

Cultivation of Students' Scientific and Technological Ability for Innovation

Zhanjun Ma

Dezhou University, Dezhou 253023, China

E-mail: dzwxbs@163.com

Abstract

Students' scientific and technological ability for innovation is high-quality talents' core and soul. Aiming at the actuality of students' scientific and technological ability for innovation and the cognition and analysis about the cultivation of students' scientific and technological ability for innovation, the thoughts and measures about the cultivation of students' scientific and technological ability for innovation are proposed in this article, in order to build the deep academic atmosphere of students' scientific and technological innovation, form the good cycle of teachers and students' innovational consciousness, enhance the cultivation of students' scientific and technological ability, fulfill the demand of the development of society and economy, realize the new spanning of talent cultivation, and make new contribution for the economic construction and the building of the affluent society.

Keywords: Students, Scientific and technological ability for innovation, Cultivation

Innovation is the soul of the advancement for one nationality. In the report to the Seventeenth National Congress of the CPC, President Hu Jintao definitely proposed to enhance the science and technology innovational ability and build the innovational country. Young students are the main force to build the innovational country. With the advent of the knowledge economy time, the competition of comprehensive national strengths is more and more drastic, so the innovational talents with high quality will be required more. The hard task of the education is to cultivate young students as the main force and talents in the modernization construction of China. And the innovational ability of science and technology is the core and soul of the talents with high quality. To cultivate students' innovational ability of science and technology is the development direction of the global education. At present, all countries take the cultivation of excellent innovational talents with high quality as the direction and breakthrough of the education reform, and the current education system of China also emphasizes the knowledge transfer but ignores the ability cultivation, and how to cultivate students' innovational consciousness and innovational ability has been the important task for the education system of China.

1. Importance and pressure to cultivate students' scientific and technological ability for innovation

School has the functions such as cultivating talents, developing science, and serving the society. The requirements of the 21st century to young students will be more emphasizing students' comprehensive quality composed by the moral quality, the scientific culture quality, and the body and mind quality, more emphasizing students' innovational ability, which is also the unprecedented development opportunity in the unprecedented change of the current science and technology. With the advent of the knowledge explosion times, human activity space and level have been developed to the unprecedented domain, scale, and level, and the flourished development of modern science and technology and the drastic competition and extensive cooperation of politics and economy in the world, and the conflict between the resource and ecological environment with the human development have forced people to try to find a new sustainable development approach. As the big country with 1.3 billion populations, the average resource of China is not abundant, and facing the opportunity and challenge, China only should enhance the innovational consciousness and ability of the nationality to win in the high technology domain in the world. As the reserve talents of high level, young students will be main force to participate in the international competition, and they will face the quick developing and drastic reforming world, and assume more complex, difficult, and formidable historical task to change and cognize the world. Therefore, when establishing students' knowledge structure, ability structure, and quality structure according to the requirements of knowledge economy, the cultivation of young students' innovational quality will be more important. In the knowledge transfer and the ability cultivation of the education, the cultivation of young students' innovational ability should be the key factor of the education, and be the base of the education of China,

which is not only the requirement of the times, but the practical behavior to really implement the quality education. The school education assuming the talent cultivation should more emphasize the cultivation of students' innovational ability. The cultivation of the innovational ability should make students to possess the spirit of actively studying, acquire the knowledge independently, study in a creative way, and form the creative consciousness, and the important one is that to make students be the builders with active and abundant creative spirit in the society when they leave the school. For a long time, because of the influence of the rooted traditional education concepts, the education of China only emphasizes the knowledge transfer, and overemphasizes teachers' teaching but ignores students' principle consciousness and state, and lack in the cultivation of students' innovational quality, and the students graduated from this concept only could be rich in theories, but be poor in practice, and they only could simulate, but not innovate, and lack in competitive consciousness and flexible ability. Traditional education idea and concepts have seriously influence and restrain the cultivation of students' innovational ability, and the cultivation of students' innovational ability become more and more urgent and important.

2. Problems existing in the cultivation of students' scientific and technological ability for innovation

2.1 Actuality of students' scientific and technological ability for innovation

2.1.1 Lacking in the perseverance and spontaneity of innovation

When students participate in the activities of science and technology innovation, they should not only have certain knowledge and practice experiences, but have strong spiritual drive, strong willpower, and spontaneity. In the first prizes of 18 subjects of the Global Teenage "Science World Cup" of 2009, 17 prizes were won by American players, and the other one was taken away by Taiwan player. Though the amount of prizes won by Chinese player was not less, but the amount of heavy prizes was deficient. The more impressive was foreign players' unfettered originalities and favor to the science from their hearts. And most items won by Chinese players were "stably bred" with certain forced component, but foreign students were "bred" in a suitable place with strong spontaneity. That indicated that when Chinese students participate in innovational activities of science and technology, most of them depend on "brief period of enthusiasm", and they lack in insistent wills and quality, which makes the innovational activities of science and technology only stay on the surface, and lack in systematic organization and long-term material support, so the good effect is difficult to be obtained. Young students generally change their interests with the time, the environment, and the enthusiasm at present, without certain depth and width.

2.1.2 Lacking in innovational consciousness and imagination

Students should be the important force in the innovational activities, but students' innovational ability and consciousness are killed too early by the examination-oriented education system of China, which can be obviously embodied in the classroom. Primary school students actively speak, and middle school students speak after teachers appoint them, and college students never speak even teachers appoint them. Traditional spoon-feed education mode has restrained students' innovational consciousness, and it makes against the cultivation of students' independent thinking. Because of the deficiency of innovational consciousness, most students could not accumulate knowledge and skills in daily learning and life, and valuable topics could not be found. Therefore, in the innovational activities of science and technology, most students only blindly listen teachers' explanations and arrangements, but lack in their own opinions and ability for the new knowledge and domain, and some students even takes the scientific research activities as the task to implement, so they will not discover and study problems. For the speed and width of observation, the integer and generalization of observation, the acuity and profundity of observation, the planning and flexibility of observation, young students are generally deficient.

2.1.3 Lacking in innovational thinking ability

The student with strong learning desire and innovational spirit should not only have rigorous theoretical thinking quality, but have the devotion and obsession to knowledge, and the should not only discover and put forward problems in his own specialty, but be good at observation and independent thinking in the daily life. Some students want to innovate, but because their ability is limited, and their knowledge and experiences are deficient, they don't know to how innovate, and their logic thinking ability, their associated thinking ability, their divergent thinking ability, and their converse thinking ability are still young, and need to be cultivated and trained. Young students have innovational potentials, and only by proper mode and methods, their innovational ability could be enhanced to large extent. On the contrary, if they could not be educated in an innovational way, their innovational potentials would shrink even disappear.

2.2 Actuality of the cultivation students' scientific and technological ability for innovation

2.2.1 The curriculum provision disjoints with the practice, and lacks in innovational contents

To generally cultivate and enhance young students' basic innovational consciousness and ability must fully utilize the teaching practice in the classroom. But most colleges have not really set up the special theoretical course about students' innovation, and have not brought the research-discussion course of students' innovation of science and technology into the normal teaching plan and curriculum provision as the required course, and the research-discussion course is only in the advocating stage. For the basic stages such as curriculum provision and teaching material construction, the basic, mature, and practical knowledge should be specially emphasized, and the attention to the new and unknown domain of the subject is deficient. In the teaching, when instructing the practical knowledge, teachers should explain more scientific discovers and innovational knowledge. And in the teaching and learning, teachers should give attention to the current demands and future demands about the social practice at any time, and they should exactly organize and lead students' learning direction, and stimulate students' learning desire, cultivate students' self-development confidence and ability. In colleges' teaching planning cultivation scheme, the practice and innovation design are deficient, and the investments about the innovational practice base, the teaching lab construction, and the science and technology group construction after school are not sufficient, and most students have no chance to operate in the labs. Therefore, even if students accept more theories in the classroom, their theoretical knowledge could not be effectively turned into the innovational ability of science and technology without the practical operation in the lab, which is the essential factor to influence college students' innovational activity of science and technology. In addition, too much hours and study tasks are another important cause to make students have not sufficient time to participate in the innovational activities of science and technology.

2.2.2 The academic atmosphere is deficient, and lacks in effective attraction

Students should fully utilize all study resources such as books resource, experiment resource, and teacher resource to actively participate in the innovational practice, strengthen their innovational consciousness, cultivate their innovational spirit, and enhance their innovational ability. A good study and information environment and a deep academic atmosphere could not only offer stage for those students with innovational ability to show their talents, but stimulate the exertion of students' potential creativity. For the "academic lectures" with different forms, the participated student amount is less, and a part of them is required or has other causes. They often "slop away" in the innovational activities of science and technology, so the anticipated education effect could not be achieved.

2.2.3 Relative supporting polices are not complete

Students' innovational activities of science and technology in Chinese colleges start late, and students' practical experiences and basic theories are relatively weak, and relative suited systems are not perfected, which are a big difficult problem in the innovational activity of science and technology. Though some colleges begun to explore the reform of the comprehensive evaluation system very early, and came on some relative policies and systems, but the mechanism making for students' creation has not be formed.

2.2.4 Professors and experts' instructions are deficient

Professional teachers' participation and instruction are the guarantee to develop students' innovational activities of science and technology. Though the principle part of the science and technology innovation activity is students, but the development of this activity could not leave teachers' instruction. In fact, it is an extension for teachers' teaching and educating works. However, in practice, teachers' enthusiasm of participation is not high, and few of them would instruct students' activities of science and technology. As viewed from the Global Teenage "Science World Cup" of 2009, if American students were interested in some items, teachers would tell them who were the top scientists in this domain, and let them to associate with them, and scientists generally would offer supports after reviewing. But in China, even if some students have good items, they will be refused frequently by those experts in universities or research institutions.

3. Effective approaches to cultivate students' scientific and technological ability for innovation

3.1 Changing the education thoughts and refresh the education concepts

The cultivation of students' innovational ability of science and technology first should be the cultivation of the education concept, and educators must have deep innovational consciousness. The traditional education ideas and concepts formed in the planned economic system are seriously limiting teaching staffs' brains, the course and the implementation of the school education teaching reform, impacting the comprehensive development of talents, and influencing the cultivation of innovational talents. To fully change this situation, colleges should

grasp the change of the education ideas and concepts, and make clear what talents should be cultivated in the 21st century, what comprehensive qualities the innovational talents should possess, and what knowledge structure and ability structure students should be cultivated in school. The change from the knowledge education to the quality education advocated at present is the large advancement of the education ideas and concepts. And the quality education is gradually implementing in the process of talent cultivation. Therefore, the modern education ideas and concepts should be accepted by people as soon as quickly, and the new education view, talent view, and quality view should be established to really develop students' individuality and innovational ability, only by this way, the cultivation of innovational talents could be guaranteed.

3.2 Strengthening the practice and cultivate students' hand ability

Colleges should encourage students to participate in the innovational activities of science and technology to strengthen their practical hand ability and the cultivation of practical skills, and realize the transformation from the scientific knowledge talents to the scientific knowledge and practical skills talents. Colleges should fully emphasize the part of the practical teaching, and let students to practice in enterprises and relative units periodically, and associate with relative industries to establish the long-term teaching practice base, and set up opening labs, and build the innovational education experiment base, and offer practice opportunities and places for students to further cultivate, train, and enhance students' innovational consciousness and ability. Colleges should also actively develop the new teaching mode combining with production, learning, and researching, establish the practice center for students' innovational education of science and technology, offer advantageous conditions to cultivate students' innovational ability, make all students to know the meaning and importance of the cultivation of the innovational ability of science and technology, lead students to participate in the innovational activities of science and technology to enhance their own innovational ability of science and technology.

3.3 Establishing relative regulations to guarantee the development of the scientific and technological innovation activities

Colleges should establish a series of system and effective operation mechanism to implement the cultivation of innovational talents of science and technology, and ensure the development of students' innovational activities of science and technology by the operation measure of project mode. Colleges should not only largely support those students with this intention and professional base from the spirit, but solve the problems of charge when students implement the innovational item of science and technology from the material, and mainly cultivate the select excellent teachers to participate in the innovational activities of science and technology after school, and establish a teacher group with hard ideas, higher academic level, contributed spirit, and innovational ability, and encourage and advocate professional teachers to participate in students' new innovational items to instruct them and enhance their own operation quality. Students could participate in teachers' research topics, and also seek topics under the charge support of the college and teachers' instruction. Colleges should periodically check and testify students' scientific and technological activities to cultivate their innovational willpower and responsibility. The "college student science and technology association" could be established to centralize those students with same interests and favors, and attract more students to participate in the innovational activities of science and technology. Colleges should also largely support students to participate in the national college student academic science and technology works competition of "challenge cup" and the Chinese college student business plan competition of "challenge cup", which will actively promote students to participate in the scientific and technological activities and cultivate their innovational ability.

3.4 Establishing reasonable course system

Students' innovational ability of science and technology comes from wide knowledge and good quality, not single professional knowledge. Therefore, for the reform of curriculum provision and teaching content, colleges should emphasize deep base, wide size, and high quality, must combine arts with science, physics with engineering to adapt the requirements of the science development in the information times. First, the course structure should be optimized, and the required courses should be set up according to the principle of "less and extractive" to ensure students with deep basic knowledge. Only students have deep basic knowledge, and the knowledge domain is extended, they could be think problems on certain height and their innovational ability could be exerted fully. In addition, students' measure to obtain information should be increases, in that way, students could have opportunities to contact the development frontier of various subjects, extend their knowledge views, know the tendency of the science and technology development, enhance their drive ability to the knowledge, and grasp the rule of the change in the future. The course of the innovation theory should be established to cultivate students' innovational consciousness. The proportion of the selected course should be

increased, which could not only optimize students' knowledge structure, and prepare for the further study of certain specialty, but help students to develop their interests, and enhance their enthusiasm of the innovation.

3.5 Building deep atmosphere of innovation education

The education environment of colleges is pivotal to students' growth and education. Young students have quite conscious will to become a useful man, so when the teaching staffs consider the cultivation objects, they should not simply regard the educated students as the "educating objects", but the principal part of the development. The teaching work should change from the single education and management to the instruction, consultation, and service, and develop from the vertical and linear management system to the complex networking direction. The campus culture construction should be strengthened, and the campus culture environment and the academic atmosphere suiting for young students' growth should be designed and established to fully stimulate their participation consciousness and enthusiasm. Aiming at students' thirst for the new and alien, each student's strong suit should be developed. By organizing young students to participate in the social practice, many activities such as academic report, science and technology thesis game, electric design competition, and hand works competition can be taken place to enrich students' life and cultivate their consciousness of thinking and handing, and dig students' innovational potentials and cultivate their innovational spirit to the largest extent, and increase their ability and knowledge, and learn to manage themselves in these activities, and cultivate and enhance their own organization ability, communication ability and handing operation ability. The practices have proved that these measures all could help to cultivate college students' innovational ability.

3.6 Reforming the examination method

The examinations in colleges should pay equal attention to knowledge and ability, theory and practice, and mainly measure students' ability to flexibly understand, grasp, and utilize their learned knowledge in the practice. The written answer sheet could be combined with scientific research thesis, product design, and social survey, to check students' knowledge, ability, and comprehensive quality, in order to promote students to actively enhance their own innovational consciousness and ability by themselves.

To sum up, it is the general trend to cultivate students' innovational ability. The education and science system of China should encourage colleges to cultivate reserve talents with innovational ability of science and technology, and turn the spoon-fed education into the innovational education, and change from cultivating students' skill to developing students' potential. By a series of teaching reform and education training, colleges should cultivate students as the talents with innovational spirit and ability, who could be adapt the future competition in the society. Under new situation, the cultivation of students' innovational ability should start from establishing innovational concept, cultivating students' scientific thinking ability, reforming teaching method and measure, and reforming the management system to comprehensively cultivate college students' innovational ability of science and technology.

References

- Deng, Chunyan. (2005). Consideration on the Development of Undergraduates' Scientific and Technical Innovation Ability. *Journal of Hebei Normal University of Science & Technology (Social Science)*, No. 1, P. 30-31.
- Sheng, Qiaoya. (2004). *Comparison and Analysis of Chinese and American Youngsters' Innovation Ability Cultivations*. Thesis of Shanghai International Studies University.
- Shi, Qingping. (2003). Probe into Scientific Innovation Activities for College Students. *Higher Educational Research in Areas of Communications*, No. 4, P. 12-13.
- Zhou, Lin. (2005). Cultivation of College Students' Creativity in Science and Technology. *Journal of Shenyang Jianzhu University (Social Science)*, No. 2, P. 21-22.