run system and reform the talent training mode	0.942
VAR00035	Innovative research-oriented teaching reform related measures	0.942
VAR00054	We will establish an effective policy support system	0.935
VAR00024	Build the evaluation index system of innovative education comprehensive ability	0.931
VAR00038	Talent training mode of "order-oriented" learning, diversified learning, innovative learning and international learning	0.929
VAR00059	Deepen the reform of professional teaching, implement and improve the talent training mode of "practical platform curriculum module"	0.929
VAR00019	Establish a scientific and perfect educational evaluation system	0.928
VAR00012	Expand the professional field and reconstruct the curriculum system	0.925
VAR00055	Build the benefit and responsibility mechanism of innovative talent training	0.925
VAR00045	To formulate and increase the project approval and support for interdisciplinary research projects	0.924

Table 6 Shows Components 2:Internal management of innovative talent training (next)

Variables	Statement	Factor Loading
VAR00007	We will improve the management of colleges and universities	0.924
VAR00022	Establish a collaborative innovation center in colleges and universities	0.921
VAR00011	An interdisciplinary curriculum teaching system with strong relevance	0.919
VAR00034	Innovative experimental teaching reform related measures	0.918
VAR00067	Build a university culture conducive to the cultivation of innovative talents	0.917
VAR00009	Improve the student evaluation	0.909
VAR00048	We will build a benefit distribution mechanism for collaborative innovation	0.906
VAR00006	Innovate the concept of education	0.897
VAR00004	Accelerate the cultivation of knowledge innovation	0.895
VAR00002	We will strengthen the development of innovation and entrepreneurship incubation platform bases	0.864

Composition 2 is described by the 21 key variables. After rotating the axis, the variable factor load in the component is between 0.864 and 0.946 with a maximum eigenvalue of 25.694, which explains 26.32% of the total variance and is found to be the highest priority compared to the variable variance of the other components, i. e., all 21 variables are the variables best combined to this component. The maximum factor load for the variable "increased input to scientific research in institutions of higher learning" was 0.946. The minimum factor load of the variable of "Strengthening the construction of innovation and entrepreneurship incubation platform base" is 0.864, which the researchers named as "internal management of innovative talent training"

Table 7 Shows Components 3： Innovate the innovative talent training mode in higher education

Variables	Statement	Factor Loading
VAR00003	To build a scientific and technological innovation system with local characteristics	0.570
VAR00029	Create a good atmosphere	0.542
VAR00001	Innovate talent training programs and models	0.456

Composition 3 is described by 3 key variables. After rotating the axis, the variable factor load in the component is between 0.456 and 0.570 with a maximum eigenvalue of 2.431, which explains 2.601% of the total variance and was found to be the highest priority compared to the variable variance of the other components, i. e., all 3 variables are the variables best combined to this component. The maximum factor load of the variable of "building a scientific and

technological innovation system with local characteristics" is 0.570. The minimum factor load of the variable of "innovative talent training program and mode" is 0.456, which the researchers named as "Innovative the innovative talent training mode in higher education"

Table 8 Shows Components 4： Improve students' innovation ability

Variables	Statement	Factor Loading
VAR00065	Take students as the center, attach importance to students' innovative thinking education	0.540
VAR00057	The establishment of the industry-university-research cooperation system	0.527
VAR00061	Promote the construction of material culture and spiritual culture	0.419

Composition 4 is described by 3 key variables. After rotating the axis, the variable factor load in the component is between 0.419 and 0.540 with a maximum eigenvalue of 2.013, which could explain 2.592% of the total variance and is found to be the highest priority compared to the variable variance of the other components, i. e., all 3 variables are the variables best combined to this component. The maximum factor load of the variable of "student-centered and emphasizing students' innovative thinking education" was 0.540. The minimum factor load of the "promoting material cultural and spiritual cultural construction" variable was 0.419, which the researchers named "to improve students' innovation ability"

3.Result of Focus group discussions

In conclusion, there were a total 14 optimization scheme guidelines: Consisted of in table 9.

Table 9 Shows the 14 optimization scheme guidelines

Item	Guidelines
1	Strengthen the quality control of innovative education
2	Strengthen the internal management system of the organization
3	Innovate the construction of the education management system
4	Innovation in the management of educational achievements
5	Strengthen the development of innovative teachers
6	Build a harmonious teacher-student relationship
7	Innovate the construction of the education evaluation system
8	Innovative curriculum
9	Innovate teaching methods
10	Innovate educational practice link, exercise students' scientific research ability
11	Innovate talent training programs and develop talents with professional characteristics

Table 9 Shows the 14 optimization scheme guidelines (next)

Item	Guidelines
12	Innovation consciousness and self-cultivation ability
13	Innovative knowledge application ability
14	Improve platforms for industry-university-research cooperation

Discussion

Discussion based on research objective:

The four components of the management mechanism of innovative talent training include the process management of innovative education, the internal management of innovative talent training, the innovation of innovative talent training mode in colleges and universities, and the improvement of students' innovation ability.

Component 1: Process management of innovative education

This study found that it is consistent with the theory or research of Yanfeng G.(2019), Guo Yanfeng found that China's scientific and technological competitiveness is constantly improving, but there are still many deficiencies compared with developed countries, the fundamental reason lies in the lack of innovation. How to train college students as skilled talents to adapt to the new era is a problem to solve. In addition, the results are consistent with those of Hongting X. (2019 and Juan L. (2019). In addition, the research found that in order to build a new model of cultivating innovative talents in universities, it should be improved from university management, teacher teaching, student evaluation and government support. Corresponding to the studies of Hui S. (2015), and Yidan P. (2017). However, Cao Aixia (2018) research found that to be applied colleges and universities innovation talents, we need the government policy support, need to have a higher level of professional ability fusion faculty team, need to have strong associated interdisciplinary course teaching system, need education institutions to education methods of innovation and improve the focus of this research, research field and research purpose is different from this study.

Component 2: Internal management of innovative talent training.

This study found that it is consistent with the theory or research of Hu Haishan, Linmin X. (2017) They found that with the in-depth implementation of economic globalization and innovation-driven development strategy, changing the concept of talent training, innovating the quality of talent training has become an important direction of higher education reform. In addition, the study results are consistent with those of Junge S. & Guozheng Z (2015).). In addition, through the study of Zhenzhen H. et al (2015), the performance evaluation index system of university collaborative innovation center with multi-dimensional scale and structure of collaborative innovation center, collaborative mechanism system, innovation environment and cultural atmosphere was constructed. Corresponding to the studies of Yaojun Y., & Hua L. (2016) .However, the research of Bin L. (2019).Weiming L& Chunyan L. (2015) and Xiaoxia L.(2020). Found that strengthen information sharing between universities and enterprises, rely on the talent pool and funds and experience, and increase support for the

reform of university education mode, and provide strong policy guarantee for the cultivation of college students' comprehensive quality, and the focus, research field and research purpose of this research are different from this study.

Component 3: Innovate the training mode of innovative talents in colleges and universities.

The results of this study are consistent with the theory or research of Bin H. (2019). Hu Bin found that synergy can seek the maximization of resource utility from the existing resource allocation and achieve the effect of 1 + 1> 2. Collaborative talent training mode its fundamental purpose is to integrate all resources, through colleges and universities, society, unit of choose and employ persons interests body synergy, eliminate information asymmetry between interest subjects, deepen cooperation, develop both have solid professional knowledge, and highly social adaptable talents, the scientific knowledge into productivity, to meet the differences in the interest demands. In addition, the study results are consistent with the study results of Weiming L. & Chunyan L. (2015). In addition, through the Weiming L& Chunyan L. (2015)research found that from the update education idea, set up reasonable professional, create a good atmosphere, rigid and soft hand management optimization teachers and mining students' personality potential six aspects, hope for colleges and universities innovation talent training mechanism practice research to provide effective opinions and Suggestions, corresponding to Jinping Z., Ziqing G. (2015). Yaguang Z. (2015). and Haijun W, et al (2019) research. However, Xiaowei Z.(2018).Found that it is of great significance to comprehensively improve the quality of higher education. At the middle level of analysis, comprehensively implement the innovation-driven development strategy, promote collaborative innovation, cultivate innovative talents, and promote open education is an important way for universities to enhance their comprehensive strength, and can provide strong support for universities to improve the quality of talent training.

Component 4: Improve students' innovation ability.

The results are consistent with the theory or research of Shi Yuhuan (2008), which believed that universities should change traditional ideas and advocate the spirit of innovation, and with the results of Jili P.(2011). and Chuan Y.(2014), as shown by Feng Wei F.(2015)It is found that the establishment and improvement of the evaluation system of innovative talents in universities is an important link and means for the training of innovative talents in universities, which corresponds to the research of Hou Lixia (2010). However, in the research of Zhifu C.(2021) it was found that the talent training system of "university-enterprise, industry-university-research cooperation and integration of innovation and entrepreneurship" was constructed. The focus, research area and purpose of this study are different from this study.

Recommendation

Recommendation for Policies Formulation

(1) Strengthen the management of innovative education process and strengthen elite education

(2) Strengthen the internal management of innovative talent training, and improve the work efficiency of innovative education

(3)Innovate the innovative talent training mode in colleges and universities

(4) Improve students' innovation ability

Recommendation for practical application

(1) Accelerate the innovation of concept and system, and continue to improve the quality of innovative talent training

(2) Build an efficient and innovative education model and effectively promote the development of innovative education

(3) Strengthen innovative practice and promote the rationalization and scientific development of innovative education

(4) Strengthen the cultivation of college students' innovation ability and improve the innovation education system

Recommendations for Further Research

(1) Improve the quality of innovative talents training, make rational use of innovative talents, and better serve the society.

(2) Further create a free and loose humanistic atmosphere for the development of innovative talents.

(3) Further promote the development of innovative talent training and management mechanism under Liaoning Province.

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