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Computer science has an effect on social life

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ABSTRACT—*The author analyzes the cultural function and spiritual value of computer science history in higher education, indicating that constructing a much broader, interdisciplinary and comprehensive knowledge system is of important significance in cultivating comprehensive computer science talents. Combining with computer education, he also investigates the practice mode of combining humanistic education and science education, and in the end he constructs a curriculum system orienting to develop students' overall quality and innovation ability as well as the concrete method on how to carry out humanistic education in computer professional education.*
Keywords*-computer science history; cultural function; spiritual value; computer science education; practice mode*

I. INTRODUCTION

Computer science, not only gives a great impact on the development of productive forces as a kind of material progress, but also exercises a great influence on the development of people's ideology as a sort of intellectual progress. People who are devoted to study and pursuit of science should attach importance to the achievements made in the study of computer science history not only from the point of productive forces but from the point of ideology, and give a full play of its cultural function and spiritual value of computer science history. The birth, evolution and development of computer science theories condenses the scientists' method of thinking and research, which is more valuable than the specific knowledge.

From the content of modern higher education, we can find that a comprehensive science education should include two aspects: one is the imparting of specific scientific knowledge and methods, the other are the cultivation of the abstract scientific thoughts and spirits. If the former is the body of science education then the latter is the soul. That is to say, higher education not only teaches students what to think but how to think. Computer science history is just the most effective way to implement the education on scientific thoughts and spirits. Therefore, in higher education, history of science possesses an irreplaceable cultural function and spiritual value.

As far as the function and goal of university education are concerned, the principle of university education is to advocate an integrated scientific thinking and cultivate well-rounded talents. That is to say science education of university is not only aimed to train all kinds of professional talents but firstly to nurture talents with humanistic spirits. In the modern university education, utilitarian and test-oriented education are still prevailing while scientific thought, spirits and humanistic education are usually overlooked and weakened, which results in the students who are only concerned about the result and utility neglecting the development of science, lacking in exploring and innovative spirits for science. Undoubtedly, it is inadvisable to orient higher education towards pragmatism.

Therefore, constructing a broader, humanistic and comprehensive knowledge system is of much significance for cultivating well-rounded talents of computer science.

II. HUMANISTIC SPIRITS AND COMPUTER SCIENCE EDUCATION

A. The scientific thought, method and spirits permeated in the history of computer science are of great significance for the cultivation of talented persons

The history of computer science is not simply an annal recording the achievements of computer science and technology, instead, it is a history full of scientists' hardships, twists and turns in the process of development and even crisis they faced in some period. For three hundred years, scientists of the old generation worked so hard on the research that some even devoted all their life to their work. The history of computer science and technology just unfolds a picture of this process of development, including raise of questions, ups and downs in the work for questions till the theories gradually reach mature, and some questions unsettled.

The history of computer science is also the history of scientists' struggle in overcoming difficulties and pulling through crisis, from which, people can get a more profound understanding of scientists' thoughts, methods and spirits of devotion. Reading the history of computer science, it is not hard to find that it is just the spirit of "science for science" that encourages scientists one generation after another to move forward on the way of exploring for truth of universe. The greatness of science gives birth to scientists' dreams and pursuits and scientists' spirits, thoughts and methods give birth to science and lead science to greatness.

Scientists, sometimes, are also encountered with perplex, hesitation and even failure. Studying the history of science, we can have an understanding of scientific research from both positive and negative sides; we can get to know the real historical process of science development so as to deeply understand scientific theories; we can also see scientists' religious learning attitude, noble moral and struggle against stereotypes and ignorance, in which they even sacrifice their lives. The vivid stories of scientists and profound thoughts are a necessity for the cultivation of creative scientific talents.

For example, J.Cocke, researcher in IBM research center of America and winner of Turing Award in 1987, found when he was designing and developing IBM360 computer system, that in a common computer system, only 20% of instructions (accounting for 80% of the total instructions for the operation of program) are frequently used, while the rest 80% of instructions are seldom used. With this finding, Cocke, in his following 801computer program, boldly put forward the definition of RISC computer, which was finally developed into a new computer architecture; Another example is American scientist R. W. Hamming, winner of Turing Award in 1968, he gave a full play of his keen insight when he worked on communication error code. At that time, people, though realizing the seriousness of error code, found no good solution for the problem. After Hamming took up this task, he at the first place realized that the improvement of line quality was limited and obstruction from the outside was unavoidable, so the problem could by no means to be solved by making sure sending the correct codes but rather by finding out and correcting once it occurred. It was just his keen insight that made his research follow the right path and succeeded at last.

British scientist C. Babbage devoted all his life and all his fortune into the research of mechanical computer, overcoming incredible difficulties, and worked out a complete series of computer structural drawings. However, due to the limitation of technology at that time, Babbage was not able to realize his assumption. But his assumption of drawing up the program on the punched cards to control computer and the design of computer structure laid a foundation for the research of modern computer. Babbage's research life gave a good expression of spirit of devoting to science and at the same time showed that science is inevitably related with the economic foundation of society, scientific research system, cultural environment and other factors.

The inventor of relational database, E. F. Codd, who has already had a very successful career in IBM at nearly his forties, having a strong feeling of shortage of knowledge in his work, decided to continue study back in university, where he got his master's degree and doctor's degree in succession. And in 1970, his accumulation of years of knowledge finally turns into a display of wisdom, opening a new era for database technology. The inventor of FORTRAN language J. W. Backus grew himself into a master of computer language from a playboy; the inventor of PASCAL language H.Wirth, after he gained his fame, returned to his own country without hesitation and threw himself into the course of education; R. W. Floyd, who was once specialized in literature, became interested in computer, and taught himself in his spare time and finally became the expert on computer, winning Turing Award in 1978 for his contribution in computer programming and computation. Their learning attitude of diligence and hard working and their spirit of aspiration moved and stimulated us all. The readers of intention, when they are learning knowledge, will share their joy of success, experience the fun of learning and absorb nutrition for growth, increasing their confidence and strength for overcoming difficulties.

B. From the history of computer science, students can get a better understanding of the background of the computer theories, which is helpful for them to form a comprehensive recognition of the knowledge structure of computer science

Apart from the imparting of knowledge, a more important task of college education is to teach students how to think, to analyze and to research. However, in today's class, teachers are more concerned about the imparting of knowledge and the final conclusions when they teach theories, neglecting the evolution of the theories, thinking methods or historical background. A direct result of this practice is that students, taking the theories, formulas, law in the textbook as the only right thing, will sanctify and dogmalize what they have been taught in class, knowing nothing about the background of these theories or different solutions for the problems and the development of the theories, which is unfavorable even harmful for the training of students' innovative thinking.

The term "Turing machine" is possibly known to everyone, yet, it is seldom known how the theory came into being. K. Gödel, Austrian descendant mathematician of American nationality, put forward the theorem of incompleteness of form system, announcing the failure of Hilbert principle and at the same time

reminding people to put energy on feasible projects rather than on those inconclusive problems. Inspired by Gödel, British mathematician Turing began his study of the law of computation with the general process of calculating one number, which resulted in the proposal of Turing model. Until then, people began to get a clear idea of a "computer", which parts it is composed of, how it computes and works, etc. Thereafter, focusing on how to judge a math problem can be mechanically solved or not, many mathematicians probed into this definition of computation from various perspectives. American mathematician S. C. Kleene brought forward the general recursive function on the basis of Gödel' primitive recursive function; A. Church brought in λ − definable function and E. L. Post put forward standard and systemic computing model. And afterwards, Turing further proved that Turing computable function was the same as

λ − definable function, so A. Church also asserted that computable function equaled to the general recursive function. So if this happens then A. Church's thesis was equal to Turing's, which was "Church-Turing Thesis", ie, computable function equals to general recursive function equals to λ − definable function equals to Turing computable function. The proposal of "Church-Turing Thesis" became a milestone in the history of computer, reaching an unprecedented high level of human knowledge of computable function and the law of computation. Learning about this background is necessary for students to study on computer theories.

C. Learning and study the history of computer science help students to further understand the function of innovation in scientific inventions

The history of computer science is an epic of unceasing innovations. From mechanical computer, electromagnetic field computer to today's digital electronic computer; from Fortran, ALGOL, SIMULA, Smalltalk to C++, Java; from the earliest ARPANET to Internet…, every improvement is nothing but the result of innovation. Having this in mind, students can have a better understanding of the proposition that innovation is the soul of scientists and the power for the development of science.

D. The history of computer science enables students to have an overall and profound understanding of computer science the proper and the related factors

Currently, computer science and technology has already played its role in every field of social life, bringing about a great change to our world. However, we should fully be aware that like other high technology, computer science and technology is a double-edged sword, creating fortune and providing power for nature remaking and at the same time causing us a series of legal, ethical and cultural issues and the problem of resource wasting.

It can not be denied that when the turbulent surge of innovation revolution rushes towards us, we are not fully prepared in mind and strategies for the great changes and influence caused by science and technology. For instance, facing the phenomena of "web culture", "information security", "computer crimes" and "intellectual property protection", we do not have a powerful system of supervision, regulation and punishment, needless to say a sound system of laws and rules.

Now, the virtual world of cyberspace is in a state of chaos, cyber games and pornography are poisoning juveniles like a kind of spiritual opium, causing great anxiety and uneasiness among people; cyber fraud and virus are happening ever minute, causing enormous harm to our society; the issue of intellectual property in the cyber environment is far more complicated than it was in the industrial times, for example, cyber patent, copyright of digital product, fair use of information, and the implication of the law on intellectual property in cyber times all need careful study. It has become a global problem calling for joint efforts of all countries all over the world to standardize cyber language, resist cyber virus and build an ordered, healthy, civilized and lawful cyber world.

Pondering on the information technology revolution and the existing problems can help people get a more detailed and profound understanding of science and the related factors so as to better develop science and implicate science; can help people fully understand the law of the development of science and technology and its characteristics so as to create a good environment for the development and innovation of science and technology; can help people follow the scientific concept of development, properly handle the relationship between science progress and economic development so as to realize a sustainable development of the whole world.

III. CONSTRUCT A CURRICULUM CONTENT SYSTEM ORIENTING CULTIVATING STUDENTS' OVERALL QUALITIES AND INNOVATIVE ABILITY

In the light of the above thought and the basic requirements of computer science education, and in accordance with the logical relationship between "background of knowledge production, development of knowledge, application of knowledge and problems in the application of knowledge", build a curriculum content system orienting cultivating students' overall qualities and innovative ability. (a) Cultural background for the birth of scientific theories; basic information of the researcher; motive of the research; thoughts and

methods of the researcher; the related rudiments. (b) Revision and improvement of the theory after its proposal; new theory or new problem derived from the proposed theory.(c) Value of theories; application area of theories. (d) The unsettled problems and weaknesses of the theory; solutions for the problems; the current study of the theory and its prospect.

(e) Impact of the theory on economy and society and the derived social problems such as legal, ethic, moral, intellectual property and career problems.

By introducing the definition of computer science, background of the birth of scientific theories, developing process, application areas, current problems and the prospect, let students understand the twists and turns in bringing out a scientific finding, inspiring their spirit and interest for exploration and innovation.

For the first-year computer majors, we should reconstruct the content of subject "Introduction to computer science" and organize the content according to the history of this subject, developing process and knowledge system of this subject. On one hand, present students an overview of the computer theories, keeping a certain difficulty and at the same time supplying as much background information as possible so as to enable students to have a more comprehensive understanding of the basic theories, content system, method and relation with other subjects; on the other hand, present students the historical background of the development of computer science and technology so that they can have a better knowledge of the twists and turns in the development in the last fifty years and scientists' hardships in their work to arouse and strengthen their enthusiasm for science and lay them a methodological foundation for the future research.

For the upper-class students, we choose six subjects: "Programming Language", "Data Structures, Principles of Computer Composition", and "Operating System", "Principles of Database System", and "Computer Network" as subjects for pilot teaching. Based on the main content of the six subjects, we add the related content orienting quality education, focusing on background information of theories and their application. Furthermore, we also compiled the corresponding supporting course: "Principle, Method and Development of Programming Language", "Algorithms and Data Structures", "Principles of Computer Composition and Computer Architecture and Development", "Principle, Method, and Development of Operating System", "Theories, Methods, and Development of Database System" and "Computer Network Technology and Development".

Four points for consideration in the design of content. (a) In accordance with the content system of subjects, through an introduction of the important progresses and inventions of computer science theories of different periods and the main scientists' research and achievements, expound the forming process of the basic theoretical system and the development process of technology so that students can get an overall recognition of computer science. (b) In a way of combining history and theory and using history to introduce theory, from the perspectives of historical features and law of the development of computer science and lessons in the scientific research, expound the features and law in the development process of computer science, relations with other subjects and its promotion for social and economical development. And attention should be paid on scientists' thoughts and methods in the hope of giving enlightenment to students.(c) In the selection of content, highlight the process of finding and developing knowledge, the related cultural background and knowledge standing for the newest level of the subject. Considering the subject system, avoid repetition of content in main subject. (d) Provide students as much background information as possible, and considering senior students' ability of reading foreign materials; attach the theory finder's representative thesis and speeches as well as the source of some classic documents.

IV. RIGOROUSLY RESEARCH FOR EFFECTIVE TEACHING PRACTICE MODE OF COMBINING SCIENCE EDUCATION AND CULTURAL EDUCATION

A. Integrating science and culture education

Discover the humanistic knowledge and spirit from professional knowledge and penetrate them into the teaching of professional knowledge in order to raise students' interest and develop their scientific and humanistic spirits. Specifically, in the explanation of a certain knowledge point, introduce the background of this point, the forming of the definition and its development so as to train students' awareness of innovation; during the teaching process, in the first place we should take students as the most important, respecting their personality and interest; and then teachers themselves should exert good influences on students with their academic learning and dignity, creating a fair, harmonious, democratic and inspiring atmosphere. The ultimate aim of combining science and culture education is to make students comprehend the cultural spirit of science to develop a scientist's ideal personality, which is the highest level of science life.

Improve teachers' cultural quality

Teachers' cultural quality plays a key role in improving teaching quality and carrying out a successful teaching reform. During the years of teaching reform, by various ways such as training class for teachers, study report, teaching demonstration and group preparation for lessons to improve teachers' teaching ability and level. And what's more, take incentive measures to encourage teachers to conduct cultural education in the teaching of professional courses.

V. CONCLUSIONS

Combining teaching practice of computer science and technology majors, the author, in this paper made a tentative study of a new teaching mode which is integrating science and cultural education, fusing quality education in imparting knowledge. He also constructs a new curriculum content system oriented towards developing students' innovative awareness and ability and proposes specific project of carrying out quality education in the teaching of professional courses. This project was conducted successively in the school of computer of Shandong Institute of Business and Technology, College of Computer Science &Engineering of Shandong Construction University, school of computer of Ludong University, and received good results. Over 80% students are supporting this project and 91% think they can not only learn more knowledge but know about scientists' thoughts and methods in this teaching mode.

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