

## Cognitive Apprenticeship and Technology Undergraduate Education

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### Abstract

Technology undergraduate education as a new type of education in higher education system, has its inevitability, Its training of technical personnel plays an important role in the development of science and technology and economic society. Faced with the scarcity of skilled talents in our country, the current situation of the structural contradiction of the labor force, Explore the high level of technical undergraduate talent training With the current economic restructuring and upgrading of the industrial structure to adapt, should be the main content of the research of technology education, It is the theory and practice of the primary solution to the transformation and development of local universities. Talent training needs to be put into practice in the teaching mode. the article begins with the analysis of the essential connotation of the cognitive apprenticeship and Technology undergraduate education , find the coupling point between the two ,constructing the teaching model of cognitive apprenticeship, from two main aspects of the curriculum and teaching methods are described in this paper.

**Keywords:** Cognitive apprenticeship, Technology undergraduate education, Model of teaching

### Chapter1.Cognitive Apprenticeship

#### 1.1The definition of Cognitive Apprenticeship

Cognitive apprenticeship in the late 1980s early 1990s teaching paradigm from "teaching centers" to "learning center", produced by the study of cognitive learning situation to the next, learning environment design background transfer of a teaching philosophy, which was at that time in order to overcome the shortcomings of school education and put forward, while a combination of the latest achievements of cognitive science at the time, but also a reasonable extract the essence of traditional apprenticeship education is more advanced teaching ideas and teaching model. It is the traditional apprenticeship and improve existing schooling beyond, prompting the school to change lifelong education second educational revolution, the traditional apprenticeship education in core technologies and integrate existing schools to form a new teaching model can effectively develop students' higher-order thinking skills, that is required for expert practice thinking, problem solving and the ability to handle complex tasks. Cognitive apprenticeship is based on constructivist learning theory, fully integrated situational awareness and learning theory, Lev-Vygotsky's sociocultural-theory, theories of Dewey's pragmatism, Bruner's discovery learning theory, formed a new teaching ideas and teaching mode. It has the following characteristics: First, cognitive apprenticeship by students in real-life situations learned useful knowledge and skills to overcome common school education theory and practice Dual Separation phenomenon, specifically the abstract knowledge of the school curriculum has placed

meaning context; the second is cognitive apprenticeship is concerned with developing students' higher-order skills, not pay attention to the existing school education concepts and factual knowledge obtained. Higher-order reasoning skills of teachers in acquiring knowledge and application of knowledge to solve complex practical problems embodied cognitive and meta-cognitive strategies; third cognitive apprenticeship encourage students to control their own learning process, encouraging students to use Expert mode of thinking, to discover and solve problems; Fourth, cognitive apprenticeship allows students to participate in different activities in the complex cognitive task, by Panel in collaboration with teachers and interactive consultation companions, role-playing and other methods will be significantly outside the complex mental processes, to promote self-monitoring and self-correction meta-cognitive strategies development; Fifth, cognitive apprenticeship learning to encourage students to reflect, and to articulate common principles between different learning tasks, the purpose is to encourage students to gradually independently acquired knowledge and skills to migrate to new situations; Sixth requires expert to understand them in a meaningful task, analysis and problem solving mental processes used explicit, to facilitate students to observe, repeat the exercise and practice, so that students not only acquire the concepts and factual knowledge, while teachers obtain strategic knowledge that is tacit knowledge, this process experts and dual emphasis situated learning can help address the vulnerabilities of the skills and knowledge of education issues inert.

### **1.2 Cognitive Apprenticeship' fundamental factors**

Cognitive apprenticeship includes content, methods, sequence and social nature of the four basic elements, these four elements are organically combined, which are mutual support of an integrated body. "Content" is the knowledge of learning containing the domain knowledge and strategic knowledge. The domain knowledge is consist of concepts, facts, and procedural knowledge, the strategic knowledge refers to the experts to analyze and solve problems using domain knowledge methods and techniques. The methods and techniques contain heuristics strategy, control strategy and learning strategy. "Methods" are composed of modeling, guidance, construction and removal of scaffolding, clear expression, reflection, exploration. "Sequence" is to determine the order of learning activities. The Cognitive Apprenticeship believe three principles must be followed in learning activities complexity of the sequence of increasing, diversity and the he global skills should be considered before the three principles of local skills. "Sociality" refers to the social characteristics of the learning environment. The social nature mainly includes six aspects: situational learning, social intercourse, expert practice culture, internal motivation, cooperation and competition.

### **Chapter2. Technology Undergraduate Education**

Technology Undergraduate Education, simply means that the undergraduate level technical education, namely, technical undergraduate education on the type of education is part of higher technical education in the levels of education is part of undergraduate education. Professor Xia Jianguo vividly technical undergraduate education as a general higher education and vocational and technical education "cross-generation" in the level of education, technology and traditional undergraduate degree is the same "class" but there are "classes" do not, in the type of education, technical and vocational college is the same "class" but "class" difference, is a special type of higher education, will further improve the higher education system. Technical undergraduate



education on the one hand should reflect technical, application, higher vocational and technical education, it must also reflect the basic, academic, professional and undergraduate levels of education. With the rapid development of modern science and technology, industrial technology combines multi-disciplinary, multi-disciplinary integration of knowledge and skills, knowledge and technology deepening, technical undergraduate education must strengthen the technical expertise and comprehensive basis, focusing on basic, through perceptible. In general, technology is a type of higher education undergraduate education. A technique under the guidance of philosophy, in pursuit of technical rationality, principles and techniques to explore the nature of technology and ultimately achieve the purpose of changing the world, in the four-year undergraduate application for entry into the science and modern technology students in the field of employment and education, vocational technical disciplines to prepare for the application of courses (programs) and other forms of rational knowledge and technical activities as the main teaching content, teaching theoretical and technical training is a combination of teaching methods to the joint industry enterprises participate in school is characterized by a strong technology to develop the theoretical basis and practical skills and ability to serve the production, construction and management of the first line of senior technical personnel (technicians or engineers) as the main objective is to implement the technology basic education teacher training.

The logical starting point is a technical undergraduate education and technical education, which is the advanced stage of technological development of education, science and technology is the product of economic development and industrial restructuring and upgrading to the new era of high-level technical personnel needed. Professor Xia Jianguo Shanghai Electric Institute of Theory and Practice of Undergraduate Education has deep technical expertise in the research, development of our technical undergraduate education theoretical exploration. He believes that the development of technology undergraduate education is an important part of our modern high-level vocational education system is an important type of diversification of higher education, vocational and technical education is communication and as a general education an important bridge. Technology Undergraduate Education as an independent type of education and levels of education, compared with the traditional undergraduate education and technical college education has its own characteristics. Distinguishing traditional undergraduate education and undergraduate education is mainly reflected in the value orientation, training objectives, training methods, teachers, and students of different school system objects. As in values, traditional undergraduate education is essentially academic education, particularly science education, is a highly rational education, mainly to solve the "what" and "why" questions, emphasizing the systematic and complete theory of knowledge sex. Academic major value orientation of traditional undergraduate. The technical nature of undergraduate education in vocational education, mainly to solve the "what" and "how" questions, do not pursue the integrity of knowledge. Applications and technical value orientation are the main technical undergraduate education. Compared with college-level technical education, although both cultivate technical talent, but talent specifications and requirements differ significantly. Technical level technical personnel should have a more solid foundation of basic theory and professional theory, research and innovation have a strong technical and technological aspects of the comprehensive ability and resolve practical problems of production capacity even better, with strong technical and management technology systems support the ability to run.

In short, technical undergraduate education is to train senior technical personnel, to meet the urgent needs of the high-tech industry development, it needs to have a strong practical ability, there are sufficient theoretical knowledge and broad expertise, have some technical knowledge integration capabilities, strong technical skills and comprehensive analysis of the ability to solve complex technical problems, with basic and comprehensive quality and practical ability and comprehensive knowledge of the structure and other characteristics<sup>[2]</sup>

### **Chapter3.Cognitive apprenticeship teaching model: the coupling of cognitive apprenticeship and technical undergraduate education**

Technical talents is a kind of technological knowledge and technical application of a high degree of integration of the compound type talents, so the technical talents training, to emphasize teaching the theory of knowledge and technology, on the other hand to strengthen practice teaching of applied technology. Technical education teaching not only the pursuit of "knowledge", even the pursuit of "do" is "knowing" and "doing" the combination, which emphasizes the combination of theory and practice, but it is not a simple combination, but the theory of practice, practice in theory, the second is integrated. Technical knowledge of the theory of teaching is to lay a foundation for the practice of teaching, or say, theory of knowledge is used to understand and applied to the practical application of process technology. Therefore, the two must highly integrated, fragmented.

Technical undergraduate education should pay much more attention to technical application ability cultivation, and certain academic capacity in technology development and research of the culture, the traditional academic education and teaching theories and the vocational technical education teaching idea are difficult to meet the need both. The teaching model of cognitive apprenticeship has great advantages in the education and teaching of technical talents. The core features of technical talents are technical, and more technical knowledge is a kind of tacit knowledge or vague knowledge. The main performance of tacit knowledge in Vocational and technical education is the tacit knowledge based on individual skills, tacit knowledge based on organizational practice and tacit knowledge based on school culture. Which is directly related to the course teaching is based on the tacit knowledge of the individual skills, here is not only refers to the skills of the skills, more refers to the intellectual skills. For technical education at undergraduate level, mainly the study of intellectual skills, which determines the teaching is not only to have cognitive learning, more important is the cognitive learning brought to the real situation of practical work, technology, work and study integration, promote students to Mo will knowledge learning and understanding. Production of cognitive apprenticeship is a study of theory and practice organic fusion of the new teaching philosophy or teaching mode, the effective integration of academic education and vocational and technical education, or said to system integration of academic education and vocational and technical education on both sides of the advantages to become a can also used in academic and vocational courses teaching mode, should become the technology undergraduate education major teaching concept and teaching mode.

### **Chapter4.The technical undergraduate training: cognitive apprenticeship teaching model**

Teaching model of university is a university personnel training process of education teaching, including the theoretical basis of education personnel training,



personnel training target specification, curriculum personnel training, teaching philosophy and methods of personnel training, training of teaching management and evaluation, etc. Following on talents training curriculum and teaching methods are presented in this paper.

#### **4.1. Curriculum**

##### **4.1.1 Curriculum design concept**

Technology Undergraduate Education, as the development of a relatively short history, is still in a series of organizational stage. More inclusive approach should be taken to 'multiple integration' concept to the curriculum guide, analysis, design and implementation of the curriculum. "Multi integration curriculum view as the theoretical basis of technology undergraduate education curriculum design is not only by its own development status decision, and more high-tech development and economic and social development of the technical requirements and the current division of the "people-oriented" core values of education, etc. and necessary objective factors. With the trend of technology science, more and more to promote the intrinsic link between technology and science, the degree of interdependence is more and more high. Without scientific discovery, there would be no technical invention, no technical invention, science will be difficult to develop, and technology is increasingly dependent on science. This requires to multiple integration of curriculum view of instruction design, overcome the binary opposition of practice oriented curriculum and theoretical orientation of the curriculum, subject curriculum and activity curriculum, curriculum and other various curriculum form fusion to integrate and to carry out construction.

In addition, the fast changing of the social technology and the fast changing of the working world, it is decided that the one-time education has been unable to meet the knowledge and ability of a person's life development. Taking the course of "pluralistic integration" concept of modular design, personalized course, the technical theory and technical ability to infiltrate into the various types of courses, the students to meet the diverse needs, to cultivate the students with the ability to go "or" potential development ability is of great significance.

##### **4.1.2. The choice and organization of course content**

Different talent training goal determines different course content. The choice of technical undergraduate education course content has its own characteristics, and in the course content choice must pay attention to the following aspects: First, the professional orientation. Technical undergraduate education is essentially a kind of vocational education, which requires the course content need to make students obtain knowledge, ability and quality about employment. Second, it should embody the characteristics of knowledge structure that take the technical knowledge as the principal thing, to good deal with the relationship between scientific knowledge and technical knowledge, engineering knowledge and technology knowledge, tacit knowledge and implicit knowledge. Third, skill plays a dominant role. Technical undergraduate education is a competence-based education, thus the ability to obtain is the main indicator of success of the education, which requires adhere to the course content should be conducive to cultivate technical capacity and access to choice. Both theoretical courses and practice course have to strengthen the technical capacity oriented. Theoretical courses focus on developing intellectual skills, practical course in strengthening motor skills based on practical projects to support culture courses for intellectual skills and motor skills of

integration. Fourth, applicability and flexibility. Technical Undergraduate Curriculum Content Selection, on the one hand we must consider and analyze the six factors of influencing the development of technical education, such as students, social, academic, business, vocational, schools, and to maximize select the actual needs of the community production line technology, reflecting the applicability; On the other hand, according to the development requirements of socio-economic and high-technology, timely adjust and change the course content, the most cutting-edge technology into the theory most needed curriculum system to reflect flexibility, and take the most needed and most cutting-edge technological theory into the curriculum system, reflecting the flexibility.

Based on "multiple integration" curriculum, according to senior technical personnel training objectives and standards, technical undergraduate curriculum content organization must be combine a variety of modes, reflect the organizational philosophy of theory and practice, create a course organizational model of "discipline and project". This requires technical undergraduate education teachers to get rid of the influence of academic education law and professional habit of imparting subject knowledge in classroom, and also to improve the course organization of the technical undergraduate education, recognizing the importance of technology curriculum for students' technical application and innovation, combining the project and disciplines, it is the trend of curriculum content organization of technical undergraduate education.

In short, technology undergraduate education curriculum design should be taking the course of "pluralistic integration" concept, with the ability to double goal orientation and subjects and project oriented concept as guidance, to build a science and technology and comprehensive professional ability of two equal and parallel sub system, composed of unique technology undergraduate education curriculum structure of and reflect the technical, direction, practice, development, diverse educational technology to make every student successful.

#### **4.2. Teaching method**

Technical undergraduate talents cultivation is aimed at "field engineers", which requests the students to have the ability to combine theory with practice, a good practical ability and the ability to find problems and solve problems in practice. The traditional way of teaching dominated by theory teaching cannot meet the needs of technical undergraduate education. Practice should be the backbone of the teaching process, so that the students can experience the real situation of the future work practice as much as possible, form the ability to do the actual work and deepen the understanding of theory and application, and become a veritable "field engineers". Therefore, technical undergraduate education and teaching method should reflect the discipline knowledge and application ability, outstanding application and strengthen practical ability, and student diversity, etc. At present, there are many methods used in the teaching process of technical undergraduate education, such as case teaching method, project teaching method, situational simulation method and experimental teaching method and so on. This paper introduces a project driven teaching method as follows.

The project driven teaching method is a new teaching methods based on cognitive apprenticeship teaching ideas. Actually, teaching is driven by the project of the tutorial system, which may also be referred to as project driven teaching method of tutor system. Project driven teaching method mainly includes five elements: studio,



tutorial system training, project source and design, teaching form and teaching evaluation.

Studio is a versatile teaching place, where teachers can not only carry on the classroom theory teaching, but also can carry on the experiment, practice, practice and so on, and can set up a number of project teaching group. Tutorial system training refers to the students have "double guide", one is the school teacher, the other is the enterprise tutor. The former is more responsible for the theory teaching, the latter is responsible for the practice of teaching. Project source and design means that the project can come from the direct demand of the market, the tutor's scientific research topic, the classic course design or the student's project. But the project must have certain research value and need to be completed strictly according to the engineering technology development process standard. Teaching form is that focus on project study and carry out various forms to organize teaching activities, such as individual learning, group learning, group communication, classroom teaching, seminars, briefings and other forms. Assessment methods, including knowledge and ability assessment, not only highlight the students' understanding and application of knowledge, but also emphasize the assessment of comprehensive practical ability of students' project learning research.

The project is the driving force of Project driven Teaching. Teachers can create real workshops (learning situations) to give students guidance about research and development of projects, and to provide comprehensive, personalized guidance and help for the students through flexible and diverse forms of organization of teaching. At the same time, students can learn and understand in the real workshop through observation, imitation, participation, cooperation, interaction, reflection and other ways to gain and sublimate the professional knowledge and improve professional skills. The project driven teaching should not only impart the system theory and application of knowledge in development of projects, but also cultivate the student ability of comprehension and application of knowledge, innovation and development of engineering technology. It combines theory with practice as a whole. Exploring the cultivation of technical undergraduate talents is of great theoretical and practical significance for the transformation and development of newly established local colleges, the development of applied technical universities, and the cultivation of the applied talents. It will be able to effectively promote the reform of higher education in China and a profound change after the expansion of enrollment. It is to adapt to the categorized development of China's higher education system, effectively serve to the needs of economic and social development and the practical needs of the development of College Students. As well as, it is the inevitable choice to improve the competitiveness of local colleges and universities to achieve sustainable development.

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