Available online at www.elixirpublishers.com (Elixir International Journal)

Space Science

Elixir Space Sci. 97 (2016) 41999-42001

ISSN: 2229-712X

Cultivating Strategies of Humanistic Literacy for College Physics Undergraduates

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ARTICLE INFO

Article history:

Received: 27 June 2016;

Received in revised form: 27 July 2016;

Accepted: 2 August 2016;

Keywords

Humanistic literacy,

Physics,

Undergraduate.

ABSTRACT

Humanistic education can build students' humanistic literacy which including freedom of thought, moral autonomy and personal authenticity. In higher physics education, both science literacy and humanistic literacy should be developed. The higher physics education can enhance the blend of scientific education and humanistic education, and promote the harmonious development between scientific literacy and humanistic literacy.

1.Introduction

Humanistic literacy plays an important role in the growth of students. Humanistic education is the people-oriented education which can cultivate students' humanistic literacy effectively. It teaches students how to do and what to do to be a citizen. Humanistic education focuses on building personality and spiritual realm. Humanistic education can cultivate students' creative thinking and creativity, help forming good morals, develop imagination and keenness, and perfect students' way of thinking [1]. It is essential for humanistic education to prioritize the value of human dignity, including freedom of thought, moral autonomy and personal authenticity [2-4].

The traditional education of physics in China lacks humanistic connotations, like attitude, method, value, emotion, responsibility, etc, which would cause that the students lose their due knowledge and attention to the problems beside science and more important than science, like society, ethic, ecological environment, etc. The scientism in physics education not only emphasizes science, its significance and function, but also it narrowly emphasizes utilitarian value of science, when humanistic value of science is often neglected. For example, we often emphasize the glorious achievements of development of electromagnetic theory, but not to mention or even to forget the existence of electromagnetic pollution that is severe in real life; we only pay attention to publicize that the physicist contributes to the knowledge system of physics, but we ignore their humanistic concern about the fate of human. Therefore, the humanistic spirit in science and its development is hard to be made widely known and the value of human education in physics science is hard to be realized. This kind of teaching only helps students know science from utilitarian perspective, when it weakens the value of human education in natural science and causes that the humanistic literacy of students is in low standard [5].

Hence, the higher physics education shall enhance the blend of scientific education and humanistic education and promote the harmonious development between scientific literacy and humanistic literacy. Humanistic education focuses more on spiritual value when scientific education focuses more on the instrumental value of scientific and technological knowledge. The organic combination of both can promote the comprehensive development of science literacy. From the view of cultivating students' comprehensive scientific literacy, the humanistic value in higher physics education must be manifested, which is to perform the scientific spirit of seeking truth, facts and innovation in physics education. In addition, in the education, to carry forward the moral value and aesthetic value, cultivate students to pursue good life and perfecting self-value, cultivate a sound personality and fashion of nobility and train students' social consciousness, the students can set up correct view of world, life and science.

2. Cultivating strategies of students' humanistic literacy in higher physics education

2.1 Humanistic education by applying history of physics

Knowledge of physics and the history of physics with physics methodology constitute two parts of physics and they are the essential content of physics teaching. The history of physics contains the scientists' thinking, creating and the development of their hard and joyful understanding, which are more colorful than the content in the textbook, because they have abundant education factors of "imparting knowledge and cultivating people". History of physics is an important material of humanistic education. Through the history, it is easy to combine the scientific education and humanistic education organically.

There are two ways to use the historical materials of physics to conduct the humanistic education. One is to run a special course, History of Physics. The other one is to permeate the history of physics in other professional courses of physics.

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Comparing with the traditional textbooks, New Concept Physics has a large number of historical materials and makes itself more readable and compatible, which is a significant juncture to conduct humanistic education. In the teaching process, we combine relevant knowledge points to introduce the scientists and ideologists' functions and contributions to the development of physics in ancient and modern China. Besides, we will introduce the achievements that the modern scholars have, carry forward Chinese nation's contribution to world-wide civilization and advocate spirit of patriotism. For example, we can introduce emission theory of Newton, undulation hypothesis of Huygens, electromagnetic theory of Maxwell, photon theory of Einstein to wave-particle duality of light to experience the scientists' wisdom and their endeavors in the scientific research process.

2.2 Strengthening scientific method in education

Target orientation of higher science education in China is to train professional personnel (scientist or engineer), who are not only required to master more comprehensive and systematic professional and scientific knowledge and professional skills, but also be required to master the research methods of this subject and the ability of innovation and of solving scientific problems. Therefore, when teaching scientific knowledge, the teachers must pay attention to give education of scientific method to students.

Firstly, we adopt the penetrative teaching method to conduct the education of scientific method, which is, combining with relevant knowledge points in teaching processes of all courses, using penetrative method to teach. Through the teaching of professional courses, when the students learn the physics knowledge, they also gradually learn, know and master some qualitative and semi-quantitative method of science, such as symmetry principle, conservation thinking, dimension analysis, magnitude estimate, simplified model, limiting case, discussion of special cases, etc. Through imitation, teachers' instruction and the textbooks, the students learn some basic scientific methods (not limited to solution approach and strategy). They master the scientific method from the process of solving problems by applying knowledge. By mastering scientific methods, it can promote the students to understand, master and strengthen the learned knowledge and to comprehend the scientific research process deeper. Then the students can well adapt to the requirements of learning field and researching field and possess the ability of lifelong learning.

Secondly, through opening elective course of physics methodology, the teachers lecture systematically to students the research methods in physics. This course mainly consists of three parts: introduction to physics method, conventional method and unconventional method. Through learning this course, the students can have a rather comprehensive and systematical understanding of the common research methods of physics and their functions in the development of physics. In addition, they can master specific physics methods. In the meantime, some scientific thinking training is necessary (including strict logical thinking training and training of irrational and logical creative thinking) to cultivate students to apply methods to solve physics problems and solve creatively.

2.3 Shaping students' scientific literacy in experiment teaching

Physics experiments have the function of comprehensive education: it not only provides specific, visual and picturesque perceptual materials, and it also trains students' experiment skill. Through the experimental activities, the students can learn to understand and master the scientific method of exploring the nature, to cultivate the rigorous scientific attitude, to deepen the understanding of natural phenomena further and to understand the relationship between human and nature. A successful experiment always integrates the experimental people's unusual thinking and his/her research method of analyzing and solving problems. Through the experiment, the students can understand and practice the basic process and method of scientific research. Students engaged in experimental research can understand the important scientific concepts and laws and improve their experimental ability. Besides, the students learn to think rationally about the interaction process between human and nature and set up view of harmony between human and nature.

Experiment teaching of college physics shall not only provide replication experiment, it shall also provide open and comprehensive experiment. An open experiment subject and experiment environment can offer the students a chance to discover, analyze and solve the problem like a scientist in the experimental process. During the process of experiment and research, the teachers can cultivate the students' ability in the following aspects: scientific and clear expression ability of expressing research thought, method and results to others, listening to others, respecting others' experimental work, allowing others; questions and opinions to self experiment process and result, thinking about others' opinions seriously, improving self experimental scheme, getting along with others, communicating and discussing in time, playing the power and wisdom of the team and being true with the experiment report, no data modification and report completed scientifically and accurately. Through an open experimental teaching, the students can broaden their horizon and activate their minds; also, their true scientific attitude, serious work style and gritty volitional literacy can be cultivated. These are all helpful to students to form correct view of science and excellent scientific literacy.

2.4 Developing aesthetic education function in physics education

The scientific beauty in physics has been understood and applied by many physicists. It is the appearance of the active power that human has in understanding nature world. Through aesthetic education in the physics education, the goal is to cultivate and perfect students' structure of aesthetic psychology and to develop their various abilities harmoniously. Although the content of physics teaching is reflecting the law of objective things, what is in it are concepts, formula, law and theorem, with teaching it can present the beauty of structure of physics textbooks, the beauty of application of physics method and the inner beauty of physics laws. From these, the students can comprehend the concision, symmetry, harmony and unity in physics and their understanding to physics knowledge and to the nature can be strengthened. For example, the simpleness and brevity of physics models and the concision and accuracy of physics concepts and laws are the manifestation of physicists' constant pursuit of concision aesthetics; movement and stillness, gravity and repulsion and reflection and refraction all presents the symmetry and unity of physics theories; acceleration and deceleration and the unification of the movement on the ground and in the sky both embody the self-consistency and completeness of the theory. Revealing the truth and the beauty through physics teaching can cultivate the students' mind, make students enhance learning interest, and improve their appreciation of beauty of science realm.

In addition, it can cultivate the students' positive and healthy aesthetic emotion and the ability of appreciating and creating beauty, so that the students' can have a harmonious development between the perceptual thinking and rational thinking.

2.5 Open comprehensive course of communication science with humanism

Opening comprehensive course of communication science with humanism is a effective way to cultivate their scientific literacy and humanistic literacy. The measure can be adopt are as follows: 1) In terms of physics specialty, what should be taken into consideration is the social relevance of the teaching content and expanding the content; set up elective course of physics science and technology and society (STS). 2) Opening some interdisciplinary comprehensive courses that is penetrated with liberal arts and science for students, like the development frontier of modern science and technology, history of science, sociology of science, music appreciation, art appreciation, etc. In the meantime, some professional experts and scholars can be invited to offer academic forum to entire school. Besides, a series of lectures, popular science lectures, science festival, and science and technology competition can be set up to build a physics education environment with strong flavor of humanism.

3 Conclusions

Humanistic education focuses more on spiritual value when scientific education focuses more on the instrumental value of scientific and technological knowledge. Humanistic literacy can help undergraduates develop their thinking and creativity, moral autonomy and personal authenticity. The combination of scientific education and humanistic education can promote the harmonious development between scientific literacy and humanistic literacy.

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