On the Core Categories of Pedagogy

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Abstract: This article starts from the perspective of great education, lifetime suzhi education, (suzhi translates directly as quality) and puts forward nine core categories of pedagogy at three different levels. At the macro level, it locates the holistic perspectives including education, suzhi and development. The middle level focuses on the collective activities of pedagogy, basically including teaching, curriculum and examination. At the micro level, individuality of pedagogy is emphasized, covering learning, knowledge and thinking. Pedagogy is an independent subject and hence has core categories of its own. To discuss the meanings of each category, the author employs the scientific methodology of dialectics and systems, as well as puts forward specific methods for each of them. That other disciplines should be applied to pedagogy by no means implies the marginalization of pedagogy. Along with the development of pedagogy, the number of core categories may increase or decrease, meanwhile, the structures and meanings of the categories may change correspondingly. The selection of core categories is not the only option. Consequently, the theory of pedagogy cannot possibly be exclusive.

Keywords: pedagogy, core category

The educational theory system of socialism with Chinese characteristics should first determine its predominant features, core categories and fundamental principles. The theory system should be theory with consistent core categories and fundamental principles. The key concepts of theory are called categories. Theory should apply core categories to discussing principles, establishing new integral structures, and hence new integral functions spring up to realize

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educational innovation and better resolve various existing educational problems in China.

Whether core categories and fundamental principles are right should be verified by educational practice to judge the operability and capability of solving problems. Category formation, principle posing and problem solving are consistent. The category and principle failing to solve the problem are hollow and invalid. Suzhi education theory, all-around development theory and lifetime education theory proposed in modern times are related to each other and need to establish the core categories basically acknowledged by the public as well as construct fundamental principles to develop educational theory.

1. Attempt on the Research on Educational Theory with Chinese Characteristics

I have discussed the consistency of formation of category, problem solving and method generation.[1] The discussion of core categories is bound to discuss the related basic approaches and which problems can be solved. In other words, the research on core categories should implement problem solving. The research on core categories not only has theoretical significance but also has practical significance. The core categories of pedagogy are of great necessity to the construction of the educational theory system of socialism with Chinese characteristics.

In modern China, the life education of Tao Xingzhi and the civilian education of Yan Yangchu do not limit education to school education, but a perspective of great education. The people's education in the era of Mao Zedong and the suzhi education in the time of Deng Xiaoping aimed to improve the basic suzhi of Chinese people. In contemporary society, school education is the main body of education. The major core categories

researched in pedagogy are the core categories of school education. Pedagogy, in a broad sense, should cover family education, school education, social education and self-education.

Education is a subsystem of society and the culture of this subsystem is called subculture. Inevitably, the subculture of education is deeply influenced by the dominant culture of society; meanwhile, the subculture of education affects the dominant culture of society. As an organic part of the dominant culture of socialism with Chinese characteristics, the educational theory system of socialism with Chinese characteristics include suzhi education theory, all-around development theory, lifetime education theory, and more. These education theories are correlated with each other. Consequently, it is necessary to research the categories of pedagogy systematically to make intensive study of educational theory.

1.1 Theory of Suzhi Education

Suzhi education is a new key word in the educational theory system of socialism with Chinese characteristics. In Chinese, suzhi means inborn features and original nature. In May 1985, Deng Xiaoping first connected developing education with improving laborers' suzhi at the National Education Working Conference.

Deng said, "The national strength and economic development of China depend on laborers' suzhi, as well as increasing the quantity and quality of intellectuals. If China, with a population of one billion, improves education successfully, the tremendous advantage of humanity resources is incomparable. With talent advantage and an advanced socialist system, we're confident to realize our goals."[2]

Obviously, the suzhi of laborers proposed by Deng Xiaoping not only has inborn features but also acquired development. In the concept of suzhi of

laborers, the suzhi contains suzhi of individuals and suzhi of groups. For example, suzhi of the nation refers to suzhi of the group. Moreover, the suzhi of laborers means the holistic suzhi in a statistical sense, which reflects the holistic suzhi based on numerous individual qualities.

Overall suzhi is the structural integration and statistical average of individual suzhi. At the National Education Working Conference, Deng Xiaoping put forward that laborers' suzhi and the quantity and quality of intellectuals are the true origin of suzhi education proposed by China, which directly resulted in the long-term study of suzhi education by many educators and such study continues intensively. It has been 20 years since the proposal of suzhi education but the academic circle has not yet reached a basic consensus.

Some people connect suzhi education with examination oriented education and consider that suzhi education only aims to overcome examination oriented education. They raise the point that Chinese education should realize the transformation from examination oriented education to suzhi education. This understanding is called transformation theory which is narrow and limited.

Different from transformation theory, suzhi education has another interpretation, namely, identity theory which regards suzhi education as education for all-around development. Without new connotation, suzhi education that equals education for all-around development can be called identity theory.

At first, the author basically accepted the interpretation of identity theory. After research, however, the author thinks that complete identity is impossible. Humanity suzhi contains inborn suzhi, acquired suzhi, individual suzhi and group suzhi. The current education can only play a role in acquired suzhi. The research on inborn suzhi can avail teaching students in accordance with their aptitude. The concept of suzhi education is under evolution gradually and may turn to be a scientific concept. While humanity's inborn suzhi can be researched by analyzing DNA. In the meantime, group suzhi includes the scientific research of national suzhi, which has not been deeply studied in academic circles and the achievements are few. The theory of suzhi education needs to be researched intensively.

1.2 Theory of All-around Development

The proposal of scientific outlook on development greatly extends the concept of all-around development and puts forward promoting the all-around development of economic society and humanity. Only the lifetime suzhi education for all people can make education promote the all-around development of economic society and humanity. There are two kinds of all-around development here: First, all-around development of economic society; second, all-around development of humanity. Strictly speaking, there is a third kind, namely all-around development of ecological nature. All-around development of humanity depends on all-around development of economic society and all-around development of ecological nature. Similarly, all-around development of economic society and all-around development of ecological nature rely on all-around development of humanity.

The theory of all-around development is at a high level. It necessarily includes promoting the all-around development of ecological nature, economic society and humanity. The theory of all-around development in a broader sense has not yet been established. From the perspective of ancient Chinese, it should include the all-around development of heaven, earth and humanity. Therefore, the theory of all-around development of humanity is only an important part. In this sense, the theory of all-around development contains suzhi education and

hence inclusiveness theory emerges. I believe that the theory of all-around development covers suzhi education. Suzhi education should materialize and deepen the theory of all-around development.

It is necessary to expand, develop and innovate the theory of all-around development of humanity based on the research achievements of Marx. At present, I employ inclusiveness theory to understand suzhi education. Consequently, transformation theory is impossible. Identity theory neglects new contents. While, inclusiveness theory may make it possible for suzhi education to exist independently. This is a new interpretation.

Currently, the suzhi we know has broken through the original narrow meaning. With rich connotations, it contains not only inborn features but also the broad meaning of acquired development. Besides, it covers group suzhi as well as individual suzhi. Acquired development is also called suzhi. However, the suzhi of suzhi education interpreted by Chinese has no equivalent translation in English.

Suzhi education gives play to inborn features, improves acquired development as well as contains individual suzhi and group suzhi. It is a kind of education with these two meanings. The word suzhi we use currently has included the meaning of accomplishment. Therefore, I suggest we should express suzhi and suzhi education directly.

Suzhi education aims to improve humanity's suzhi, which includes four kinds of suzhi; ideological and ethical suzhi, cultural and scientific suzhi, work and skill suzhi, physical and psychological suzhi. It is a kind of description rather than a definition of suzhi education. According to formal logic, the definition of suzhi education cannot contain the word suzhi; otherwise it becomes a tautology. Based on the above description of suzhi education, it is the all-around development education in accordance with education policy. Suzhi education is related to all-around development education and lifetime education. Consequently, suzhi education can be defined as lifetime all-around development education for all. The paper also uses lifetime suzhi education for all.

1.3 Theory of Lifetime Education

The International Board of Education of the 21st Century submitted a report, *Learning: The Treasure Within* to UNESCO. The report put forward that lifetime education is based on four pillars; learning to know, learning to do, learning to live together and learning to be.[1] The four suzhi of humanity raised by Chinese is comprehensively corresponding to the four pillars of education raised internationally.

Suzhi education is internally linked with lifetime education. Learning to know corresponds to improving cultural and scientific suzhi, learning to do to improving laborers' suzhi and skill, learning to live together to improving physical and psychological suzhi, learning to be (it should be translated to be learning to be humanity) to improving ideological and ethical suzhi.

Why is lifetime education needed? Because school education cannot satisfy the needs of society. On the one hand, knowledge is updated faster and increasingly needs lifetime education. On the other hand, it has no terminal to enhance humanity's suzhi. Everyone needs continuing education and no one is ever too old to learn. Lifetime education view will lead to suzhi education. Similarly, suzhi

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[1] *Learning: The Treasure Within*, is a report submitted by International Board of Education of 21st Century to UNESCO, translated by Chinese Department of the headquarters of UNESCO, published by Educational Science Publishing House, 1996. It is on page 87. Some scholars suggest that learning to be should be translated to be learning to behave in Chinese. Researcher Zhou Nanzhao raised that the original meaning of to be here should be to be humanity, to be a complete man rather than to live or to exist. The four pillars of education are closely related and inseparable and the core is learning to be humanity.

education view is bound to bring about lifetime education.

At the World Conference on Education for All in Jomtien, Thailand in 1990, the United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Development Programme (UNDP), the United Nations International Children's Emergency Fund (UNICEF) and the World Bank put forward Education For All. The World Education Forum held by UNESCO in Dakar, the capital of Senegal, in April 2000 became the new milestone of education for all. The conference drew up the Dakar Framework for Action and passed six education goals, among which two goals were regarded as the millennium development goals in that year. The framework includes five aspects; quality education for all, ensuring basic skill for all, lifelong education for all, strong education for all and inclusive education for all. In short, education for all is considered as a subject term.

The predominant feature of the educational theory system of socialism with Chinese characteristics is lifetime education to improve suzhi for all or lifetime suzhi education for all. Rather than being limited to school education, it is great education. Once the great education view is defined, the categories of pedagogy will change correspondingly, so will the connotations of pedagogical categories.

In the core categories of pedagogy, some concerns are entirety at the macro level; some are related to group with a neutral view; some correspond to individuality with a micro view. To be simple and clear, these core categories can be divided into three types; holistic categories of pedagogy, including education, suzhi and development; collective categories of pedagogy, covering teaching, curriculum and examination; and individual categories of pedagogy, containing learning, knowledge and thinking. I try to employ the scientific methodology of dialectics and systems to discuss the meanings of each category and solve problems.

2. Holistic Categories of Pedagogy

At the macro level, the holistic categories of pedagogy include education, suzhi and development.

2.1 Education: Individual and Societal

From the analysis of dialectics, education should deal with the categories of individual and societal.

Education is a social activity to educate people. It is closely related to the development of society and humanity.[3] This simple definition contains the individual and society. Meanwhile, it connects education with development. Education is related to both the individual and society. In modern educational history, there was a long-term debate on the individual standard or social standard for education. Individual and society are opposite but unified. Teaching is a subset of education. According to pedagogy, teaching is educational. Therefore, this paper regards education as a holistic category, teaching as a collective category and learning as an individual category.

From the perspective of scientific outlook on development, there is no contradiction between individual and society. The improvement of humanity's suzhi is beneficial to social progress; the favorable development of society does good to individual development. Under the viewpoint of lifetime suzhi education for all, the dialectical relationship between individual and society can be settled preferably. To some nation's education under specific historical conditions, too much emphasis on the individual standard would result in extreme individualism. Then social standards should be emphasized to provide balance. When social standards are over-stressed and individual development is strangled, individual standards

should be emphasized to create a balance. This development in a wave-like manner will repeat in the new century. If either extreme condition is avoided, such development has a rationality of its own.[4]

Under a systematic and scientific analysis, education includes moral education, intellectual education, physical education and aesthetic education. Chinese education policy clearly put forward that we should insist on education serving socialist modernization construction, serving people; we should combine education with productive labor and social practice, nurture socialist builders and successors featuring all-around development in morality, intelligence, physique and art. Suzhi education is the education under the guidance of educational policy. Personally, suzhi covers all-around development in morality, intelligence, physique and art. Suzhi education is not unaccountable educational thought apart from educational policy. Deng Xiaoping has long since proposed that we should popularize the educational policy instead of limiting it in school education.

Within the framework of lifetime suzhi education for all, education aims to improve the lifelong suzhi for all. According to the integrity principle of system science, modern education has the following features.

Education emphasizes harmony: Health first, educating people with morals, developing intelligence, penetrating beauty appreciation and possessing systematic features.

Education pursues effectiveness: Assisting teachers and students to obtain great achievements with less time, possessing scientific nature.

Education needs to be motivated: Motivating education by examples, enlightening education by

problems and communication, possessing artistry.

Education requires action: Knowledge starting with practice, skill coming from training and wisdom originating from experience; possessing technicality.

There is no end for everyone to improve his suzhi. Education should accompany humanity for life, from antenatal training to ultimate concern. How is one like before the birth and after death? Everyone needs to answer the question. Confucius, the originator of Confucianism, avoided giving a clear answer by saying, "Even life is unknown, what about the afterlife?" [1] In ancient times, since science lagged far behind, Confucius answered it frankly. However, Taoism and Buddhism in China gave an unequivocal reply. We respect people's religious beliefs; meanwhile, we should make scientific and convincing explanations. Education should be for a lifetime.

Education is a social activity to cultivate people. Pedagogy is often considered to be part of the humanities and social sciences, with the nature of the humanities and social sciences. I consider that pedagogy should not be restricted to the scope of antenatal humanities and social sciences. For example, mathematical education, physical education, chemical education, biological education, geographical education, agricultural education, medical education and comprehensive scientific education, in terms of their contents and methods, are mainly thinking sciences, natural science and engineering science. So how can we simply attribute these subjects to the scope of the humanities and social sciences?

Starting from the perspective of system science, I have a new opinion on the attribute of pedagogy: Pedagogy belongs to integrated science, related

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① *The Analects of Confucius, Advanced Articles* No.11.

to thinking science, natural science, engineering science, the humanities and social science. Since educational methods and contents are varied and colorful, pedagogy pertains to integrated science. Therefore, pedagogy can never be regarded as simply a part of the humanities and social sciences.

Pedagogy belongs to integrated science and the curriculum and teaching of every subject needs to be researched and guided by classification. There exists limitations and drawbacks for guiding the curriculum reform of natural science by the methods of the humanities and social sciences, or, guiding the curriculum reform of the humanities and social sciences by the methods of natural science. Thus, if pedagogy is a first level discipline, then general curriculum theory, general teaching theory, subject curriculum theory and subject teaching theory should be second level disciplines.

As an integrated science with theoretical values and practical significance, pedagogy is the integration of science, philosophy, technology and art.

Pedagogy is science. From the perspective of educational contents, it belongs to the scope of generalized science. Generalized science includes thinking science, natural science, engineering science, the humanities, social science and integrated science. From the perspective of educational methods, the following scientific approaches should be employed; observation and experiment, induction and deduction, analysis and synthesis, quantitative and qualitative, and more. System science lays a modern scientific foundation for education.

Education is philosophy. Educational contents and methods are closely related to a world outlook, an outlook on life and values. Every teacher consciously and unconsciously penetrates a world outlook, and an outlook on life and values in teaching. Education has its own epistemology, theory of knowledge and methodology. Philosophy is the knowledge of a world outlook and needs to study epistemology, theory of knowledge and methodology. Philosophy is a discipline pertaining to nature, society, humanity, and its general rule is the development of thinking. Education is inevitable to connect with a world outlook, epistemology, theory of knowledge and methodology. Therefore, pedagogy is philosophy, which may seem to be a little difficult to understand, but evident.

Pedagogy is technology. Technology includes many intelligences. Technology in a narrow sense refers to products and artifacts invented by humanity as well as necessary knowledge systems. Technology in a broad sense covers products, knowledge, staff, organizations, rules, regulations and social structure. Internet technology and educational technology belong to technology in a broad sense. Undoubtedly, education has products and artifacts; teaching materials, teaching plans, courseware (mainly software), teaching aids and learning aids. Moreover, education also needs specific staff, organizations, rules, regulations and social structures. Education requires tools, from chalk and blackboards to complicated networks and multimedia. Since pedagogy is technology, this requires teachers to possess some professional skills.

Pedagogy is art. Since the publication of *Great Didactic* (1632) written by Comenius, pedagogy has been universally acknowledged as art. The basis of art is emotion and the philosophy of art is aesthetics. For the art of education, the emotional engagement of teachers and students is the foundation. Education requires the unity of the true, the good and the beautiful. Educational process combines logical thinking and image thinking. That education is art is the internal requirement of education. Pedagogy has scientific beauty as science, rational beauty as philosophy, technological beauty as technology and artistic beauty as art. Additionally, pedagogy has integrated beauty and unified beauty. The beauty appreciation and construction is internal.

As pedagogy is integrated science, we should realize the diversity, complexity and comprehensiveness of education when we are making educational reform. To summarize the experience and lessons of educational reform, we should raise questions positively and use concepts correctly. Besides, we should know restrictive principles and understand the diversity of education.[5]

2.2 Suzhi: Nature and Nurture

From the analysis of dialectics, suzhi should deal with the categories of nature and nurture. In the *Encyclopedia of China* and the *Encyclopedia of International Education*, there was no suzhi or suzhi education, which were newly raised by modern Chinese pedagogy.

Suzhi contains both inborn features and acquired development. Suzhi is a category related to structure. If the internal structure of humanity and its change can adapt to the development of nature, society and thinking, then suzhi is favorable with good functions.

The category of suzhi has a close relationship with the basic principle of pedagogy. In the history of education, Comenius put forward, in *Great Didactic*, that the basic principle of education is adapting to nature; later, Diesterweg added adapting to society in his *Guidance to Training Teachers in Germany*; Piaget actually raised adapting to thinking in *The Principles of Genetic Epistemology*. To enhance humanity's suzhi, education should follow the principle of adapting to nature, adapting to society and adapting to thinking. Adaption makes evolution and development possible.

The achievements of modern biology help us to gradually decode the genetic code of humanity; while the achievements of modern psychology assist us in closely understanding the micro-mechanism of human learning. We know that everyone's suzhi contains congenital factors as well as acquired

factors. The development of biotechnology in the 21st century is conducive for people to know humanity's congenital suzhi based on the genetic level. The improvement of humanity's congenital suzhi mainly depends on education, including family education, school education, social education and self-education. From a person's genes, physical examination and medical records, we can know his congenital suzhi; from the family background, education background and experience, we can learn his acquired suzhi.

The ideological and ethical suzhi of humanity includes congenital factors but gives first place to acquired factors, so does the cultural and scientific suzhi of humanity. The skill and suzhi of laborers, as well as physical and psychological suzhi of humanity contains congenital factors and acquired factors. Suzhi education is the education with differences and individuality. It needs to teach students in accordance with their aptitude instead of average development for everyone or making everyone receive the same education or imposing uniformity on everyone. It should stress harmony in diversity.

From the analysis of system science, suzhi includes knowledge, skill, emotion and communication. Suzhi education should be defined as the education insisting on scientific outlook on development. Suzhi education should be a lifetime all-around developmental education for all. School education cannot realize the goal of suzhi education independently. We need a lifetime education to comprehensively improve everyone's suzhi. Therefore, suzhi education must be a lifetime education.

Suzhi is a significant core category of the educational theory system of socialism with Chinese characteristics. Education is a big concept and suzhi education is a sub-concept. The warrior education in ancient times, the gentlemen education and elite education in modern times are not suzhi education.

The most distinct feature of suzhi education is that it requires people to change the pure utilitarianism toward educational goals in the past (considering winning promotion and getting rich, becoming famous and gaining profit as the goals), regarding the continuous improvement of different kinds of suzhi as the educational aims and realize lifelong learning.

The purpose view of suzhi education is beneficial to reflecting educational functions; promoting harmonious development of the individual, enhancing peaceful development of society as well as facilitating coordinated development of humanity and nature. On the surface, lifetime suzhi education denies the utilitarian educational aims in the past. In the long run, it can coordinate the contractions between individual standards and social standards, human development and nature development. Finally, education will realize the harmonious development of the individual, society and nature so as to obtain the maximum benefits for humanity.

Suzhi is not only a category of educational theory, but also a category of educational practice. Through the measurement of genes, the inborn features of individual suzhi can help people to know their advantages and disadvantages. At present, it can at least benefit the prevention and cure of genetic diseases in medicine. In education, it helps to carry out the teaching method of teaching students in accordance with their aptitude. There is still a gap from the practical application and great efforts should be made. However, genetic measurement has no use for talents with congenital advantages in art and sports. The acquired development of individual suzhi can employ investigation and statistics to realize concrete operations. We can see that the statistic rule finds invariance in change.

Starting from the middle of the 1980s, under the guidance of Deng Xiaoping's Theory, we systematically researched the suzhi of excellent teachers, students, principals and parents, then published *Research on Educational Talent Quality* in 1991. After more than ten years of investigation and research, we made new progress. The book, *20 Keys For Teachers* (2007),[6] provides 10 questionnaires about the suzhi of education talents for teachers. Questionnaire A is about suzhi investigation of excellent teachers. The basic method is shown as follows: There are 40 questions and asks students to choose ten. Then we make statistics and feed the results to related people for reflection and improvement.

Over ten years, the investigative samples covered more than 30,000 people. According to the results, over 50% of teachers and students chose the following items: (1) sense of responsibility, (2) emphasis on moral education, (3) sense of humor, (4) protecting the self-esteem of students, (5) treating students equally without discrimination, (6) vivid and intriguing teaching, (7) wide scope of knowledge, (8) bravely acknowledge errors, (9) organizing ability, (10) understanding the thought of modern students, (11) respecting and caring for students, (12) paying attention to cultivating students' abilities. In the 1980s, an American educator investigated 90,000 students and summarized 12 characters of excellent teachers: (1) patience, (2) virtue, (3) sense of humor, (4) respecting everyone in the class, (5) justice, (6) rich teaching methods, (7) broad interest, (8) flexibility, (9) paying close attention to individual, (10) tolerance, (11) friendly attitude, (12) nice appearance. Although the investigative results of different grades and classes in different places are varied, most students gave basically same descriptions about the suzhi of excellent students.

The above statistical results between Chinese students and American students are almost the same. I adjusted the placement on the lists so that

every content is basically corresponding, except one term: To Chinese students, nice appearance selected by American students is less important than paying attention to cultivating students' abilities. Obviously, nice appearance contains congenital factors as well as acquired factors. Teachers should take nice appearance into consideration. The above discussion shows that humanity's suzhi can be surveyed. Everyone can improve his own suzhi. Suzhi is concrete instead of abstract. Suzhi education is not a slogan but operable.

2.3 Development: Entirety and Individuality

From the analysis of dialectics, development should manage the categories of entirety and individuality.

The category of education is closely related to the development of society and humanity. Therefore, pedagogy should study the category of development.

In philosophy, economics, sociology, biology and other disciplines, development is a core category. To the theory of individual all-around development in pedagogy, development is bound to be a core category. It has a narrow sense and a generalized sense. In a narrow sense, development means individual development; in a broad sense, it refers to natural development, social development and individual development. Since development is related to nature, society and everyone, development should be regarded as a holistic category.

Development is a category pertaining to process. The process of growth, evolution, order and innovation is development. The individual all-around development theory of Marx is the key for us to understand development. Marx and Engels wrote that, "Only in the collective can the individual obtain methods to realize all-around development." That is to say, individual freedom only exists in the collective.[7]

In *The Communist Manifesto,* Marx and Engels wrote that the free development of everyone is the condition of free development for all.[8] The discussion is fairly profound. Economically, the world (China included) is under the transitional process from an industrial economy to a knowledge economy. Industrial economies give priority to material production, but neglect the development of humanity and regard humanity as a tool.

Based on criticizing humanity alienation caused by the industrial economy of capitalism, the all-around development theory of Marxism put forward that the communist society should aim at the all-around development of humanity. Suzhi education should be the education of all-around development. The main points of scientific outlook on development lie in development, people-oriented, comprehensive, balanced and sustainable and overall consideration. As for the scientific outlook on development, development is interpreted in a broad sense and includes natural development, social development and individual development.

Einstein emphasized that education should aim to cultivate people with harmonious development. It is related to his educational experience. Einstein spoke highly of the education he received in Switzerland and his thought was influenced by Pestalozzi (1746–1827), a famous Swiss educator. Pestalozzi said that education aims to develop all the gifted power and capacities of humanity. It should be all-around development, harmonious development and free development.[9]

Einstein believed that education should cultivate the educated to develop harmoniously, namely, not only learning professional knowledge, but also possessing morality, correct values and a strong sense of social responsibility. Besides, he also pointed out that schools should insist on the goal that the young can graduate from school as a harmonious person rather than an expert. In my opinion, technical schools, in a sense, should hold the same goal.[10]

Sustainable development is a significant connotation of development. Sustainable development can be explained as satisfying the development of contemporary society and people, as well as the development of descendant society and people. It also includes the following thought: Satisfying the development of this region and group, as well as the development of other regions and groups. Additionally, sustainable development means that the development of this period should benefit the development of the next period. Undoubtedly, this view covers the protection of the natural ecology and the protection of biological diversity.

Guiding students to maintain physical and mental health is the foundation of individual sustainable development, which is the key to implementing suzhi education. It also reflects the requirement that the scientific outlook on development takes development as its essence, putting people first as its core, comprehensive, balanced and sustainable development as its basic requirement, and overall consideration as its fundamental approach.[11]

The all-around development of society includes scientific development, harmonious development and peaceful development. We must implement the strategies for making China strong by developing science and education and training competent personnel and the strategy for pursuing sustainable development. We must step up efforts to create development models as well as institutions and mechanisms that facilitate development in a scientific way. We must continue to release and develop the productive forces and promote scientific, harmonious and peaceful development to lay a solid foundation for upholding and developing socialism with Chinese characteristics.[12] The all-around development of the individual is closely related to the all-around development of society. Without the all-around development of society, individuals cannot realize all-around development.

The all-around development of the individual is closely related to the all-around development of nature. Without the all-around development of nature, individuals cannot realize all-around development. Promoting ecological progress is a long-term task of vital importance to the people's wellbeing and China's future. Faced with increasing resource constraints, severe environmental pollution and a deteriorating ecosystem, we must raise our ecological awareness of the need to respect, accommodate and protect nature. We must give high priority to making ecological progress and incorporate it into all aspects and the whole process of advancing economic, political, cultural, and social progress, work hard to build a beautiful country, and achieve lasting and sustainable development of the Chinese nation.[13]

Modern China has new knowledge of the all-around development theory of Marxism: Only on the basis of the all-around development of society and nature can the all-around development of the individual be realized. Harmony in diversity is the common rule of development. Social development is full of features; natural ecological development is rich in diversities while individual development is characterized by peculiarities. Development should deal with the categories of entirety and individuality. All-around development is diversified instead of identical.

From the connotation of development, mass education and elite education are complementary. In school education, great differences exist between mass education and elite education, which are difficult to make balance. For example, it is quite different for students to study in Peking University, Tsinghua University and an ordinary local university. However, from the perspective of lifetime all-around development education for all, mass education and elite education are opposite as well as unified. In the science of personnel, child prodigy, middle-

aged success and great minds maturing slowly are common and acceptable.

Since China has implemented the three development strategies of invigorating the country through science and technology, strengthening the country through humanity resource development, and sustainable development, we should connect mass education with elite education. The performance in school education cannot be regarded as the sole judgment standard for the elite. Lifetime all-around development education for all provides an equal chance for everyone to be elite. In the system of lifetime all-around development education for all, the equality of educational opportunity offers bigger possibilities to everyone to be successful. Based on the three development strategies mentioned above, China gives wider space for the all-around development of the individual.

At the macro level, the three categories of integrity, education, suzhi and development are interrelated and interactional with inner links. The pedagogy in the past discussed education and development but failed to systematically analyze suzhi, let alone the dialectical relationships between education, suzhi and development.

The relationships between education, suzhi and development are like the relationships between structure, function and fluctuation in system science: The three have non-linear complicated relationships with definiteness and randomness. Structure and function are definitive while fluctuation is random.[14] Randomness is also called uncertainty. Similarly, education and suzhi are definitive; while development is random. Therefore, it reflects the complexity of education.

3. Groupment Categories of Pedagogy

At the middle level, the groupment categories of pedagogy include teaching, curriculum and examination.

3.1 Teaching: Subject and Object

From the analysis of dialectics, teaching should handle the categories of subject and object.

In the *Encyclopedia of China*, teaching means the common activities of teachers' teaching and students' learning. Under the goal-directed and planned guidance of teachers, students master the systematic basic knowledge of science and culture as well as basic skills, develop abilities, improve

constitution and form a certain morality.[15] Teaching is a kind of art and in close relationship with beauty appreciation and construction. Moreover, teaching is related to morality, intelligence, physique and aesthetics.

Teacher is the subject of teaching and student is the subject of learning. Individual has subjectivity. The development of subjectivity and individuality in humanity has become the common teaching objective. Generally, teaching contents and learning materials are defined as object. Under certain conditions, teachers and students can become objects mutually. Humanity learns from the interaction of subject and object. The result of human cognition is knowledge. Knowledge has both subjectivity and objectivity. In the teaching process, teachers should play a leading role and students should give play to initiative.

Diesterweg said that we should first consider the following factors that determine teaching activities: (1) teaching object, students – subject; (2) teaching discipline, teaching contents and learning materials – object; (3) the external social relations of time and place of students; (4) teachers.[16] According to dialectics, we know that teachers and students have subjectivity; meanwhile, under certain conditions, teachers and students can mutually become objects.

The common activities of teachers' teaching and students' learning are called teaching. It is a simple and clear definition of school teaching. In school, teaching activities are synchronous and jointly composed. Students learn in the teaching environment; teachers teach in the learning atmosphere. In school education, there is no teaching apart from learning and no learning without teaching. Some people suggested learning before teaching or teaching before learning. Obviously, the suggestion does not conform to the basic definition of teaching. The research of core categories of pedagogy can help people use concepts correctly.

Teaching and learning is mutually influenced and promoted. *Record of Learning* writes that the more a man learns, the more he sees his ignorance; the more he teaches, the more he knows his confusion. He makes introspection before seeing his ignorance. He becomes strong before knowing his confusion. Then we say that teaching and learning is mutually influenced and promoted.[①] Since teachers need to play a leading role in teaching, they should propagate doctrine, impart professional knowledge and solve doubts. Students should be initiative in teaching and need self-study, discussion, cooperation and exploration. They are not diametrically opposed but mutually tolerant. Some people said that teaching method should transform from teacher imparting to independent, cooperative and explorative methods by the student, which fails to catch the inner connotation of teaching.

From system science, the main methods of teaching include enlightenment, demonstration, empathy, discussion and cooperation. Teaching requires teachers to enlighten students with reason, guide students with action, motivate students with emotion, impart essence to students and integrate students with methods. For students, teaching should be thinking and acceptance, activity exploration, emotional experience, cooperation and exchange, as well as overall comprehension.

Teachers enlighten students with reason and students use thinking and acceptance, the cognitive pattern; teachers guide students with action and students take activity and exploration, the behavioral pattern; teachers motivate students with emotion and students have emotional experiences, the emotional

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① *Book of Rites·Record of Learning.*

pattern; teachers impart essence to students and students take cooperation and exchange, the group pattern; teachers integrate students with methods and students realize overall comprehension, the integrated pattern. The five teaching models mentioned above can make combinations by any two, then a 5×5 matrix can be obtained and 25 kinds of teaching models are realized. Teaching models are varied and every model has its own application conditions and limitations. Therefore, we should understand and employ teaching models dialectically and systematically.[17]

Confucius advocated heuristic teaching. He said that teachers will not explain knowledge unless students are desperately anxious and determined to learn.[①] This covers the essence of heuristic teaching. Teachers raise questions or select questions from students' doubts, then ask students to think over the questions. Students should reach the condition where they seem to know but fail to catch the aim and express the reasons clearly[②] so that they are desperately anxious and determined to learn. Finally, teachers re-analyze and solve the questions, explain reasons to students so that students can master knowledge. In school class teaching, teaching and learning are synchronous and inseparable. Teachers should guide students to feel desperate for learning to realize heuristic teaching.

I published a paper, *Education Model Construction of Enlightenment–Innovation*, to discuss the profound inner link between enlightenment and innovation. The common point of enlightenment and innovation lies in feeling desperately anxious and determined to learn. Teaching aims to impart the known knowledge. Teachers should master the time to guide students to feel desperately anxious and

determined to learn, which is difficult to do.

Historically, the teaching models of Confucius and Plato basically belong to the dialogue pattern. The teaching models of Comenius, Herbart and Kairov belong to the teaching and practicing pattern. The education patterns of Dewey and Cai Yuanpei belong to the self-study pattern. The teaching model of Tao Xingzhi and cooperative pedagogy of the Soviet Union belong to the cooperative pattern and that of Zhu Xi and Qian Xuesen belong to the research-based pattern. These teaching models are not extremely antagonistic but complementary, coherent and unified.

In *Thought and Language*, Vygotsky (1896–1934) put forward the concept of the zone of proximal development.[18] He emphasized the leading character of teaching in development and discussed that the key to teaching did not lie in strengthening inner mental functions through training but in motivating to form the nonexistent mental functions. Vygotsky believed that good teaching should go ahead of development. He proposed that transcendence should be realized based on adaption.

In teaching theory, teaching principles include the principle of working within one's capability, the principle of acceptability, as well as the principle of high speed and the principle of high challenge. The first two principles indicate that teaching should be adaptive; the last two principles show that teaching should have transcendence. Adaption and transcendence have a dialectical relationship in the unity of opposites. Negative adaption leads to low efficiency; positive adaption creates high efficiency. Positive adaption requires transcendence.

From the perspective of lifetime education, teachers play a leading role in school education but

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① *The Analects of Confucius・Shu´er.*
② Zhu Xi, *The Analects of Confucius Variorums*, Vol.4:He who is seem to know but fails to catch the aim and express reasons clearly is desperately anxious and determined to learn.

the initiative of students should be emphasized. In non-school education, learners play a dominant role, but teachers in a broad sense are indispensable. The organic combination and good performance of teachers' dominance and learners' initiative is the key to improving teaching efficiency.

In the system of lifetime suzhi education for all, the connotation of teaching is greatly expanded. Economically, the development model has turned to an intensive pattern from an extensive pattern. Extensive pattern means expanding the economy mainly through capital and labor rather than through technological progress; intensive pattern refers to relying on improving workers' suzhi and technological progress to grow the economy. Correspondingly, the development model of teaching should change from an extensive pattern to an intensive pattern, that is, we should realize effective teaching by relying on the subjectivity and scientific methods of teachers and students instead of consumption of labor and time.

3.2 Curriculum: Design and Implementation

From the analysis of dialectics, curriculum should handle the categories of design and implementation.

In *Basic Principles of Curriculum and Instruction* written by Ralph Tyler, chapter one discusses what educational objectives school should reach; chapter two tells how to select the learning experience that may help to achieve the objectives; chapter three is about how to organize the learning experience for effective teaching; chapter four describes how to evaluate the effectiveness of the learning experience.[19] The first two chapters describe the design of curriculum and the last two chapters pertain to the implementation of curriculum.

Curriculum refers to the contents and progress of lessons, which includes both the logical structure of discipline and the implementation progress of

teaching. Curriculum is closely related to teaching and both have strong mutual effects. Curriculum design influences its implementation and curriculum is judged by teaching evaluation. The design and implementation of curriculum should combine top-down and bottom-up patterns. According to the feedback of teachers and students in curriculum implementation, curriculum and teaching materials should be revised in time every five years.

Teaching is defined as the common activities of teachers' teaching and students' learning. Teachers and students are the subjects of teaching. Therefore, teaching should manage the categories of subject and object. Curriculum is defined as the content and progress of lessons. Curriculum is the object: Teaching discipline, teaching contents and learning materials. Curriculum should deal with the categories of design and implementation.

Teaching theory is connected to curriculum theory. However, from the definitions of these two core categories, their research objects are obviously varied. Consequently, teaching theory covering curriculum theory is called great teaching theory; while curriculum theory covering teaching theory is called great curriculum theory – both great theories go against against logic. In mathematical linguistics, teaching theory and curriculum theory are mixed. But they have no common relationships. People engaged in curriculum construction and people engaged in specific teaching belong to two different groups.

In school education, the contents of discipline curriculum cover science of thinking (linguistics, mathematics, logistics, and such), natural science (physics, chemistry, biology, and others.), humanities (music, art, literature), social science (politics, economics, sociology, law) and integrated science (philosophy, history, geography, education, psychology).

In school, different curriculums have quite varied learning features. The learning feature of

natural science is experiment and exploration, understanding issues; the learning feature of literature is carefully reading the classics, writing and lecturing. The learning feature of social science is investigation and discussion, researching issues. The learning feature of technological science is designing plans, making operational tests. The learning feature of art is imitation and appreciation, appreciation of beauty and construction. From the above examples, we can know that the learning methods of the literature and art curriculum are different from those of the science and technology curriculum.

The design of curriculum, especially top-level design should be scientific, reasonable, logical and practical. In the eighth curriculum reform in 2001, experts identified knowledge and skill, course and method, emotional attitude and values as three-dimensional targets. But please note that the *Outline of Elementary Education Curriculum Reform (Trial)* issued by the Ministry of Education on June 8, 2001, after approval of the State Council (hereinafter referred to as the Outline), does not cover the three-dimensional target! Consequentially, it is unscientific to consider the three-dimensional target as the general objective for curriculum design.

What is dimension? In the *Modern Chinese Dictionary*, it means the basic concept of geometry and space theory. Every element (such as length, width and height) consisting of space is called one dimension. For example, a straight line is one-dimensional; a plane is two-dimensional and common space is three-dimensional. Junior high school students known one dimension is one element. If one dimension contains multiple elements, it will inevitably lead to a logical mess. Besides, the *Encyclopedia of China* has a scientific definition of dimension.

Just as teaching is a subset of education, curriculum is also a subset of education. Teaching is

instructive, so is curriculum. The general objective for curriculum can only be an educational objective which should be the all-around development objective of moral, intellectual, physical and aesthetic education. Obviously, the design that defines the three-dimensional target as the general objective for curriculum has a one-sidedness, which neglects physical and aesthetic education and misunderstands the concept.

In *Taxonomy of Educational Objectives*, Bloom divided educational objectives into cognition, emotion, and motor skill. This classification can be regarded as three dimensions, for every dimension is a single element with obvious distinction. Although the classification is logical, it is one-sided.

In the three-dimensional target advocated by the ten-year curriculum reform, every dimension is not a single element but contains two, even three elements. Every dimension is not independent but mutually contained. Since the inner logic of the new curriculum reform design is not coherent, its implementation is beset with difficulties and lacks verification by external experience. One dimension includes multiple elements and three dimensions with inaccurate basic conception are overlapped and logically disorganized.

In teaching theory, knowledge and skill are researched as two dimensions. It is by no means innovative to define knowledge and skill as one dimension. Knowledge emphasizes logic and skill stresses operability. Besides, differences exist in the evaluation methods of knowledge and skill. For example, learning hydromechanics and learning swimming are entirely different. Knowledge and skill include process and method. If we define progress and method as an independent dimension, it will repeat and inevitably miss curriculum objectives and teaching objectives.

The curriculum reform implemented in 2001 identified the three-dimensional target as the general

objective for all discipline curriculums. It requires the curriculum standards and textbook compilation of every discipline to reflect the three-dimensional target. The three-dimensional target becomes a unified curriculum objective. Later, teachers are required to implement the three-dimensional target in every lesson. The three-dimensional target becomes the teaching objective of a great leap forward. This curriculum reform with confusing concepts will inevitably bring difficulty to basic education.[20]

The design and implementation of different curriculums have different methods. From the analysis of system science, curriculum can be divided into standard curriculum and non-standard curriculum. Standard curriculum includes required courses and selective courses; non-standard curriculum includes formal courses and informal courses. Formal courses contain activity courses and special courses; informal courses mainly refer to potential courses. Informal courses can be divided into normal courses and non-normal courses. Normal courses include life courses (such as watching TV, or traveling); non-normal courses mean random courses (such as firefighting or fighting natural disasters).[21] The curriculum classification mentioned above is suitable for lifetime suzhi education for all. We should interpret curriculum in a broad sense.

3.3 Examination: Formation and Selection

From the analysis of dialectics, examination should deal with the categories of formation and selection.

Examination aims to check and evaluate a person's suzhi in some aspect by employing some methods of assessment. There are two main functions of examination: first, to check whether students reach teaching objectives; second, to select talents. Through examination, selection can be realized in formation and formation is achieved in selection. Formation and selection should not be regarded as diametrically opposed. They are unified as well as differential.

From the analysis of system science, the contents of examination include examinations of knowledge, skill, art and communication. At present, the college entrance examination emphasizes a knowledge examination to select the students with academic ability. Such an examination system has huge limitations. In the future, the reform of the examination system should not only benefit the selection of academic talents, but also promote the selection of skill-oriented talents, art-oriented talents, service-oriented talents, management-oriented talents, and others. According to their hobbies and specialties, students can take different examinations rather than being limited in the single-plank bridge of academic talents. The examination system should set up an overpass suitable for the selection of different talents.

The feedback principle of system science shows that only by information feedback can a system realize effective control to achieve expected goals. As an effective feedback form, examination facilitates teachers and students to make introspection so that teaching efficiency and teaching quality can be enhanced. In the examination of school education, the biggest disadvantage is that teachers always play an active role while students are in a passive position. This has led to many negative results. We should research and implement the examination through which students can show their learning achievements initiatively. Improving the examination is a favorable method. In school education, there are three ways of examination: teachers checking students, students checking themselves and students checking students. These three ways may be the choice of examination reform and should be taken alternatively.

In China, examination oriented education has

become an entirely negative word. All practices against education rules, such as working overtime, making up lessons during vacation, over weighted load of study, mechanical memorizing, cheating on exams, fraudulent behavior, damage to health and vicious competition, are attributed to examination oriented education. All practices against education rules do harm to the health of teachers and students, fail to satisfy people and fail to win the support of the government. Therefore, we should firmly oppose examination oriented education. No teacher is willing to support this education. Someone defined examination oriented education as high enrolment rate. It is impractical to consider Chinese education as examination oriented education.

The features of the college entrance examination are equal chance, treating every student equally without discrimination and emphasizing justice. It is a democratic system. The examination test is decided by knowledgeable experts, college teachers and middle school teachers. The credibility, validity, difficulty and discrimination of every question should be studied. The current college entrance examination system in China is fair and efficient, and can select talents in a short time. The college entrance examination is a good system. At present, there is no talent selection system better than the college entrance examination. During the "Great Cultural Revolution" lasting ten years, China canceled the examination, which led to painful lessons. Maybe not everyone is in favor of the college entrance examination, but it is conductive to the nation and people.

Teaching according to education rules and improving students' examination ability obviously does not conflict with suzhi education. But under the transformation stress of examination education, many principals and teachers believe that it can only be done rather than said. Nowadays, students cannot leave the examination. The examination is essential for entering a higher school, applying for a job, as well as selecting civil servants, teachers and administrators. The examination is needed in China and foreign countries. Can you be close to life if you fail in the examination? Can you be geared to international standards if you fail in the examination?[22]

Certainly, we cannot be besotted with examinations. Although the examination system benefits talent selection, it may not be conducive to innovation. I believe that if you don't aim at the examination, your creativity may develop better. Consequently, selective examinations should not dominate our lives. The examination system, which is not the disadvantage of examination, is a kind of democratic system in nature. Malpractice in the examination should be guided by rule of virtue and governed by rule of law.

From the cultivation of the innovative elitist, two kinds of persons should be awarded doctorate. First, he who is eligible of master's degree by examination passes his doctoral dissertation after finishing specific courses and obtains a doctorate. It is called curriculum doctor. Second, he doesn't need to pass the postgraduate qualifying examination or finish courses. He makes innovation and breakthrough on a significant but non-settled question through independent research or cooperative research, then writes a corresponding paper and summits it to the university or scientific research institute eligible of awarding a doctorate. After strict review, he passes his paper and obtains a doctorate. It is called paper doctor. In some developed countries, these two ways are allowed to obtain a doctorate but China is only in favor of the former way at present. I believe that two ways should be supported to discover and cultivate innovative elitists. Einstein was awarded a doctorate by passing his paper.

From the perspective of lifetime suzhi education for all, examination methods should be varied and

reflect subjectivity. In other words, we must change our opinion on examinations and examination reform is imperative. In China, although examination oriented education is not satisfying, the problems exerted are rather serious. Examinations should give consideration to both fairness and efficiency.

Examination is closely related to teaching and curriculum. Different teaching types and curriculums should have varied examinations. We should not impose uniformity in all cases. Within the system of lifetime suzhi education for all, examination methods are bound to be various.

Corresponding to the classification of curriculum, examination can be divided into standard examination and non-standard examination. Standard examination includes required examination and optional examination; non-standard examination covers formal examination and non-formal examination. Formal examination includes activity examination and special examination; while non-formal examination refers to potential examination, which includes normal examination and non-normal examination. Normal examination covers life examination (such as watching TV or traveling) and non-normal examination means random examination (such as firefighting or fighting natural disasters).

The systematic classification of examination is suitable for the examination classification of lifetime suzhi education for all. In the education system, examination is similar to evaluation. We should combine teaching, curriculum and examination to research the reasonable connotation of examination intensively and understand its meaning in a broad sense.

At the middle level, the three categories of groupment include teaching, curriculum and examination, which are mutually related and interact with inner links. The pedagogy in the past discussed teaching and curriculum but seldom explained examination, let alone expounded the dialectical relationships between teaching, curriculum and examination systematically.

With definiteness and randomness, teaching, curriculum and examination have nonlinear complicated relationships. Teaching and curriculum are definitive, while examination is random, which reflects the complexity of education.

4. Individual Categories of Pedagogy

At the micro level, the individual categories of pedagogy include learning, knowledge and thinking.

4.1 Learning: Passiveness and Activeness

From the analysis of dialectics, learning should handle the categories of passiveness and activeness.

According to the principle of system science, learning means the process that a leaner assimilates and outputs information, then judges right and wrong by feedback and evaluation. Learning is related to teaching. Teaching contains learning, while learning includes teaching in a broad sense. However, they are obviously different. Learning is related to individuality while teaching is related to group.

The whole process of school teaching is both passive and active. Learning includes passiveness and activeness. We can't judge that passiveness is bad and activeness is good. Humanity is the subject of learning and needs to select the object of learning. The effective learning of humanity cannot leave teacher and curriculum in a broad sense.
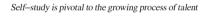
Self-study is pivotal to the growing process of talent. The growing path of Einstein can explain the great significance of self-study. Einstein studied Sacred Geometry Chapbook independently when he was 12, learned *Critique of Pure Reason*[23] of Kant at 13, learned basic mathematics between 12–16, as well as the principles of calculus and some theoretical physics. Einstein said that his knowledge

mainly came from self-study, he was enthusiastic about understanding but seldom recited. At college, Einstein was still greatly keen to learn from masters of theoretical physics at home. He had formed good habits and continued to study independently and habitually.[24]

If Einstein was limited by the knowledge received in school, he could by no means establish the theory of relativity. In 1905, Einstein developed the special theory of relativity, negated the absolute time-space concept raised by Newton and revealed the relativity of time. Einstein wrote: As for me, I made decisive progress on the critical thinking needed by discovering this central point especially after reading the philosophical works of David Hume and Ernst Mach.[25]

We should give students enough self-study time to cultivate their self-study habits and abilities. It is important for students to finish basic courses in school. The elementary courses, such as Chinese (including foreign languages) and mathematics, should have clear-cut and appropriate requirements. Except for coursework, we should guarantee that students have enough free time and space to develop their own features and hobbies. Otherwise, it is impossible to cultivate students' independent thinking, independent judgment and independent action abilities.

In system science, the combined principle of self-organization and other-organization has three features: First, complicated artificial systems need self-organization and the function of self-organization should be played to form a system with cohesion and internal motivation; second, complicated artificial systems need the coordination and control of other-organization so as to realize orderly development; third, self-organization and other-organization should be combined organically

Self–study is pivotal to the growing process of talent

to form an effective and optimized system. The three features mentioned above are indispensable.

Education system forms other-organization systems based on self-organization. It needs to follow the combination principle of self-organization and other-organization. The other-organization system of individual learning is also based on self-organization.

In epistemology, there are eight basic learning models from the easy to the difficult according to the school age order of students: (1) the perceptual model in infancy; subjective activities, learning from perception; (2) the game model in early childhood; game-centered learning, learning from playing; (3) the concrete model in elementary school; image-centered learning, learning from concentration, situation and perceptual intuition; (4) the learning style in junior high school; abstraction-centered learning, learning formally; logic-centered learning, learning historically; (5) the learning style in senior high school; speculation-centered learning, learning from sudden enlightenment; (6) the learning style in college; structure emphasized, learning from transition; (7) the learning style as a graduate; comprehensive analysis, learning from creativity; (8) the learning style as a post-doctor (expert); comparison and inclusiveness, learning from development.[26]

The independent, cooperative and probing learning style is conditional, which is mainly suitable for graduate and adult. In the elementary education in school, learning should be from the easy to the difficult level and the independent, cooperative and probing learning style should be permeated appropriately rather than take a leading role. Independent method is not suitable for elementary education completely but tends to lead to indulgence, which will go against the growth of children. The probing method is fit for natural and scientific courses rather than other courses. The main learning method of Chinese and foreign languages should be reading and writing; mathematics should be thinking and exercise; art course should be appreciation and creation; technical course should be design and manufacture. Meanwhile, the cooperative method is not suitable for everyone. It first emphasizes independent thinking and independent action then it can realize effective cooperation on the basis.

From the analysis of system science, the main methods of learning are acceptance, exploration, beauty appreciation, cooperation and understanding. According to different teaching contents, there are five learning models: logical content, selecting the thinking acceptance mode, namely thinking on problems and active acceptance; operative content, selecting the activity exploration mode, namely activity exploration and attempting practice; emotion content, selecting the image experience mode, namely image inspiration and emotional experience; communication content, selecting the cooperation and exchange mode, namely exchange reflection and sharing cooperation; comprehensive content, selecting the overall understanding mode, namely integral grasp and understanding the essence.

Lifetime suzhi education for all requires that everyone should take lifetime education. We should not be anxious for success in education and learning. Instead, we should realize individualized education, namely teaching students in accordance with their aptitude. Lifetime education and lifetime learning is the only way to realize equality of education, as well as the effective method to release the burden of teachers and students.

4.2 Knowledge: Sensibility and Rationality

From the analysis of dialectics, knowledge should handle the categories of sensibility and rationality.

Knowledge is formed and constructed in the interactional process of subject and object. The

formation and construction of knowledge needs both sensibility and rationality. Perceptual knowledge and conceptual knowledge are opposite, unified and inseparable. Meanwhile, there is no isolated knowledge. Knowledge is always interconnected and forms knowledge chains with certain systems. Empiricism emphasizes perceptual knowledge while rationalism stresses conceptual knowledge. They should be connected.

Empiricism and rationalism are complementary. As the basis of theory, experience can check theory. Theory is not inferred by experience but the innovation of human thinking! Experience and theory are mutually independent and related. It is one-sided to overstress empiricism or rationalism. Originating from practice, experience must rise to theory and avoid falling into narrow empiricism. The principle of theory should explain experience and accept inspection in practice to avoid narrow rationalism.

Knowledge is the result of cognition. Cognition includes perceptual cognition and conceptual cognition. Similarly, knowledge contains experiential knowledge and theoretical knowledge. According to epistemology, the basic process of cognition covers from perceptual cognition to conceptual cognition, from conceptual cognition to specific practice. Perceptual cognition and conceptual cognition are inseparable. It is the same with experiential knowledge and theoretical knowledge.

Lao Tzu once wrote, "The Tao that can be told of is not an unvarying Tao; the Name that can be named is not an unvarying Name. It was from the Nameless that Heaven and Earth sprang. The named is but the mother that rears the ten thousand creatures, each after its kind. Truly, 'Only he that rids himself forever of desire can see the Secret Essences.' He that has never rid himself of desire can see only the Outcomes." These two things issued from the same mold but nevertheless are different in name. This "same mold" we can but call the Mystery. Or rather the "Darker than any Mystery," The Doorway whence issued all Secret Essences.[①] Lao Tzu believed that there are two kinds of knowledge, expressible and inexpressible. Conceptual knowledge can be expressible but experiential knowledge is inexpressible.

There are two kinds of internationally recognized knowledge: codified knowledge and tacit knowledge.

The Organization for Economic Cooperation and Development (OECD) said that knowledge can be divided into know-what, know-why, know-how and know-who. The concept of knowledge is wider than information. Knowledge involves know-what and know-why, which are the knowledge types nearest to market commodities and suitable for the economic resources of production. Other types, especially know-how and know-who, belong to tacit knowledge, which is more difficult for modification and measurement. One basic aspect of learning is to translate tacit knowledge into codified knowledge and apply it to practice and then develop new tacit knowledge.[27]

This discussion raised the concept of knowledge to modern scientific levels as well as fully reflected the dialectical relationship between sensibility and rationality.

Knowledge is justified true belief.[28] Knowledge consists of belief, truth and verification. Knowledge is belief. Knowledge should be verified and true before being accepted by people. Knowledge must accept two tests. First, in logic, whether the overall belief system is internally coherent; second,

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① Lao Tzu, *Tao Te Ching*, Chapter 1.

in operation, whether it is supported by external specific experience. In short, knowledge should be internally coherent and supported by external experience.

Without internal coherence, knowledge fails to win the support of external experience. Similarly, without the support of external experience, internal logic lacks coherence. However, the ultimate judgment of testing the truthfulness of knowledge needs the support of overall experience. The combination of internal coherence and the support of external experience is the minimum condition to judge the truthfulness of knowledge. Overall experience covers historical experience and practical experience as well as the summary of all kinds of experience.

Popper raised the theory of three worlds.[29] World 1 refers to the physical world. In China, it means the world of heaven, earth and humanity. Cosmic evolution, biological evolution and social evolution happen in world 1. World 2 refers to the spiritual world of humanity. The evolution of awareness, the development of the thinking model and origin of knowledge and innovation take place in world 2. World 3 is the world of knowledge. The evolution of objective knowledge, the development of knowledge systems and the identification of knowledge innovation happens in world 3. Therefore, the three worlds include the physical world, the spiritual world and the knowledge world.

Knowledge comes from the understanding of the world by humanity. Knowledge innovation is related to world 1, world 2 and world 3. Humanity discovers knowledge based on world 1 and invents knowledge based on world 2. The discovery of knowledge is intrinsic in world 1. But the invention of knowledge is created freely by humanity. All the cognitions of humanity result in knowledge and form world 3. World 3 contains both discovery and invention. Humanity exists in the three worlds. It is

humanity that forms the three worlds. The physical world, spiritual world and knowledge world have independence, relevance and integrity.

Research into how humanity knows the world is conducted in world 2 and the research achievement is epistemology. Research into how humanity knows the world is called knowledge and forms world 3, whose research achievement is called the theory of knowledge. Epistemology and theory of knowledge have relevance as well as significant differences. They cannot take the place of each other. It is one-sided to solely emphasize epistemology or theory of knowledge.

Epistemology stresses the process of cognition. The theory of knowledge underlines the structure of knowledge. In philosophy, process and structure are of equal significance and should be regarded equally. For a long time in China, we paid much attention to epistemology but neglected the theory of knowledge, which brought negative influence on curriculum reform in modern times.

Elementary education should attach importance to knowledge education, which is a common pursuit in the world. In middle school, students should understand what is knowledge, how do students acquire knowledge and the Theory of Knowledge which has become a required course for middle school students in many countries. In China, some areas have set up International Baccalaureate Program (IB) schools which Taiwan calls the international college entrance examination. Students should learn Theory of Knowledge with original English textbooks. After attending on-site lectures and researching the textbook, I evaluated the theory of knowledge and found it to be a unique thinking course integrating different disciplines. It is similar to the common sense of dialectical materialism of senior high school in China but less abstract. It combines different knowledge disciplines of senior high school and effectively improves students'

creative thinking.

From the analysis of system science, the ways of forming knowledge include experience, concept, experiences and verification. It is one-sided to only emphasize experience and neglect concept. Similarly, it is not comprehensive to stress subjective experiences and ignore objective verification. Treating knowledge formalistically will inevitably despise knowledge, which does harm to the growth and development of humanity. We should hold a dialectical attitude toward knowledge. Experience, concept, experiences and verification are essential to the formation and construction of knowledge.

4.3 Thinking: Assimilation and Accommodation

From the analysis of dialectics, thinking should handle the categories of assimilation and accommodation.

In the *Encyclopedia of China*, thinking activity is caused by certain problems and aims at the solutions. Thinking remarkably manifests in acquiring knowledge and employing knowledge to solve problems. Thinking is closely related to language. Many psychologists believe that language not only serves as a method for people to exchange thoughts but is also a tool of thinking. Concept is the fundamental factor of thinking.[30] Great concepts are called categories. Every discipline should research its core category, which is conducive to scientific thinking.

In pedagogy, thinking categories are closely correlated with knowledge categories. Learning aims to acquire knowledge and employ knowledge to solve problems. According to brain functions, learning, knowledge and thinking are linked.

The process of solving problems is called thinking. In accordance with the genetic epistemology of Piaget, when people solve problem, they just need to bring the problem into the existing schema, called assimilation; when they need to

change the internal schema and construct a new one it is called accommodation (also conformance). Obviously, thinking of solving problems contains assimilation and accommodation.

In the *Principle of Genetic Epistemology* and other important works, Jean Piaget (1896–1980) discussed the principle of adaptive thinking, namely the principle of adaptive individuality. Adaption includes the functions of assimilation and accommodation. The cognitive structure of humanity continues to develop and adapt to new environments. Piaget regarded adaptation as the essence of intelligence. Through adaption, assimilation and accommodation can create relative balance.[31]

From the analysis of system science, thinking can be divided into logical thinking, operational thinking, emotional thinking and communicative thinking.[32]

The feature of logical thinking is that humans use characters, figures and symbols in language, mathematics and logic (including formal logic, dialectical logic and mathematical logic) to solve problems through abstract concepts. The expressions equivalent or similar to logical thinking are theoretical thinking, formal thinking, abstract thinking and dialectical thinking.

The feature of optional thinking is that humans uses material objects, instruments and machines to solve problems by operation. The expressions equivalent or similar to operational thinking are empirical thinking, concrete thinking, action thinking and experimental thinking.

The feature of emotional thinking is that humans use pictures, music and models to solve problems by experiencing images. The expressions equivalent or similar to emotional thinking are image thinking, artistic thinking, intuitive thinking and aesthetic thinking.

The feature of communicative thinking is that humans use investigation, statistics and discussion

to solve problems by exchange, interaction and introspection. The expressions equivalent or similar to communicative thinking are interactive thinking, introspective thinking, conversion thinking and statistic thinking.

The Analects of Confucius wrote that Confucius taught students by four ways; cultural knowledge, practice, loyalty, and integrity, which correspond to the four thinking models mentioned above; cultural knowledge emphasizes logical thinking; practice stresses operational thinking; loyalty underlines emotional thinking; integrity in communication requires communicative thinking. In other words, we can say that enlightening students with reason employs logical thinking; guiding students with action employs operational thinking; motivating students with emotion employs emotional thinking; imparting essence to students employs communicative thinking, namely spreading spiritual essence through communication. When solving teaching problems, we should use the four thinking methods mentioned above to improve teaching effects. The four thinking models correspond to the four elements of modern psychology; cognition, emotion, consciousness, and behavior.

From the analysis of system science, the all-around development of humanity includes the development of knowledge, skill, emotion and communication. At the micro level, it is the thinking development of humanity in nature. When we emphasize the all-around, free and harmonious development of the individual, we should not eliminate the individual's development of feature, personality, innovation and uniqueness. The professional development of teachers contains systematic specialized knowledge (logicality), teaching and demonstrative skill (operability), artistic and literary accomplishment (emotionality), as well as social communication capacity (communicative feature). It requires the all-around development of

teachers. Meanwhile, teachers should have different teaching styles and personality charm.

According to thinking types, it is quite necessary to know teaching contents and basic lesson types.

There are five contents and ten lesson types; logical content, conceptual lessons and principle lessons; operational content, experimental lessons and practice lessons; emotional content, appreciation lessons and creative lessons; communicative content, discussion lessons and evaluation lessons; comprehensive content, introduction lessons and revision lessons. Different teaching contents have different lesson types and teachers should select appropriate teaching models.

Accordingly, there are five teaching models:

Logical content selects the cognitive pattern, enlightenment, proceeding with problems, going from the easy to the difficult, enlightening students with reason.

Operational content selects the behavioral pattern, demonstration, making attempts, combining teaching and practice, guiding students with action.

Emotional content selects the emotional pattern, appreciation, exerting a subtle influence on students' character, beauty appreciation and construction, motivating students with emotion.

Communicative content selects the group pattern, exchange, discussion and demonstration, imparting essence to students.

Comprehensive content selects the integrated pattern, comprehensiveness, openness and integration, leading to innovation, integrating students with methods.

In elementary education, suzhi education requires students to master four kinds of basics; basic knowledge, basic skill, basic attitudes and basic methods. Teachers should train students in four kinds of abilities; ability of discovering problems, ability of raising problems, ability of analyzing problems and ability of solving problems.

There are four kinds of basic thinking to cultivate the students' four abilities. Using logical methods to discover problems, raising problems, analyzing problems and solving problems is logical thinking. Using experimental methods to discover problems, raise problems, analyze problems and solve problems is operational thinking. Using artistic methods to discover problems, raise problems, analyze problems and solve problems is artistic thinking, or image thinking, or emotional thinking. Using communicative method to discover problems, raise problems, analyze problems and solve problems is communicative thinking.

In practical application, we often use integrated methods to solve problems. Using integrated methods to discover problems, raise problems, analyze problems and solve problems is system thinking. The category of thinking is equivalent to that of ability. Ability is the outward manifestation of thinking. The category of thinking includes ability.

At the micro level, the three categories of individuality contain learning, knowledge and thinking, which are mutually linked and influenced with inter relations of its own. The pedagogy in the past discussed the categories of learning and knowledge but seldom systematically expounded the category of thinking, let alone explained the dialectical relationships of learning, knowledge and thinking.

With nonlinear complicated relations, learning, knowledge and thinking have definiteness and randomness. Learning and knowledge are definitive while thinking is random, which reflects the complexity of education.

The three broad categories of pedagogy proposed in this paper contain nine core categories of pedagogy. The relations between the three categories show that the integrality category restricts the groupment category and the individuality category; the groupment category restricts the individuality category; conversely, the individuality category affects the groupment category and the integrality category; the groupment category affects the integrality category. The relationships between the three categories are nonlinear and complicated.

There are four kinds of basic thinking to cultivate the students' four abilities

This paper does not simply enumerate the nine categories. Instead, it divides the categories into three levels and forms a new theoretical structure of pedagogy. The three broad categories inside pedagogy also form a new theoretical structure, within which is a complicated sub-structure, the dialectical unity of certainty and uncertainty. This new theoretical structure with new functions will help solve problems.

The in-depth research on the three broad categories and nine core categories of pedagogy is beneficial to solving some present existing difficulties in the pedagogy field. This paper is a new attempt of core categories research as well as a new combination and explanation of pedagogic categories. It aims to provide new thought for the construction of educational system of socialism with Chinese characteristics.

5. Conclusion

Pedagogic theory should have its own core categories and basic principles. It aims to solve significant problems, explore the theory consistent with objective facts of education and accept the strict inspection from educational practice. The paper employs dialectics and system theory to discuss the core categories of pedagogy, tries to connect and integrate suzhi education, all-around development education, lifetime education and education for all so as to explore a new educational theory of socialism with Chinese characteristics.

Philosophy of science shows that there is no inevitable logical access to selecting core categories to construct a new discipline theory. It is a free creation of people and people have broad innovation space. Therefore, the construction of educational theory of socialism with Chinese characteristics cannot be unique. We should construct different

theories and allow mutual comparison and mutual competition so that it is conducive to the growth of knowledge and the improvement of science. The rationality of theory aims to conform to the facts, explain phenomenon better and solve more problems. Not all theories out of free creation can win the approval of people. Besides, the theory which has been tested in practice and acknowledged by people is not the ultimate theory. There is no ultimate theory in the world and theory is under development all the time.

Suzhi education is proposed under the cultural background of modern China. It is not a product of wholesale westernization or wholesale restoration. Instead, it is an innovation. Suzhi education discussed in this paper refers to lifetime all-around developmental education for all. All-around development should include all-around development of the natural ecology, all-around development of the economic society and all-around development of the individual. Suzhi not only refers to individual suzhi, but also contains group suzhi and holistic suzhi. Holistic suzhi means humanity and survival environment. Systematic suzhi educational theory is under exploration and construction.

The connotation of education has already expanded beyond the scope of school education. But so far, school education is still the emphasis of pedagogic research. Education in a broad sense is also called great education, including family education, school education, social education and self-education. The core categories of pedagogy should be suitable in school education; meanwhile, they should fit great education, namely accepting the strict test of great education. The core categories of pedagogy are always constructed in innovation, make progress in trial and error and develop in criticism.

(Translator: Cao Suling; Editor: Hu Jinglei)

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