

## **The Innovative Thinking and the Scientific Methodology of the Specialized Courses Teaching in Practice**

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### **Abstract**

Mr. Qian's Questions: "In recent years Chinese can't have grown as rapidly as it is not a college can follow innovative model of Science and technology to develop talent, no unique things, no best minds, this is a big problem. This article explores the application of university courses innovative ideas and the scientific method in the teaching, and it is put forward that if want to speak good specialized course, our professional teachers must have the very strong learning capability and all these express requests for innovating is based on endlessly study, then the innovative ideas is transmitted to the students. Researched the scientific methodology to construct knowledge system framework, we should do our utmost to Develop the students' innovation ability by making use of innovative ideas methods of system theory or information theory and cybernetics in teaching.

**Key words:** Scientific methodology; System theory; Information theory; Cybernetics; Innovation thinking method; Specialized course teaching

### **1. Introduction**

In 1991, the club of Rome pointed out in the first global revolution: the key of three methods to solve the problem is learning and teaching constantly, and emphasize the power of the human development in the future depend on the teachers. As a result, the fourth function of university---continuous innovation. University should shoulder the responsibility of guiding the human development and advised to the social development and progress. University courses are divided into basic courses and specialized courses. Furthermore, university teachers are also distinguished basic course and specialized course teacher. University teachers are both scientific and cultural heritage and the creator of scientific and culture. It's different between basic

course and specialized course; specialized course should keep up with the technological frontier. University of professional class teacher must have innovation ability, continuous innovation is the eternal pursuit of university teachers' professional development. At the same time teachers should convey the innovative ability to students, teach students, encourage and guide students to innovate.

## **2. A university professional class teacher how to do good professional class**

National education "twelfth five-year" project essentials for pointed out: "make people education as a basic requirement of education work". Based on the current university students as the center, the basic goal of university professional class should not be only satisfied with what he taught, students can successfully find a job in the future, but to enable students to learn the professional course through the university cultivate students' ability of independent thinking and innovative thinking, with this ability, no matter what to do in the future, they will have the achievements of innovation.

To do this, the university course teachers should have professional spirit, always put the teaching in the first place, to constantly update their ideas and knowledge, constantly to meet the needs of times development, always stand in the forefront of this discipline. At the same time, professional teacher should be able to offer as many courses as possible, not content with only a second lesson, within the scope of professional knowledge structure is mutually, hierarchical, each university course actually only covers the aspects of the professional, only the teachers, who put the teaching and students on the first place, can let oneself constantly issued a new lesson, grasp the development direction of this major comprehensively in the whole system.

Now, there is a tendency of lay particular stress on scientific research and does not pay attention to teaching in university, it is inseparable that higher education does not take the students as center. It must be heavy scientific research and light teaching. But they seldom realize that Confucius had thought researching without teaching as their biggest worry, university should be proud of cultivating excellent students, with outstanding students, university's fame and influence will be more and more naturally. And there must be a large number of professional dedication teachers, who grasp the subject knowledge structure from the depth and breadth, and with a high level of scientific methodology teaching skills, creative thinking method, should teach the students innovative.

### **2.1 University of specialized course teachers should have a strong ability to learn**

The effect of university professional class teacher lectures was the comprehensive effect of their own learning, quality and flow and increment. The learning ability of university teachers is to create a high level university. System of knowledge structure is not only the university teachers to carry out the teaching of basic conditions, and it is necessary for scientific research, innovation and development of knowledge. Scientific research practice also proved that scientific research is based on systematic knowledge structure, so only college specialized course teachers has a strong learning ability to master systematic knowledge structure, the ability to learn is a key part of the university teachers' professional quality. Although there may be difference on the

development of the different disciplines teachers and the way to optimize the knowledge structure, but overall, the continuous learning is very necessary for development of university teachers' and optimization the structure of knowledge.

## **2.2 Innovation on the basis of learning**

A specialized course teacher in university should have teaching academic and scientific research ability, social service ability of learning teachers, or creative thinking, innovation consciousness, being good at from self-reflection, school-based learning, action research, and constantly learning to improve their professional literacy education the conversation of the innovative talents. Innovation is only on the basis of the study.

There are original innovation, which efforts to get more scientific discovery and technological inventions. Integrated innovation, make all sorts of relevant technology of organic integration, to develop the market competitiveness of products and industries; Digestion, absorption and innovation, on the basic of the introduction of foreign advanced technology, actively promote digestion, absorption and re-innovation. Important trends in the development of contemporary science and technology is the discipline overlapping and fusion, it is to cultivate innovative talents, closely follow the pace of time concept, the spirit of innovation and encourage innovation loose environment, makes the United States to lead the world science and technology since 100.

Western (especially Germany) is a set of mechanisms to prevent errors especially emphasizes logical thinking, anticipation, reasoning, which is rather than the Oriental replacement parts, simple maintenance. Pay attention to the process in the west, the Orient focus on a result, which called "winners and losers". In the early 20th century, there is a question that why Germany can become the world science center. Excellent academic tradition, the guidance of philosophy, mathematical research lead, close combination of theory and experiment, activity of the academic thought, institute for the study of open flow, frequent academic exchanges and intense academic debate, cultivate talent of college major courses, is accepted. Its academic tradition dates back to the Humboldt in the early 19th century. Humboldt put forward the teaching and scientific research which should be unified, the university's mission is to spread knowledge, and to develop science, which should be emphasized, become scientific and academic centers. The purpose of university is to get pure and the highest form of science (including all the knowledge of the system).

In addition, the university teachers' continuing professional development cannot leave the high creativity. The main characterization of innovation is teachers make the necessary supplement and adjustment according to the change and development of internal and external environment, the education concept, teaching method, discipline knowledge. In brief, liberal arts of university teachers must have the science literacy, and to learn science class of university teachers must have the profound humanities cultivated manners, all kinds of knowledge should be penetrated each other and completed each other, then create.

Innovation of science and technology talents should have the following qualities:

(1) Aspire to the national goals identification for personal goals; Dare to doubt,

criticize the existing theory, method, patterns; Dare to surmount forefathers of scientific spirit. Respect facts, discover and compare the similarities and differences of international similar research and the lack of global vision.

(2) Have a certain level of humanistic quality, such as moral character (character and moral), willpower (tolerance mind share happiness and pain);

(3) Literature art accomplishment: writing and expression ability, image thinking ability, ability to communicate, stamina and endurance (cherish lonely, thoughts was able to fly alone).

(4) Dedication spirit (love science, fear of truth), organization, management ability, restraining, team spirit.

(5) Independent thinking, self-learning and obtain information skills.

(6) Mathematics, physics, chemistry, computer and professional necessary basis (such as oil and gas storage and transportation of fluid mechanics, mechanical, engineering, materials science knowledge, etc.).

(7) Experimental ability, comprehensive analysis, put forward the research idea.

(8) Strong professional English level: ability of academic oral and written communication; They can use English to participate in the discussion, to ask questions and to answer the questions, they can talk from the statement and comment on talk of others; They can carry out the work by English in the laboratory; They can read research literature independently, draw points at a rapid pace and give comprehensive analysis; They are able to use reference books skillfully, or use modern means of science and technology for study and research as reference documents; They can write the specification work reports, articles or academic paper; They can do scientific research combined with their own professional conduct, etc.

### **2.3 Transmute innovation thought to students**

Science and technology is the first productivity, national science and technology innovation system are forming. University has the foundation platform of science and technology such as instruments, data, documents, network, natural resources of science and technology, key laboratory, engineering laboratory, industrialization of scientific and technological achievements (high-tech zone, the university science park; engineering center, productivity promotion center) etc. Our country also vigorously develop science and technology project and talent support system such as the ministry of science and technology 973, 863, science and technology public relation, NSFC, the national science foundation for outstanding university course, outstanding innovation group; academy of sciences knowledge innovation project; the ministry of education Yangtze river scholars distinguished professor, innovation team development plan, new century excellent talents scheme; and science and technology projects and talent from different provinces.

The university is the main force of scientific and technological innovation. The purpose of the university take participate in the program for promote academic development, technological innovation and personnel training rather than obtain economic benefits.it may form strategic reserve of advanced and provide output talents and advanced idea for businesses as well as the technical innovation research project carried out according to businesses requires by scientific innovation. But at

present our country enterprises also independent innovation ability is weak, need to have innovation consciousness of college students into the enterprise. The present is the promotion of outstanding engineer plans, hundreds of doctoral backward enterprises, such is the elite training program.

As for normal college students, we can exploration innovation by master the scientific methodology. In the specialized course learning process, the professors who apply scientific methodology skillfully need to use it to organize training classes and build up the system of specialized courses for students can understand and grasp skilled professional knowledge by use the "three theory" basic method types, namely "Systems Theory" "Information Theory" and "Cybernetics" that developing ability to master new knowledge contact with social practice and independent innovation.

In December 2011, "The Professional Ethics Of Teachers Colleges" is sued by the Education Department are dedicated that teaches the wind is: not only should love the country and obey the law, but also the professional love lives. I believe that teaching is the most honorable job in the world. Generally speaking, the teachers should have a very conscious of never too old to learn. The characteristics of the university teachers occupation have determined that it is the spread of ideas. Not only do they need to be able to establish open knowledge system, the professional course teachers must also conduct exploratory learning that is essentially adapt to the constantly challenges in an new era of knowledge economy in order to construct an innovative country. Moreover, many influences help to fashion our students characters, such as thoughts, feelings, determination, personality and capability during the teaching process of professional courses by the guidance of scientific methodology. These actions are closely linked to the fate of the nation, social development and the national competitiveness in a world of globalization. What is more important than imparting knowledge is to cultivate the students to have patriotic ambitions, high aspirations, spirit of science, global visions, to master scientific learning methods, learn how to ponder, raise questions and cogitate how to solve the innovation problems.

### **3. Teaching practice of creative thinking method**

Let's take construction of oil and gas storage and transportation engineering for example, to explore the major teacher is that the professional course how to carry out innovative way of thinking under the direction of the application of scientific methodology and practice in teaching.

#### **3.1 The scientific methodology**

Learning to apply some basic philosophical methods: classification, synthesis, illustrate, contrast, metaphor, causal analysis, logic and reasoning, etc. Application of traditional research methods: deductive method, induction method, dialectics, materialist dialectics, positivism, and phenomenology, hermeneutics, etc. In the teaching of the use of specific construction examples (second from the line of west-east gas line 3 line 4 line five line, the C

China-Russia crude oil pipeline, oil and gas pipelines in Kazakhstan, Beijing ring products pipeline, the shield tunnel crossing the Yellow River, pipeline span

suspension bridge engineering, etc.) of the images and video. By teaching of basic skills (import skills, questioning skills, explaining skills, change skills, improved skills, presentation skills, blackboard writing skills, ending skills, classroom organization skill, etc.), if you believe everything you read, better not read. It is important that emphasis on students' thinking and learning methods.

### 3.2 Creative thinking method

The development of modern science and technology on the basis of the characteristics of highly integrated in high differentiation. On the one hand to the depth development, scientific research object is more and more focused and scientific classification is more and more sophisticated lead to new areas, new science, new professional produce continuously. On the other hand, science and technology is becoming more and more integrated and comprehensive influences upon every aspect of the subject. System theory, Cybernetics and Information theory is the integration of science and technology, this is one of major achievements of natural science that a comprehensive characteristics of transverse science that relate to the natural science and social in 1990s. Lifestyle and the thinking way that modern science and technology it is changing the development picture of scientific with unprecedented speed that it is expand the breadth and depth of the research question for scientific research provides a new method by its unique innovative ideas when realized substance was acquainted with new leap of various relationships from qualitative to quantitative in the human of cognitive history and greatly improved the ability of humans to know and change the world. Because the three theory have so special status of science in science transverse architecture that it hold irreplaceable important role in terms of enrich and develop philosophy of dialectical materialism, as well as promoting the development of science and technology and solving all the complex scientific, technical aspects, economic and social issues.

Information theory studies how to understand the information, and Cybernetics and Systems theory study how take advantage of information. Feedback control theory reveals how things linked to feedback for achieve effective control to the system.

### 3.3 Teaching practice

The "Construction of oil and gas storage and transportation engineering" have much in direct contact with "Engineering survey" "Metal technology" "Oil and gas gathering and transportation" "Depot design and management" "Pipeline process" "Pump and compressor" "Gas distribution" "Gas pipeline design and management" "Oil and gas storage and transportation professional English" "Transportation engineering optimization basis" "Tank and pipe strength design" "Principles and applications of metal corrosion" "Rock and soil mechanics and foundation engineering" "Computer graphics (Auto CAD )" and other 14 courses .Beside it is that the "VB program design" "Engineering drawing" "Introduction to Petroleum industry" "Oil science" and other four courses have some contact. With "Complex hydrodynamics" "Engineering fluid mechanics" "Mechanical design basis" "Engineering Thermodynamics" "Heat transfer" "Electrical and electronics and

technology base" and other six courses for the theoretical foundation.

To "Higher mathematics" "Probability theory" "Calculation" "Linear algebra" and other four courses for math tools. However, the courses of "Fundamentals of computer" and "Information retrieval and utilization" is taught yourself how to improvement and study of tools by yourself. The three courses contain "College physics" and "Basic chemistry" and "Physical chemistry" is the elementary lessons. The three courses of "Basic principles of Marxism" "Introduction to Mao-Deng" "Situation" and "Policies (news, current affairs)" is guided to the pattern and method of thinking. Total are 36 courses.

Also involve other knowledge systems, such as "Civil engineering" "Automation instrumentation" "Pipeline integrity management" "HSE management" "Marine oil" and many other courses.

In such a vast information systems of knowledge architecture must be applied innovative thinking of three theory by the system reveal that contact with grasp and exploit the information for achieve effective control to the system . If our want to learn " the oil and gas storage and transportation construction" of the system within 32 hours, the development of intensive construction program could not the details of specific in depth and various different construction techniques and equipment in the development history and future trends. Only guide students to grasp the breadth of long-distance pipelines of gas storage and transportation, station, equipment installation, process pipe network layout, use of equipment, construction procedures, construction plan, construction design and other construction of main contents (science methodology) to construct the framework of the construction knowledge to developing students self-learning ability. Arouse students' interest in learning for students enable to improve the construction of knowledge system in the future work and study. Guide students to discover new ideas and perspectives, methods as well as technologies and equipment in learning that always make use of innovative thinking to think or ask questions, invention and innovation needed to prepare for solve the problem in the future. Meanwhile, in the form of teaching jobs to complete a construction design reports to students enable to master the construction design programs in practice, exercise creative thinking ability .

Only specialized teachers have innovative ideas that Cybernetic, Systems theory, Information theory. On the whole, the teacher must be good at explain which making complicated subjects understandable adopt to scientific methodology to grasp disciplines from the depth, breadth and a certain height. It was crucial that a teacher to transmit wisdom impart knowledge and solve doubts, so that students understand and master the course content, and then they can establish and learn a scientific and innovative thinking, enhance innovation skills. Meanwhile, the students not only independent finish the report, but also inspired students of creativity and pioneering spirit.

## **Conclusion**

(1)After a strict academic training system, senior university teachers who have a solid theoretical foundation and strong enterprising consciousness can have a sharp

thinking angle and keep pace with the age. Taking scientific researches to promote teaching and regard them as the mark of high education factor is the development trend of high education. Teachers of university courses are not professional but Doctors and Masters who take scientific research as the guide thus lacking the systematic teaching methods. Once taking a training or more, they will surely master the teaching method, and thus greatly improve the teaching ability. Universities' organizing professional course teachers to learn the teaching methods systematically contribute to improving teacher's teaching ability quickly, saving their time of self-exploration teaching skills and accelerating cultivate first-class the faculty. However, the now adopted assessment expert evaluation system of high universities fails to fundamentally improve the ability of professional teachers. Pseudo experts just focus on picking up university teachers' dressing, entangling in the profession even they themselves do not understand and commenting on the field they don't familiar with. Say that major English in university is about how to learn English or about the English grammar? I think both are wrong. English major should be emphasized professional. It is only when you understand professional can you use professional English to discourse. English is only a tool what source of most are the courses and the well explanation of professional courses.

(2)The Professional Teachers can use that it needs to gradually accumulate in the long term development, feedback and assessment to your advantage can not be obtained in a short form by learning from it. So specialized teachers is essential to listen old teacher lectures, and listen to other people talk about multi-class, even Those listened as a teacher completely without nervous, this is purely learn from each other. So the accumulation of each semester, teaching ability is becoming stronger. People often says that "Among any three people walking, I will find something to learn for sure." it is this truth.

(3)Specialized course teachers' innovation ability is not only based their own efforts in the university, but also with the help of this platform, which university administrators to create, a healthy learning culture. Administrators should encourage teachers to learn together by creating learning opportunities, build learning sharing system, rely on continuous learning mechanism of school as a whole, so that teachers can detect the need of society and knowledge change quickly and effectively, enhance the endogenous driving force of the development of the university teachers, implement innovation. So administers should give teachers chance to communicate academic with the outside world, to widen teacher's sight and commanding. Annual conferences often waste a lot on travel play, I think we should give each teacher a chance to peer learning, and master training, let the our school expand the influence and popularity of the school. Thus, Chairman Xi Jinping comrades hard to practice strict economy, combat extravagance and waste, can really do a lot of practical work.

Above all, to teach university course well, except for the deep and wide professional knowledge structure, there is scientific methodology guidance. To improve university course innovation teaching level, teachers must be constantly study, research in teaching and practice application.

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