

Research on problems of engineering textbooks construction for applied undergraduates

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Abstract: Textbooks are the carriers of knowledge, and superior textbooks are the key factors for universities and colleges to carry out high-quality teaching activities. There are significant differences between applied undergraduate and traditional undergraduate in engineering education. From the aspects of content and system, engineering application, novelty, and textbook resources, the problems and their causes of the current engineering textbooks for applied colleges are analyzed in this paper. Only by fully recognizing the defects of existing textbooks in the use process, can we contrapuntally adjust their construction path, innovate the writing style and form, and the role of textbooks can be better played in talent training.

1. Introduction

Engineering education is closely linked with social production, because it provides a large number of high-quality talents of different types to support social production and industrial development [1]. With the rapid economic development in China, profound changes have taken place in social demand and talent supply, and the demand for high-level applied talents is further increased. Nevertheless, the structural contradiction of China's higher education is quite prominent, and the tendency of homogenization is serious. The structure and quality of talent training can no longer meet the requirements of economic restructuring and industrial upgrading. For solving this problem, the State Council and the Ministry of Education have issued a series of documents to improve the training system for high-level applied talents and guide the transformation of some ordinary colleges and universities with qualified condition into applied ones [2].

The applied undergraduate is a type of higher education different from the traditional academic undergraduate, and its training goal is targeted at high-level applied talents in professional fields to solve misplacement between higher education and social demand. Since in the applied colleges, the number of engineering students accounts for a considerable proportion, improving the quality of their engineering education plays a significant role in advancing social and economic development.

Textbook is the most basic and commonly used tools in students' learning process, and also is the main basis for teachers to carry out teaching work. It is self-evident that high-quality textbooks are of great importance to the major development and teaching quality of colleges and universities.

However, textbooks construction does not meet the current industrial requirements for applied personnel. Studying the problems existing in the engineering textbooks for applied undergraduate, analyzing the causes of these problems, is of great significance to adjust the compilation ideas and innovate implementation paths of applied undergraduate textbooks for promoting its reform of teaching and giving better play to the role of textbooks in talent training.

2. Existing problems in applied undergraduate textbooks for engineering majors

Currently, there are many kinds of engineering textbooks titled "for applied undergraduate". However, the compilation quality of such textbooks, especially those of specialized basic courses, is generally not high. The author has made a comparison between some textbooks of specialized basic course in mechanical major for applied undergraduate from Huazhong University of Science and Technology Press, Dalian University of Technology Press, Nanjing University Press and other publishing houses, including Mechanical Design, Engineering Mechanics, etc., and found that the structure and content of the textbooks for the same courses from these publishing houses are very similar, which only minor adjustments have been made in the chapter order, name and some contents. There are very few high-quality textbooks that are really suitable for applied undergraduate teaching, and innovative textbooks can hardly be found. here generally exist a few problems as follow in the textbooks of engineering majors.

2.1. The content and system are similar to those of traditional undergraduate courses.

The research university in China mainly cultivate academic talents. Many application-oriented undergraduate textbooks follow the compilation system of research-oriented undergraduate textbooks, with similar forms and contents, only have simply been deleted and adapted based on these textbooks.

There are obvious differences between application-oriented colleges and research-oriented universities in talent training goals, and there are also significant differences in source of students. The research universities set up the curriculum system with the main goal of cultivating academic talents, while the application-oriented colleges mainly cultivate the front-line applied personnel in production and service rather than scientific researcher. For the same course, there is a big difference in teaching requirements and class hour allocation between the two kinds of personnel. Among them, teaching in research universities covers more comprehensive knowledge system and more in-depth content.

Due to the lack of appropriate textbooks, a considerable number of applied colleges usually use the research-oriented undergraduate textbooks. These kinds of textbooks are too difficult and too much content for applied undergraduates, which are not inconsistent with the training goals of applied talents. Taking "Refrigeration Principle and Device", a core course of energy and power major, as an example, many application-oriented colleges choose "Refrigeration Principle and Device" edited by Zheng Xiande, or "Refrigeration Principle and Equipment" edited by Wu Yezheng, as their textbooks. Most application-oriented colleges have set only about 40 class hours for this course, and these textbooks are compiled according to more than 60 class hours. So teachers usually only select some contents to teach, which has caused a certain degree of obstacles to teachers' teaching and students' learning.

2.2. The application consistent with the applied talent training goal is not highlighted.

Higher-level applied talents are the orientation of applied undergraduate college. The school running characteristics of applied undergraduate colleges and universities are to establish a talent

training process led by improving practical ability, and realize the docking of professional chain and industrial chain, curriculum content and professional requirements, teaching and production, industrial talent training and technological innovation needs [3]. That is to highlight the practice and application required by industry.

However, the outstanding problems of current textbooks for applied undergraduate are that theory is emphasized and practice is neglected, knowledge is emphasized and ability is neglected, principle is emphasized and occupation is neglected. The textbooks tend to lay particular emphasis on the construction of discipline theories, but ignore the application of theories to solve practical engineering problems; attach importance to the description of knowledge, but neglect to lift application ability; and attach importance to the explanation of basic principles, but hardly involve some key technologies, difficult processes, etc.

Although many textbooks for applied undergraduates state in their forewords that theory is integrated with practice, and application is highlighted; but the application in these textbooks is just some simple examples or calculations for specific problems, which is far from the required connection with industry, occupation and production. This leads to the disconnection between the content of textbooks and the actual production and service of enterprises, seriously weakens the practical ability of college students, which deviates from the purpose of cultivating applied undergraduate talents.

2.3. The presentation of new knowledge and technology lags behind.

Obsolete content is an obvious problem in the engineering textbooks for applied undergraduate, which is also a common in college textbooks. There is a sizable gap between some technologies, methods, views, applications, etc. in the textbooks and the latest scientific and technological development, but they are still full of textbooks. It brings the dilemma of "knowledge is outdated once students are out of college". Moreover, new technologies, applications and methods emerging in the industry have not been incorporated into the textbooks in time.

Take the textbooks of specialized course "Refrigeration Principles and Devices" as an example. GSHP is an air-conditioning technology with energy-saving and environmental protection features that is widely used at present, but the textbooks, including some classic textbooks, does not include it. Heat recovery technology is a new technology to improve the utilization rate of heat energy, which is not introduced in most of the "Refrigeration Principle and Device" textbooks; some textbooks involve this part of content, but only in a sentence or two. [4]

Higher education is a process for college students to face the future career directly. The use of outdated textbooks causes the teaching content not to keep pace with the dynamics of disciplines and technological frontier, and there is a huge difference with the latest standards and development of the industry, which ultimately leads to the teaching being inconsistent with social demands for college students, it is "what they have learned is useless, and what to use is not learned", which weakens their vocational adaptability.

2.4. Supporting teaching resources are too simple or single.

At present the digital resources of textbooks for applied college are not perfect. Many textbooks are equipped only with PPT made by simply copying some words and figures from the textbooks.

For a single paper textbook, there are following limitations to teaching. Firstly, only a limited amount of space can be used to discuss the subject content, so that the key teaching content and difficult problems cannot be explained thoroughly. Secondly, knowledge content can only be presented in a static way, which makes it impossible to carefully observe complex equipment structures, intuitively describe the working principles and processes that are difficult to understand,

and dynamically display application scenarios. Thirdly, the interval between the revision cycles is at least 3 years, some of which is more than 5 years, which makes new technologies, new knowledge, new methods and other contents unable to be compiled into the textbooks timely, nor into the classroom. Now and future, paper textbooks cannot solve all problems in teaching.

3. Causes of problems in applied undergraduate textbooks for engineering majors

For a long time, the compilation of college textbooks is usually completed by college teachers. There are many causes for the problems of applied undergraduate textbooks, including both the factors of compilers and the way of soliciting contributions. The main reasons are as follows.

3.1. No grasping the connotation of the training objectives of applied undergraduate talents

The construction of application-oriented colleges in China started relatively late and developed far behind the traditional research-oriented universities. In the beginning, the training model of research universities was generally followed, and many teachers had vague understanding of the specific objectives and connotation of applied undergraduate training. In addition, these teachers also graduated from research universities, inevitably bringing the concept of academic talents into the textbooks. In the process of compiling, the authors referred too much to the textbooks of research university, which made the applied undergraduate textbooks become "reprints" of them. Finally, the level of the compilers is uneven, which is also an important cause of numerous low-level similar compilation.

The goal of talent training determines the content of teaching materials as well as the content of teaching. It is precisely because the compilers are not clear about the talent training goals, and correspondingly they do not thoroughly understand the features of applied undergraduate talents, which also leads to the unclear characteristics and inaccurate positioning of textbooks.

3.2. Single object of solicitation

For the compilation of textbooks, the publishers only solicit contributions from teachers according to the original fixed mode. "Practice and Application" is the outstanding characteristic of the applied undergraduate for engineering. However, most college teachers have no practical experience in enterprises, are not closely connected with the industry, and do not know what kind of talents the enterprises really need. As a result, Cases and materials about application of textbooks are not only not targeted, but also have a great deviation from the actual production. As college teachers do not have more opportunities to go deep into the enterprise, their understanding of industrial technology in relevant fields has remained many years ago, so that new knowledge and technology cannot be discussed in the textbooks timely. If the compilation is completed only by college teachers, the content will not be close to the industry and not meet its needs.

3.3. Lack of thinking and research on textbooks

In colleges and universities, it is a common phenomenon that textbooks are selected by the teachers, and are almost unchanged for several years to avoid the trouble of preparing lessons repeatedly. After receiving solicitation contributions, many teachers rarely actively think and study the textbooks, and compile them according to the content that have been used for teaching for many years and are very familiar to themselves. Additionally, they pay little attention to the latest development of disciplines and corresponding technologies, which results in a lack of innovation in textbooks, or even a rough compilation.

With the development of the times and the continuous iteration of information technology, the teaching methods in colleges are evolving, and the ways for students to obtain knowledge are also becoming diversified, therefore textbooks are no longer just traditional "paper materials for students to remember and understand". Teachers' lack of thinking and research on textbooks will inevitably lead to the "simplification" and "traditionalization" (i.e., there is a lack of innovation in the content, style and form) in the construction of textbooks. Teachers are the decisive factor of talent cultivation. "What kind of textbooks are helpful for teaching and learning?" and "What kind of textbooks supporting resources need to be equipped?", all these require authors to spend a lot of energy to think and research.

4. Conclusions

Textbooks are an important part of curriculum resources. The engineering textbooks of applied undergraduate ought to be improved according to the problems analyzed in this paper, that is, the content ought to conform to the orientation for applied undergraduates, reflect application characteristics, synchronize with the development of science and technology, and develop the teaching resources corresponding to the paper textbooks. At the same time, in view of the above-mentioned causes of the problems in textbooks, we should explore a new mode of soliciting contributions and select the appropriate authors, so as to compile textbooks that meet the requirements of engineering teaching for applied undergraduate.

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