



Exploration on Curriculum Ideology and Politics of Science and Engineering Based on “Interdisciplinary Concept”

Yanbin Zhang^{1,2}(✉) and Zhixiong Chen²

¹ School of Marxism, Beijing Normal University, Beijing, China
zhangyanbin@ncepu.edu.cn

² Department of Electronics and Communication Engineering, North China Electric Power University, Baoding 071003, Hebei, China

Abstract. In order to carry out curriculum ideology and politics, it is necessary to strengthen moral education and cultivate people, but not to apply the same pattern. Therefore, it is required to combine the characteristics of carrier courses with ideological and political education scientifically and artfully. By deeply excavating the characteristics of science and engineering courses in colleges and universities, this study put forward a general curriculum ideological and political model based on “interdisciplinary concept”. In other words, by introducing the concepts of “entropy” and “system”, students can realize the unity of natural science theorems and philosophy and social science laws at the philosophical level. Students of science and engineering should be guided to understand the laws of human social development in the process of studying science and technology, and then they would further identify the high scientificity of the socialist path with Chinese characteristics.

Keywords: Curriculum ideology and politics · Interdisciplinary concept · Science and engineering · Entropy

1 Introduction

Curriculum ideology and politics is to integrate ideological and political education into courses other than theory courses of ideology and politics, and is also an important part of “three-all education” system. The interdisciplinary concept reflects the deep

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relationship among the theoretical construction, operation mode and internal laws of different disciplines. Therefore, it is suggested to use interdisciplinary concepts to build a bridge between scientific theorems and the law of social development, which is conducive to the in-depth development of ideological and political education, and is also a model of curriculum ideology and politics in science and engineering specialty that deserves in-depth study.

2 The Connotation of Science and Engineering Curriculum Ideology and Politics Based on the “Interdisciplinary Concept”

2.1 Definition of “Interdisciplinary Concept”

In this study, “interdisciplinary concept” refers to the existence of the same concept in two or more disciplines at the same time, there is the relevance among connotations in different disciplines, and even the theoretical presentation of the concept has similarity or analogy.

Typical interdisciplinary concepts include “entropy”, “system”, “structure”, etc. The concept of entropy was first introduced by Clausius, a major founder of thermodynamics, and was originally intended to explain thermal phenomena at a macroscopic level and to constitute a formulation of the second law of thermodynamics. Later, Boltzmann proposed the statistical significance of entropy based on the study of the statistical phenomenon of molecular motion of ideal gases, and linked the macroscopic physical quantity of the system with the microscopic physical quantity, and so far entropy stayed in the field of natural science. However, Thomas Pynchon introduced the concept of “entropy” into the field of social science in his book “Entropy”, and explained the profound law of human social development, that is, if a civilization, country, organization or even individual no longer received external energy and information input, it would definitely become more and more involute and tend to dissipate and decay. With the emergence of the concept of sociological entropy, the scope of application of entropy has been greatly expanded. Currently, entropy is involved in physics, statistics, sociology, psychology and management. More importantly, there is a high degree of similarity and deep unity among the connotations of “entropy” in different disciplines, which can be expressed as that isolated systems tend to be disordered and dissipated to a certain extent (entropy production). In other words, the concept of “entropy” makes a deep connection between “the natural world composed of matter, energy and information and the man-made world composed of people and society”. Therefore, from the concept of entropy, it is possible to carry out curriculum ideology and politics deeply integrated with professional courses.

For example, the concept of “system”, which started as a concept of engineering, has gradually become an important methodological concept of philosophy and social science with the development of the times. In particular, under the guidance of Marxist thought, Qian Xuesen created the discipline of system science, proposed that “system theory was the bridge between system science and Marxist philosophy” [1], and insisted on using Marxist philosophy to guide scientific research and scientific and technological organization and management, while fully absorbing and drawing on the latest

achievements of modern science and technology, which provided natural science nutrients for the continued development and improvement of Marxist philosophy. There are many other such concepts, for example, Karatani Kojin, the Japanese scholar, pointed out in his explanation of post-structuralism that “the concept of structure itself was an architectural term” [2].

2.2 The Model of Curriculum Ideology and Politics in Science and Engineering Courses Based on “Interdisciplinary Concept”

Science and engineering, as an important discipline in Chinese higher education, covers the fields of natural science and engineering technology, including various applications and combinations of mathematics, physics, chemistry, astronomy, geography, biology and engineering. There are a wide variety of science and engineering courses with great variation in contents. As a carrier course to carry out curriculum ideology and politics, science and engineering courses have its uniqueness in the disciplinary paradigm, especially in scientific thinking and craftsmanship, it requires strong logic and practicality. All of this leads to the difficulty of carrying out curriculum ideology and politics in them. At present, it is urgent to explore and condense a basic methodology, and to construct one or more modes of curriculum ideology and politics based on this methodology.

In June 2020, the Ministry of Education issued the “Guideline for the Construction of Curriculum Ideology and Politics in Higher Education” (referred to as the “Guideline”), which pointed out that “the ideological and political education resources contained in various courses and teaching methods should be deeply explored, so that students can grasp the laws of development through learning” [3]. With regard to the curriculum ideology and politics of science and engineering, it is very important to dig deeper and select elements that are unique to the science and engineering courses as carriers and are really closely related to ideology and politics. For teachers and students of science and engineering, this ideological and political element should have strong rationality and logical self-consistency in addition to sensibility, and fully convince people with objective laws of social development and progress. Only in this way, teachers and students accustomed to rational thinking can accept it more easily and enhance their identification with the path of socialism with Chinese characteristics.

How to combine the characteristics, thinking methods and value concepts of science and engineering courses with the teaching contents, deeply explore the ideological and political elements in each science and engineering course, and organically integrate them into professional teaching to achieve the effect of educating people? It is required to start according to the characteristics of professional courses, course content and teaching methods of science and engineering. As we all know, science and engineering are based on hypothesis, experiment and practice, especially the curriculum system is based on the logical (mathematical) relationship among basic concepts, and it can be said that concepts are the roots of supporting the whole discipline curriculum. Then, it is suggested to dig deeper into the conceptual and political resources of science and engineering courses, and even some concepts would involve both natural sciences and philosophical and social sciences. Taking the natural advantage of “interdisciplinary concepts”, it is suggested to introduce the connotation and regularity in philosophy and social sciences while talking about the laws of science and engineering, which can greatly promote the construction

of curriculum ideology and politics of science and engineering, and can form a model of curriculum ideology and politics of science and engineering with good applicability and promotion value.

2.3 The Unique Advantages of Educating People with Curriculum Ideology and Politics Based on “Interdisciplinary Concept”

To comprehensively promote the construction of curriculum ideology and politics in all disciplines and majors of higher education, it is the key to combine the characteristics of disciplines and majors and promote the classified characteristics. For science and engineering courses, it is required to teach the scientific spirit and the ability to solve practical problems. In view of this feature, it is difficult to deeply integrate historical materialism and dialectical materialism, the most scientific world outlook and methodology of human society, into science and engineering courses. The “Guideline” pointed out that “in the course teaching, it is better to combine the education of Marxist positions, viewpoints and methods with the cultivation of scientific spirit to improve students’ abilities to correctly understand, analyze and solve problems” [3].

The curriculum ideological and political model based on “interdisciplinary concept” emphasizes the similarity or unity of a concept in science and engineering theorem and ideological and political law. By comparing and introducing the connotation expression in the field of natural science and social science, this study looks for the universal law of science and engineering and human growth. This curriculum ideological and political model can not only enable students to quickly connect different fields and seemingly unrelated contents, but also promote the coordinated and comprehensive progress of humanistic and scientific literacy, and help shape students’ highly integrated world outlook and values.

General Secretary Xi Jinping has stressed that “it is necessary to educate and guide students to correctly understand the general development trend of the world and China, understand and grasp the historical inevitability of human social development and the historical inevitability of socialism with Chinese characteristics from our party’s exploration of the historical development and great practice of socialism with Chinese characteristics, and constantly establish the belief of striving for the lofty ideal of communism and the common ideal of socialism with Chinese characteristics” [4]. In science and engineering courses, by telling students the philosophical and social scientific significance of the “interdisciplinary concept”, especially the law of social development and the law of human growth, students can be guided to consciously compare the objective law of natural science with the law of human growth in social science through the “interdisciplinary concept”. Combined with the great practice of building socialism with Chinese characteristics, students can deeply understand the objective law of the future development of the world such as the community of shared future of mankind, and the ideological and political effect of moistening things silently would be realized.

3 Three Unities of Curriculum Ideology and Politics in Science and Engineering Based on “Interdisciplinary Concept”

With the “interdisciplinary concept” as the core, the natural sciences is organically connected with the social sciences and Marxist philosophy, bridging the gap between disciplines and introducing students of science and engineering to a new integrated world. In other words, the knowledge of each discipline is not clear-cut, and the disciplines are only “boxes of candy” formed in the process of discovering knowledge, which will keep changing over time. True knowledge, whether in the natural sciences or in the philosophical and social sciences, is unified at a deeper level. In addition, it is possible to educate and guide students to deepen their knowledge, broaden their horizons, and improve their realm while experiencing the power of Marxist truth more deeply.

3.1 Adhering to the Unity of Political and Scientific Rationality and Increasing the “Depth” of the Curriculum Ideology and Politics

Interdisciplinary concept can make up for the lack of depth of knowledge in ideological and political education in engineering courses. General Secretary Xi Jinping pointed out in the ideological and political work conference of colleges and universities that “it is very necessary to provide ideological and political theory courses in elementary and secondary schools and universities in a gradual and spiraling manner, which is an important guarantee for training generations of socialist builders and successors” [3]. In other words, China’s ideological and political education well reflects the value and socialist ideology. On the other hand, it must be admitted that compared to ideological and political education which focuses on politics, knowledge and value at all stages of primary and secondary schools, ideological and political education in universities should be strengthened in terms of scientific rationality, especially the construction of connotations in curriculum ideology and politics.

At present, most colleges and universities attach great importance to curriculum ideological and political construction. The weakness lies in the insufficient ability of teachers to carry out curriculum ideological and political construction. If the curriculum ideology and politics is carried out purely by teachers spontaneously, there will be two phenomena, such as insufficient connotation of ideological and political education, poor integration of ideological and political elements and curriculum. In particular, compared with the ideological and political teachers, most of the science and engineering teachers do not have the knowledge background of ideological and political education. Their understanding of ideological and political education often stays in the patriotism, moral education and even inspirational education at shallow level. It is difficult to tell the scientific rationality and regularity of the ideological and political elements in the professional classroom of science and engineering. At present, some ideological and political courses of science and engineering are about the growth experience and inspirational stories of discipline founders and well-known experts, and even have the tendency of entertainment. This kind of curriculum ideology and politics with insufficient scientific rationality and connotation would make college students who have a wide range of knowledge, active thinking and critical thinking difficult to recognize the necessity

and legitimacy of curriculum ideological and political education in professional courses from the bottom of their hearts.

Besides, expanding the connotation of philosophy and social science of the concept of this discipline in the classroom of science and engineering can not only increase the scientific rationality of curriculum ideology and politics in the courses of science and engineering majors, but also give full play to the function of political guidance. Moreover, this kind of political guidance is not a simple political propaganda, but persuades students with the common regularity of natural science and social science. Marx said, “as long as the theory is thorough, it can convince people” [5]. If students learn the law of entropy increase in thermodynamics (if an isolated system does not produce heat exchange or work with the outside world, the energy in the system tends to dissipate) while experiencing the law of entropy increase in Sociology (a closed country or civilization is easy to fall into involution), and compare the history of seclusion during the period of the late Qing Dynasty and the history of reform and opening up in New China, students will naturally highly agree with the basic national policy of “deepening reform and opening up”, and deeply understand “the Belt and Road Initiative” and “the community of human destiny” to promote global integration. This kind of curriculum ideology and politics unifies politics and scientific rationality, so that students can convince the power of truth from the bottom of their hearts.

3.2 Adhering to the Unity of Explicit and Implicit Education and Enriching the “Dimension” of Curriculum Ideology and Politics

General Secretary Xi Jinping emphasizes that “it is required to adhere to the unity of explicit and implicit education, explore the ideological and political education resources contained in other curricula and teaching methods, and realize the three-all education” [8]. It can be said that explicit education such as instilling values in ideological and political education and implicit ideological education in other forms promote the fundamental task of “strengthening moral education and cultivating people” from different dimensions. At the same time, the “three-all education” of all-people, all-process and all-round education and “ten-field education” systems of curriculum, scientific research, practice, culture, network, psychology, management, service, financial support, and organization aim to coordinate all fields of school governance, all aspects of education and teaching, and all aspects of talent training from multiple dimensions to build an integrated education system and realize the synergy and cooperation of ideological and political education.

The explicit ideological and political education is a common dimension in the curriculum ideology and politics of science and engineering. For example, in professional courses such as fluid mechanics and automatic control principles, students are told about the profound patriotism of Qian Xuesen and other scientists of old generation and their significant contributions to the development of science and technology in new China, which is a good kind of explicit ideological and political education. At the same time, when introducing the concept of “system” in control theory to students, teachers can explain the concept of “system” in engineering cybernetics and system engineering and the philosophical and methodological significance of the concept of “system” in the field of system science, which helps students understand the system thinking and dialectical

thinking emphasized in Xi Jinping's socialist thought with Chinese characteristics in the new era. These are educations for students from the dimension of implicit ideological and political education. Due to its own characteristics, the synergy of explicit and implicit dimensions of education would be achieved with the application of the model of curriculum ideology and politics based on "interdisciplinary concept".

3.3 Adhering to the Unity of Uniformity and Diversity and Expanding the "Breadth" of Curriculum Ideology and Politics

Xi Jinping stressed that to promote reform and innovation in ideological and political theory courses, it is suggested to enhance the ideological and theoretical level, affinity and relevance of ideological and political courses. At the same time, it is necessary to adhere to the unity of diversity and uniformity, implement the unified requirements of teaching objectives, curriculum setting, the use of teaching materials, teaching management and other aspects, and make adjustment according to local conditions, the times and aptitudes [4]. Similar to ideological and political course of reform and innovation, the construction of curriculum ideology and politics must adhere to unity and diversity if it is to continue to go deeper. The curriculum ideology and politics of science and engineering should have unity in methodology and have diversity due to different courses. That is to say, it is required to explore the ideological elements and characteristics and individuality of resources in each course.

A mature and perfect model of curriculum ideology and politics of science and engineering needs to balance unity at the level of methodology and diversity at the level of specific contents. In contrast to the ideological and political classes with unified syllabus and teaching materials, there is an urgent need to find a more general methodology for curriculum ideology and politics, which is related to the logical starting point and construction standards of curriculum ideology and politics. The curriculum ideology and politics based on "interdisciplinary concept" takes the "interdisciplinary concept" as the logic starting point and the "fusion of the laws of natural sciences and philosophical and social sciences" as core, which is used to refine a relatively unified methodology for the curriculum ideology and politics of science and engineering. For each specialized course, teachers should try to create a special feature for each course according to different concepts in different courses, and fully reflect the diversity of the curriculum ideology and politics.

4 The Practical Value of Carrying Out Curriculum Ideology and Politics in Science and Engineering Courses Based on the "Interdisciplinary Concept"

Compared with ideological and political courses, which emphasize the education of beliefs and values, curriculum ideology and politics should highlight its practicalness and focus on profound practice in combination with scientific thinking education and the existence of today's society. As Marx uncritically criticized the ideal philosophers in his "Theses on Feuerbach", "philosophers interpret the world in a different way, but the problem is to change it" [5]. Once ideological and political education loses its

practicality, only falsehood, emptiness, and counterfeit remain. Besides, once curriculum ideology and politics lose its practicality, it would easily degenerate into formalism or even entertainmentism. In contrast, the model of curriculum ideology and politics of science and engineering based on “interdisciplinary concept” has a strong practicality as its basic concept is rooted in the development of science and technology and the progress of human society.

4.1 Helping Guide Teachers and Students to Think Deeply About the Ethics of Science and Technology

Since the beginning of the new century, with the rapid development of artificial intelligence, big data, cloud computing, blockchain, Internet of things, new energy and new materials, the development of global science and technology has been accelerating, and breakthroughs in the fields of science, technology and engineering under the interdisciplinary integration have been made. However, while new scientific discoveries and engineering technologies bring benefits to mankind, their safety risks and ethical challenges are becoming increasingly prominent, which have a profound impact on the existing social governance system and even the way people exist in the future. While the world is immersed in the carnival of losing direction after the peace between science and technology and capital and only pursuing the exponential expansion of both sides, many scientists and engineers are also addicted to the materialized world they “create” and firmly believe in the natural fairness and justice of science and technology, so “science and technology are increasingly alienated into ideology” [6]. Therefore, it is particularly important for scientists to carry out the ethical education of science and technology in the future. The curriculum ideology and politics based on the “interdisciplinary concept” can guide teachers and students to understand the value and significance of human society and individual existence while learning scientific theorems and technical formulas. Through value and ethical reflection, they can penetrate the fog of scientific teleology and technological determinism, and move towards communism with people’s own happiness and liberation as the ultimate goal.

4.2 Helping Carry Forward the Spirit of Scientists and Great Country Craftsmen

Science and technology has become the core driving force of development and the core competitiveness of the country. At present, a preliminary consensus has been reached worldwide on this, which is directly manifested in the increasing investment in scientific research and engineering technology development and the increasingly fierce competition among countries. To develop science and technology, the first thing is to cultivate talents. People who have cultivated the talents, people who can decide the future. According to the National Science Foundation, 79.4% of Chinese students who received their doctoral degrees in the United States in 2018 intend to be employed in the United States. Regardless of the reliability of the survey data, it is an indisputable fact that a large number of Chinese international students have stayed in the U.S. for decades after graduation to pursue research careers. There are certainly many reasons for this, but the most important is that they do not establish strong beliefs and values during their college years and could not identify with the Chinese political and economic system and cultural

traditions from the bottom of their hearts. In September 2020, General Secretary Xi Jinping discussed in detail the connotation of “patriotism” and “spirit of innovation” in the spirit of scientists at a symposium for scientists. The curriculum ideology and politics of science and engineering based on “interdisciplinary concept” can enable students to fully understand the logical relationship between the patriotism in the spirit of scientists and the spirit of great country craftsmen and the exploration of truth, innovation and creation. The former is the goal and direction of the latter, while the latter is the means and method of the former. The combination of the two is indispensable.

4.3 Being Conducive to the Integration and Mutual Promotion of Ideological and Political Education and Professional Education

With the continuous promotion of curriculum ideology and politics, there are more and more paradigms of curriculum ideology and politics. However, the most common curriculum ideological and political paradigm of science and engineering is to add the struggle deeds of discipline founders and famous scholars in the introduction of professional courses, or introduce the great achievements made by China in this professional field in combination with history and hot events. This timely introduction of some ideological and political elements into the professional classroom can indeed stimulate students' patriotic enthusiasm and encourage students to devote themselves to professional exploration, but it does not help the theoretical learning of the professional course itself. The curriculum ideological and political paradigm of science and engineering based on “interdisciplinary concept” is characterized by its logical continuity and structural integrity. On the one hand, it fits in with the highly organized and logical thinking of science and engineering students, and is easily accepted and internalized by them. On the other hand, teachers and students can not only receive ideological and political education, but also in turn deepen the understanding and mastery of relevant concepts in the original carrier courses because of the similarity of interdisciplinary laws, so as to promote the teaching effect of the original carrier courses and realize the “mutual integration and promotion of professional education and ideological and political education”.

5 Conclusion

As the world is facing the unprecedented changes in the past hundred years, the education of worldviews, values and scientific thinking methods for university students is particularly important, and it is related to the issue of “what kind of person” to cultivate. There are a higher proportion of science and engineering students in China. The education for university students should not be limited to the level of professional education in natural sciences, but should emphasize value guidance, that is, to organically integrate the objective laws of faith formation and moral development into professional education and seek the grand unification at the philosophical level. The model of curriculum ideology and politics based on “interdisciplinary concept” would be very useful in this regard, promoting the integration of social science and natural science to cultivate talents with both political integrity and professional competence.

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