

Research on the Docking of Spatial Information Technology and Tourism Teaching Based on CDIO Concept

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Abstract: Based on the analysis of the subject background, current situation and talent demand of Tourism Management Undergraduate Education in China, this paper studies and analyzes the Undergraduate Tourism Education in XX Normal University Tourism College. It is found that the Undergraduate Tourism Education in Henan Normal University attaches great importance to theory but neglects practice and tourism geography and the setting of information technology courses. Under the guidance of CDIO engineering education concept, this paper constructs a classified training mode of step-type tourism talents and points out the core elements of the training mode, the main realization links of CDIO stage and the key direction of personnel training improvement; it constructs a three-factor talent training based on the promotion of students' spatial information technology transportation on both the level and the practical ability as well as the "321" teaching system aiming at cultivating compound tourism talents to meet the needs of the market and the industry with a view to reforming the training scheme of the college by improving the teaching methods and adjusting the teaching design. In the 40 years of the development of China's higher tourism education, great breakthroughs have been made in the number of tourism colleges and universities as well as in the number of students. However, problems such as the imbalance of theoretical and practical abilities, the low degree of professional recognition, the low employment rate of graduates in the industry and the low status of Tourism Colleges and universities have gradually emerged^[1]. CDIO emphasizes on ability cultivation and practical teaching. It has achieved remarkable results in the reform of Engineering teaching. It can also guide the teaching reform of tourism management specialty. The main purpose of this study is to analyze the current status of Undergraduate Tourism education, through a comparative analysis of XX Normal University Tourism College (hereinafter referred to as "our college" for short) Undergraduate Tourism education, to study the optimization of the training program of our college. Contrasting with the practice of CDIO education mode in engineering education reform, this paper explores the reform ways of talents training mode and teaching design under the concept of CDIO.

1. Review of Related Research

1.1. Related Concepts

CDIO (Conceive-Design-Implement-Operate) which is conceptual, design, realization, and operation is an engineering education model developed by four leading international universities, including the Royal Swiss Institute of Technology and the Massachusetts Institute of Technology. It contains 12 standards for capacity development, teaching implementation and monitoring^[2]. CDIO effectively alleviates the problems in the development of Engineering education, and promotes the optimization of engineering education and personnel training mode.

1.1.1. Current Research Abroad

CDIO is a new concept put forward by MIT in the early 21st century by using the "Engineering Problem Solving Paradigm". It is a breakthrough in the reform of Engineering education. Its syllabus V1 was formed in 2001 and the standard was designed and formed in 2004¹(Notes: ① Originates:

The CDIO™ INITIATIVE is an innovative educational framework for producing the next generation of engineers. Website: <http://www.cdio.org/>).

In 2001, Crawley published CDIO Document No. 1, which is the first comprehensive exposition of CDIO in the world. It systematically introduces the concept, connotation and objectives of CDIO, and explains its application in curriculum reform^[3]. In 2003, Bankel et al. outlined the CDIO syllabus and its creation process, and introduced in detail how to redesign it with input from industry, academia, etc^[4]. In 2009, Woollacott proposed to validate the CDIO syllabus for engineering education by engineering competence classification, and pointed out that more attention should be paid to product engineering environment^[5]. In 2017, Muoz et al. proposed to monitor compliance with CDIO standards by assessing students' proficiency and developed tools and mechanisms to accurately assess and monitor compliance^[6]; Quist et al. proposed a Chalmers course based on CDIO that combines engineering design methods with modern optimization theories to stimulate students' creativity to a greater extent^[7].

1.1.2. Domestic Research Status

CDIO education concept emphasizes the cultivation of students' comprehensive ability and emphasizes the organic combination of theoretical knowledge and practical skills. It can be used for reference to solve the problem of imbalance between theoretical knowledge and practical ability that exists universally in China's education. Shantou University is the first institute in China to introduce CDIO to carry out engineering education reform, and has creatively put forward the EIP-CDIO training mode which pays attention to professional quality^[8]. In 2008, seven key CDIO standards were introduced in detail, and the standards to be followed and the common mistakes in implementing the CDIO reform in China were pointed out^[9]. In 2009, Wang Shuoweng and others expounded the CDIO Competence Outline, summarized the reform ideas that CDIO provided for the cultivation of Applied Undergraduate Talents in China, and no longer confined CDIO to the reform of Engineering education^[10]. In 2013, Li Yan and others put forward the reform ideas and ways of foreign language professional ability training on the basis of CDIO^[11]. In 2016, Kang Quanli and others used visualization technology to analyze and summarize the research transformation and existing problems of CDIO education model in China^[12].

To sum up, the research on CDIO at home and abroad is mainly to reform the teaching system and personnel training mode of engineering specialty with the help of its concept, ability outline and standards. And based on this, new ideas have been put forward for the optimization and development of specific specialty. At the same time, domestic scholars discussed the impact of CDIO on China's education reform and development of the existing problems through adjustment and transformation to gradually improve and promote and began to try to reform the teaching of non-engineering majors.

2. Data Sources and Research Methods

2.1. Data Sources

The research data come from the education and training data and tourism data of the National Tourism Administration, the official websites of some colleges and universities, the national information inquiry system of colleges and universities, CNKI and the training program of our college.

2.2. Research Methods

2.2.1. Literature Research Method

Through sorting out the domestic and foreign scholars' research literature on CDIO, this paper expounds the connotation, development process and application of CDIO in the teaching reform of specific specialties and summarizes its introduction and development in China, and then illustrates its reference significance and value for the teaching reform of tourism management specialty.

2.2.2. Qualitative and Quantitative Analysis

Through the analysis of the National Tourism Colleges and Universities, the number of students in

schools and the situation of education and training, this paper points out the imbalance of supply and demand in China's higher tourism education at the present stage; analyzes the main courses offered by some colleges and universities, the departments subordinate to the tourism (department) specialty and the specialty-based disciplines, and summarizes the higher tourism education to provide the foundation for the teaching system optimization research. Through the analysis of the credit and time arrangement in our college, this paper sums up some problems in the personnel training of our college, such as unreasonable credits and periods distribution, single teaching method, neglecting the cultivation of students' practical ability and so on.

3. Result Analyses

3.1. Development of Higher Tourism Education in China

3.1.1. Development of Higher Tourism Education in China

According to the China Tourism Statistics Bulletin and Tourism Education and Training issued by the Personnel Department of the State Tourism Administration, the number of institutions of higher learning in tourism increased significantly. The number of institutions of higher learning in tourism increased significantly from 770 to 1690 from 2007 to the end of 2016, and the number of students increased from 3974,000 to 4404,000. But from 2010 to 2016, the number of school students showed a downward trend.

Table 1 Statistics of the number of higher tourism institutions and students 2007-2016

Year	Number of institutions	Increase	Number of students (10,000)	Increase
2007	770	1.04%	39.74	6.56%
2008	810	5.19%	44.01	10.74%
2009	852	5.19%	49.84	13.24%
2010	967	13.50%	59.61	19.61%
2011	1115	15.31%	59.98	0.62%
2012	1097	-1.61%	57.62	-3.93%
2013	959	-12.58%	49.44	-14.2 %
2014	1486	54.95%	43.52	-11.97%
2015	1518	2.15%	57.1	31.20 %
2016	1690	11.33%	44.04	-22.87%

In 2016, the total number of students majoring in tourism is about 4,404,000, the number of doctoral students is 1,403, the number of graduate students is 4,481, accounting for 1.3% of the total; the number of undergraduate students is 221,000, accounting for 50.18% of the total. According to the distribution of academic qualifications, the number of Undergraduates in higher tourism education accounts for a large proportion, which is the key stage of training tourism talents. But in fact, the current situation of Undergraduate Tourism Education in China is not optimistic, and there is a phenomenon of education shrinkage. Educational shrinkage refers to the phenomena of students' low acceptance of specialties, low employment rate in lifelong industries, and declining status of tourism colleges and universities^[1].

3.2. Tourism Undergraduate Education in China

3.2.1. Department of Tourism

According to the statistics of word frequencies on tourism, management, geography and other key words economy of 66 institutions with tourism management major of master's degree, the highest word frequencies are managed, followed by tourism (word frequencies are 28), but only 8 independent tourism colleges and departments are included. It can be seen that the number of colleges and universities setting up tourism departments alone is not large from the affiliated departments, which limits the development of tourism discipline.

Table 2 Word frequency tables of key words in departments of Tourism Department

Key Words	Management	Tourism	Economics	Geography	Commercial Science	History	Humanity	Programming	In Total
Frequency	29	28	12	6	6	6	3	2	92

3.2.2. Disciplines Relying on Tourism

The tourism specialty of more than 60 colleges and universities is summarized by the key words of management, geography, history and economics. Geography and management are the most frequently used words, followed by history and economics. From this we can see that the tourism discipline and management, geography, economics, history and other disciplines are more relevant. It also involves geology, architecture and other disciplines of science and engineering, as well as language disciplines.

Table 3 Statistics of word frequency of tourism discipline

Key Words	Geography	Management	Economic	History	Landscape、Forestry	Foreign Language	Geology
Frequency	17	17	15	11	3	3	3
Key Words	Architecture	Gastronomy	Transportation	Law and Commercial Science	Chinese	Food science and Engineering	
Frequency	2	1	1	1	1	1	

3.2.3. Curriculum Setting

The main courses of Tourism Specialty in 76 colleges and universities are classified into management, economics, information technology and statistical accounting. The results show that the main courses of tourism specialty are management and economics, accounting for about 43% of the total, followed by tourism planning, marketing and basic tourism and statistical accounting category.

The total number of statistical courses was 1917, of which 29 were geography courses, 49 were information technology courses, and 4% were both. This shows that geography and information technology courses have not been given enough attention. As far as curriculum is concerned, most colleges and universities have problems of less practical application.

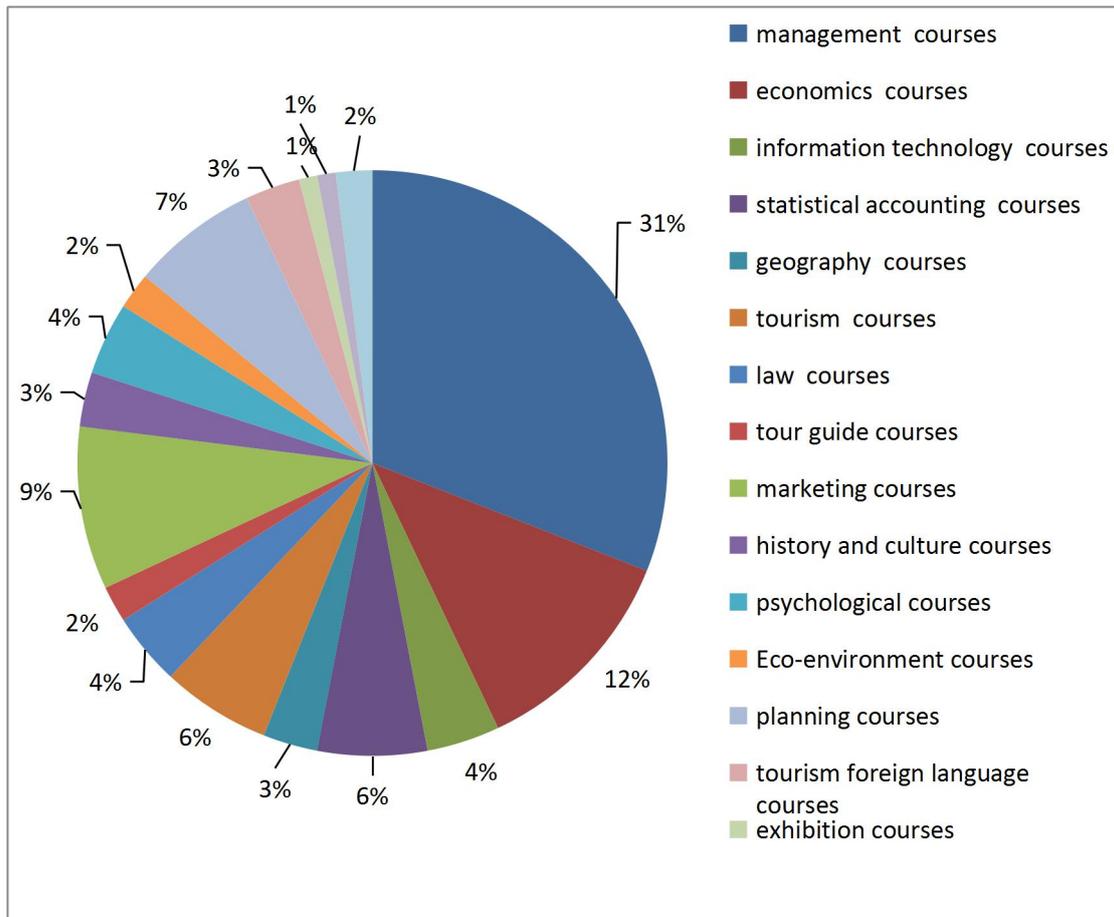


Chart 1 Analysis on the Main Courses in 74 Colleges and Universities

3.3. Basic Situation of Tourism Talents in China

3.3.1. Tourism Industry has a Large Demand for Tourism Talents

According to the data of tourism education and training released by the State Tourism Administration, the total number of employees training in the tourism industry in 2014 was 4.6213 million, which reached 4.754 million in 2015. The tourism industry with the largest number of employees training was tourism hotels, followed by travel agencies, tourist attractions and tourist vehicle companies. The largest number of employees are waiters and guides from the position distribution. From the basic situation of job training, we can see that there is a great demand for talents in the tourism industry, especially those who pay attention to service skills and practical ability.

Table 4 Basic training status of tourism employees 2014-2015

Application	2014Hotel	2015Hotel	2014Travel Agency	2015Travel Agency	2014Tourist Attraction	2015Tourist Attraction	2014Tour Vehicle Company	2015Tour Vehicle Company
General and Deputy Manager	5.78	4.8	6.02	5.4	2.91	2.4	0.599	0.6
Department Manager	16.95	14.2	10.15	10.9	6.27	5.7	1.24	1.2
Supervisor	32.78	29.8	---	---	---	---	---	---
Waiter	151.73	172	---	---	---	---	---	---
Guide	---	---	60.03	51.1	---	---	---	---
Commentator	---	---	---	---	11.81	11	---	---
Waiter	---	---	---	---	22.77	22.8	---	---
Chauffeur	---	---	---	---	---	---	7.16	7.8
In Total	282.58	272.3	96.18	91.2	63.83	58	11.52	12.2

3.3.2. Imbalance Between Supply and Demand of Tourism Talents

The unbalanced supply and demand of tourism talents is mainly reflected in two aspects, one is the unbalanced quantity of supply and demand, the other is the unbalanced technical ability of supply and demand. Through a preliminary analysis of the requirements of core posts in some tourism institutions, it can be found that there are not many posts corresponding to the "tourism management" major.

Typical positions set up by representative tourism planning companies emphasize a certain level of technical ability and practical ability requiring job seekers to have the corresponding software use ability, planning experience; professional requirements are mainly about regional planning, urban planning, tourism planning, landscape design and other related majors^[13]. At the same time, in the "13th Five-Year Plan for the Development of Tourism Talents" the development goal to upgrade the number of new products, new formats, new technology personnel, and to form a talent plateau in the key development areas and platforms was clearly put forward.

From the market demand point of view, the tourism management specialty with the management science as the main discipline background can no longer meet the diversified needs of tourism industry for tourism talents. It is urgent to adjust the training program according to the industry development trend and talent demands.

3.4. Tourism Undergraduate Education in Our College

3.4.1. Distribution of Credits

By comparing the course structure, total credits and total periods of tourism management major (undergraduate) in different professional directions, we can find that the emphasis of training programs in different professional directions is different. In terms of credit distribution, the credit distribution of different types of courses in Tourism Management (development and management direction) is not very different, and more attention is paid to the cultivation of students' basic ability. While tourism management (international bilingual direction) is more inclined to set up the basic courses of the specialty, emphasizing students' professional ability. Moreover, the proportion of general courses in both major directions is high, accounting for 27% of the total courses, while the proportion of basic courses in both major directions is 20% and 8% respectively, which is lower than the proportion of general courses.

Table 5 Credits and Periods schedule for Tourism Management (undergraduate) in Our College

Curriculum structure	Total credits				Total Periods			
	Development Direction		Bilingual direction		Development Direction		Bilingual direction	
	Credits	Rate	Credits	Rate	Instruction	Practice	Instruction	Practice
General knowledge course	43	27%	43	27%	716		716	
Basic courses	32	20%	12	8%	538	146	222	232
Professional basic courses	37	23%	57	35%	510		756	
Limited course	32	20%	32	20%	302	144	474	200
Optional courses	16	10%	16	10%				
In Total	160	100%	160	100%	2064	290	2168	432

3.4.2. Distribution of Periods

The result shows that the proportion of practical periods is too small when analyzing the distribution of periods of the two majors. The total periods of tourism management (development and management) major are 2354, of which 2064 are lecture periods, 290 are practice periods accounting for 12.3% of the total class hours; 2600 are tourism management (international bilingual direction) major, of which 2168 are lecture periods and 432 are practice periods accounting for 16.6%.

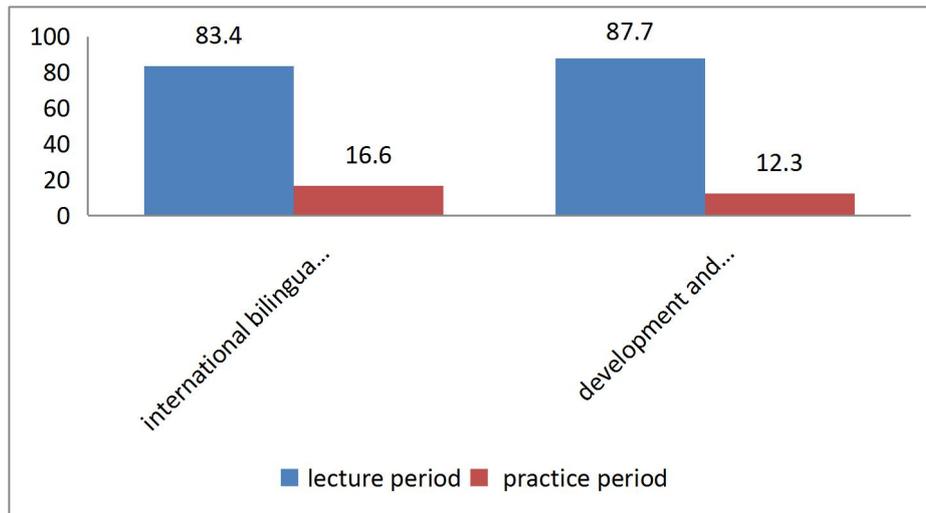


Chart 2 Proportion of Lecture and Practice Period

3.4.3. Situation of Students Engaged in Scientific Research Projects

The situation of the students engaged in scientific research projects in our college from 2014 to 2017 show that there are many theoretical research projects, and the degree of application of information technology is not high. Of the 63 statistical projects, only 4 projects are supported by spatial information technology. In the keyword search of the research object, the highest frequency of scenic spots is 11, followed by tourism impact, hotels, tourism and tourism market as well as tourism products. There are 17 research projects focusing on "Internet + tourism", smart tourism, rural tourism and global tourism which account for not too much. To sum up, it can be seen that students are not concerned about the new format of tourism and the ability to use information technology and professional knowledge to explore and solve practical problems needs to be further improved.

4. Research on the Docking of Spatial Information Technology and Tourism Teaching

4.1. Teaching Docking Views

4.1.1. The Training of Tourism Talents should be Guided by the Demand of Talents

The contradiction between the traditional "wide-caliber, thick-based" training mode of tourism talents and the professional requirements of the tourism industry, the contradiction between the stratification of talent demand and the homogenization of tourism education and the contradiction between the dual requirements of the industry for theory and experience and the lack of practice in undergraduate education make the degree of tourism management undergraduates identify with the industry and the employment rate are low, resulting in the disconnection between the supply and demand of tourism talents^[1]. In order to solve this problem, we should start from the market demand of tourism talents to adjust the training objectives of talents with demand-oriented and cultivate various types of professional talents.

Tourism talents can be divided into tourism administration personnel, tourism enterprise management personnel, tourism high-end technical personnel, tourism service personnel^[14]. The training orientation of tourism administrative personnel is to cultivate a group of leaders who have both tourism professional knowledge and administrative ability and can improve administrative efficiency. The training orientation of tourism enterprise management personnel is to train a group of excellent managers with international vision, innovative consciousness and ability, familiar with the domestic and foreign markets. The training orientation of service personnel in tourism enterprises is to train a group of high-quality service personnel with professional knowledge and service skills. Tourism high-end technical personnel include tourism scientific research, tourism planning, tourism development and design, tourism information and other personnel. Its training objective is to train a number of technical personnel with a certain level of technology. The talents can engage in

professional work and promote tourism technology innovation and industrial upgrading.

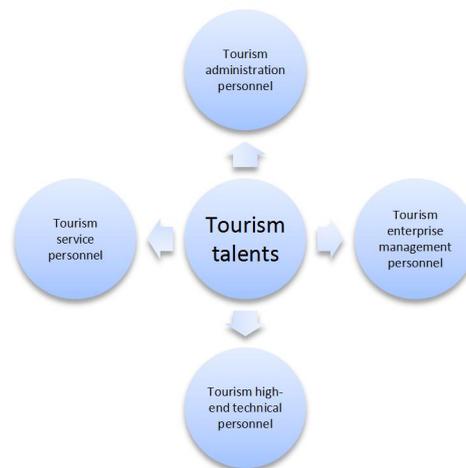


Chart 3 Classification of tourist talents

4.1.2. Strengthen Space Information Technology and Cultivate Information Technology Talents

Tourism informationization has promoted the development of tourism industry transformation, tourism product upgrading, tourism economic growth, tourism service upgrading and so on. However, China's tourism informationization construction and technology research and development personnel are very shortage. As an important talent training platform, colleges and universities should set up information technology related courses and practical links to promote students' knowledge and ability to synchronize, and cultivate information technology talents to promote the development of the industry.

Spatial information technology plays an important role in the further study of tourism resources development and regional planning, regional tourism competition and cooperation, tourism motivation and action, spatial structure evolution of tourism sites, tourism impact and other fields. Geography as the theoretical basis of spatial information technology in tourism research, including community tourism, festival tourism, heritage tourism and other emerging areas has a wealth of research results^[15]. Its research field is gradually expanding and research methods increasingly emphasize the combination of mathematical methods and spatial information technology.

Through the study of the main courses offered by other colleges and universities and the background of tourism, we can find that geography occupies a certain proportion in the courses, but the courses offered by tourism geography and spatial information technology in our college are relatively inadequate, which leads to the lack of students' basic knowledge of geography and the ability to use spatial information and technology to conduct relevant research. Therefore, the college should add geography courses and basic courses of information technology to encourage students to use spatial information technology to study tourism phenomenon.

4.1.3. Increase Practice Teaching Links and Pay Attention to the Improvement of Students' Innovative and Practical Ability

At present, many undergraduate colleges and universities attach importance to theoretical teaching and neglect practical skills training, while tourism enterprises need more applied technical personnel with professional knowledge and practical ability. This supply and demand dislocation results in low employment rate and professional identity of tourism graduates. In view of this phenomenon, the college should increase the practice teaching link appropriately to let the student use and consolidate the knowledge in the practice and enhance the technical level as well as the comprehensive ability.

On the contrary, Beijing Second Foreign Language Institute attaches great importance to the cultivation of students' practical ability, stressing the coordinated development of knowledge, ability and quality, featuring "practice + foreign language + internationalization" and taking the cultivation

of all-round development of high-quality tourism talents as the goal. In the course design, it highlights the setting of practical innovative education curriculum, including five categories of social practice, professional practice, the second classroom, graduation thesis, military training to fully exercise students' practical ability. The practice internationalization and social diversification and coordination of personnel training model has a certain value for undergraduate tourism education reform.

4.2. Optimization of Teaching System

CDIO is an educational concept which emphasizes the application of technology and practice as well as the cultivation of ability. It is of guiding significance to alleviate the problems of emphasizing theory over practice and neglecting skill training^[16]. Guided by the concept of CDIO, this study constructs a ladder-type tourism talents training model based on the classification of tourism talents, and points out the core elements of training, the main realization links of CDIO stage and the key direction of talent training. It also constructs the "321" teaching system based on the three essential factors of knowledge, ability and quality, focusing on improving the spatial information technology and innovative practical ability, aiming at cultivating compound tourism talents to meet the needs of the market and industry. It also has made certain explanations on the training objectives, teaching methods and teaching design.

4.2.1. Talent Training Mode of Ladder-type

The classified training mode of ladder-type tourism talents is based on "knowledge, ability and quality" as the core elements and talent demand as the guidance, aiming at training high-quality talents with professional knowledge and ability. The conceive stage is mainly realized by learning the basic courses, specialized courses and core courses. The main purpose of this stage is to enable students to construct a systematic professional knowledge system. The design stage is a targeted training on the basis of the conception stage. The main approaches are classroom practice, professional investigation, research practice and so on. This stage enables students to test the effect of theoretical learning in the specific process of tourism product design, which is helpful to cultivate the ability of learning design, knowledge application and innovation consciousness. Implement-Operate stage is mainly to cultivate students' practical ability, through social practice and professional practice so that students can achieve a balanced development of theoretical knowledge and practical ability in the actual practice process. Finally, in the process of graduation thesis creation or graduation design, students can summarize and reflect on the learning results so as to achieve the effects of improving the ability of the system. On the basis of summarizing the deficiencies of existing training programs and the current situation of talent demand, this model puts forward two major improvement directions: 1) to improve students' practical ability; 2) to enhance students' information technology level.

4.2.2. "321" Teaching System

"321" Teaching system is a teaching system with three core elements (knowledge, ability, quality), two key training points (improving practical ability, improving the level of spatial information technology), and one training goal (training compound tourism talents to meet the market demand) as the leading factors, aiming to cope with the optimization of the teaching system to deal with the shrinkage of tourism education at this stage.

For the tourism market and industry demand for talent stratification, the determining of the training objectives of talent should be guided by market and industry needs, so the training objectives under the teaching system are as follows: cultivate tourism management, technical and service personnel with professional knowledge and ability, high comprehensive quality, and ability to engage in management, planning, service and other work in different fields.

At the same time, the "321" teaching system emphasizes the improvement of teaching methods, replacing the traditional pure theory teaching methods with project-based or problem-based research teaching, case-based subject frontier teaching, production-learning-research integration of innovative teaching methods to provide students with a teaching environment that emphasizes both theory and

practice. Questions can be used to guide students to think to let students actively participate in the classroom so as to cultivate their innovative consciousness and practical ability.

"321" teaching system emphasizes that the curriculum design should be guided by the idea of "de-disciplines" to get close to the actual industry and industry, and pay attention to the relationship between the practicability of knowledge and knowledge, instead of taking the systematicness and integrity of disciplines as the leading ideology. It only pays attention to the systematic output of knowledge without paying attention to its application value, which leads to the ignorance of knowledge and repetition of knowledge and rigid content of learning. Therefore, we should lay stress on the arrangement of practical teaching so as to enhance the comprehensive ability and practical technology. The concrete practical teaching links include cognitive practice based on visiting and learning, classroom practice based on simulation practice, professional practice aimed at deepening the experience of tourism products, upgrading practical skills, and investigation and research as the main body. At the same time, in order to improve the students' level of spatial information technology, we should first add the basic courses of spatial information technology, and in the teaching process, case or project should be oriented so that students can use spatial information technology to study tourism phenomenon and solve practical problems in practice.

5. Conclusion and Deficiency

Through the analysis of the present situation of China's higher tourism education, the basic situation of tourism talents, the undergraduate education of tourism in China and the undergraduate education of tourism in our college, this paper finds that the undergraduate education of tourism is still facing the problem of education shrinkage, and finds out the main problems existing in the present personnel training mode of our college: first, the proportion of practical teaching is small; second, the lack of tourism geography curriculum; third, ignorance of the information technology curriculum. With the help of CDIO concept, this paper puts forward the training mode of ladder tourism talents and "321" teaching system, and explains the training objectives and the training emphasis in order to realize the docking of space information technology and tourism specialty through the optimization of teaching methods and teaching links.

The deficiency: Firstly, it is difficult to find out all the courses offered by more than 70 colleges and universities when statistics are made on the major courses offered by other colleges and universities. Therefore, the statistics of this study are based on the enrollment brochures provided by the National University information inquiry system. Some of the courses are listed in detail, some are simply introduced, and There will be some deviations in the statistical results. Secondly, when indexing the background of tourism management discipline, some colleges and universities have a low frequency of the discipline. In order to simplify the results, they are not listed, so the results are not comprehensive. Thirdly, because of the differences in the curriculum settings of the same specialty in different directions, this paper only puts forward the overall opinions on the reconstruction of the teaching system of the college, and does not make a detailed study of the specialties. Fourthly, when subdividing each link of CDIO, due to the differences between engineering and humanities and social sciences, the four links are not clearly divided.

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