Adult and Higher Education (2023)
Clausius Scientific Press, Canada

DOI: 10.23977/aduhe.2023.050114
ISSN 2523-5826 Vol. 5 Num. 1

Research on Innovation Curriculum Reform for Training Innovative Mechanical and Electronic College Students under the Background of Emerging Engineering Education

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Keywords: Science innovation course, mechatronic engineering, innovative teaching reforms

Abstract: Under the background of emerging engineering education, it is meaningful to explore a kind of innovative science innovation course to mobilize students' learning enthusiasm and develop skills in which theories is applies to practice. By combining the curriculum with the discipline competition and the enterprise's demand for the skills of mechanical and electronic talents, this paper conducts an study intensively on the teaching scheme and method of science innovation courses which is consists of such four aspects as "preparatory work", "course content", "course assessment" and "expected results", and finally proposed some specific innovative teaching reforms.

1. Introduction

From the trade friction between China and the United States which has been escalated in the past few years, it is found that the comprehensive national strength depends on the ability of scientific technological innovation. Talent is the most important carrier of scientific and technological innovation, and talent innovation and training is the inevitable trend of national and social development [1-3]. Colleges and universities are the key places for cultivating innovative college students and college basic courses are the guarantee for cultivating students' basic abilities. The science innovation course is a bridge connecting the innovation course and the basic course, stimulating students' innovation and creativity ability, and an important means to implement the innovation education.

Compared with other disciplines, mechatronics engineering is an emerging discipline with potential, difficult and comprehensive. Students of mechanical and electronic disciplines not only need to master the knowledge of mechanical engineering, but also need to integrate microelectronics technology, information processing technology and so on [4-6]. Only in this way, can they be competent for future design, manufacturing, production and other jobs, which is requiring comprehensive talents. Therefore, the teaching and training of students of mechanical and electronic disciplines have very high requirements for the quality of integrated practice teaching [7-9]. Although

students have mastered the basic skills through regular basic curriculum training, they still lack the practical experience and the ability to connect other subjects. Mechanical and electronic science innovation course is a comprehensive teaching course that integrates design, manufacturing and production quality inspection. It not only requires students to master the operation of basic manufacturing equipment and application software, but also requires students to deduce the influence of various design parameters on the surface quality of the manufacturing parts through the theoretical knowledge learned in class. Therefore, the scientific innovation course of mechatronic engineering plays an important role in mobilizing students' enthusiasm, connecting theoretical knowledge and practical skills, which has significant meaning and could never be replaced in the teaching activities of cultivating students' innovation and creation ability.

Mechatronics engineering as an alternate application course is developed under the background of "emerging engineering education" in Guangdong Province, China. In order to ensure the implementation and reform of the innovative talents training, this paper mainly focuses on the reform of the mechanical and electronic science innovation course, and proposed a series of reform on its teaching content, teaching mode and curriculum system. By doing this, this article intends to cultivate innovative talents in accord with the target of the emerging engineering education background.

2. Measures of Teaching Reform

2.1. Establish a Complete Curriculum Content System Based on Measurement, Manufacturing and Testing

Considering mechatronics engineering as an discipline with potential, difficult and comprehensive, and in order to let students have a more comprehensive understanding of each course, this paper starts from the manufacturing process of rotating parts of machine tool, including measurement, manufacturing and detection. Through hand-held laser measurement, students are asked to obtain the three-dimensional of the model, and the electronic assembly model of the workpiece are built through the three-dimensional software and imported into the 3D printer. By adjusting the parameters of the 3D printer, each part of the model is manufactured and then be assembled. Finally, the precision measurement of the dimension of the model is carried out by the coordinate measuring instrument. The whole course content mainly includes the following aspects: measuring the 3D size of the workpiece with the handheld laser, drawing the model with SOLIDWORD or other 3D software, printing the design model with the 3D printer, assembling the parts, and measurement of the accuracy of the model with the coordinate measuring instrument.

2.2. Combining the Science Innovation Courses with the Discipline Competitions

Mechatronics engineering is an application discipline. Students' ability of practical operation is an important indicator to test whether the course content has been well implemented. The discipline competition is the best platform to test students' practical operation ability. This course analyzes the demands of mechanical innovation competition, robot masters competition, electronic design competition and other competitions, and provides students with technical guidance of the competition through the form of exchange meeting. For example, the technical guidance would include the design of the mechanical parts, the assembly technique of each part of the machine, the design of the interface software, the detection of the dimensional accuracy of the mechanical parts and so on. The reform of the course mainly includes the following aspects: the research of manufacturing method, the research of assembly technique, the control method for mechanical and electrical devices, the static and dynamic indicators of mechanical devices.

2.3. Evaluation System

This examines of the course will not only focus on students' operation of specific instruments, but will adopt a combination of operation and course design. The object of the examines is not unified, so the students can freely select a key component of the machine tool for analysis and research. The course design and operation section mainly includes measuring and drawing the size of the workpiece, printing and assembling the workpiece, and measuring the accuracy of dimension of the workpiece. The content of the analysis part mainly includes the analysis of the technique of the assembly process, the influence of the parameters of the machine parts on the final molding quality. The evaluation system mainly includes the following aspects: students' actual technique of operating instruments, the processing precision of the workpiece, workpiece design and process analysis.

3. Implementation Scheme

Based on the analysis of the characteristics of mechatronic engineering students and the needs of local and nearby enterprises for specific talents [10], with the help of the internet and other information method, according to the syllabus requirements of science innovation projects, this paper proposed a comprehensive systematic courses which is consists of such four aspects as "preparatory work", "course content", "course assessment" and "expected results". And then exploring ways to cultivate innovative students, the project are shown in Figure 1. The following is the four sections proposed in this paper.

3.1. Preparatory Work

Firstly, the course will organized field trips to factory which need mechanical and electronic talents. By analyzing the needs of factory and reading literature and academic papers, the content of the course is set to process the typical workpiece which is required by the enterprise. The main content of the measurement, processing and detection methods of the workpiece would be recorded into the internet learning tools such as Wechat and Dingding classroom in advance.

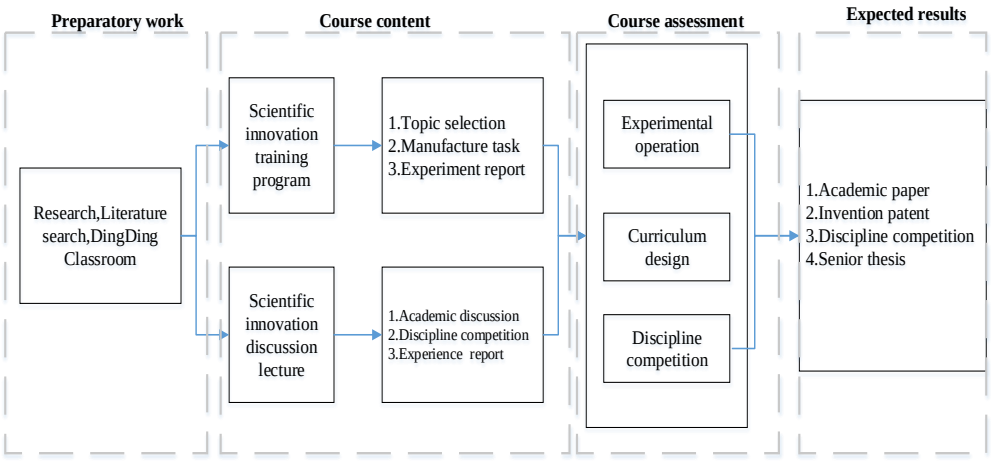

Figure 1: Implementation scheme

3.2. Course Content

The course content is divided into two parts: practical operation training and extracurricular communication and discussion. For the practical operation training, the operation training of 3D

printers, laser scanners, three coordinate measuring machines and other instruments was arranged. Let the students independently select the machining model. Then, through the computer aided design software and the content of the instruments learned in the course, Let the students carrying out the machining task. Finally, according to the quality of the workpiece, write an experiment report for discussion. For extracurricular communication and discussion, academic exchanges will be held to discuss the assembly requirements and processing technology for the typical workpieces, and analyze and discuss the performance indicators of the instruments learned in the course and their application occasions. The applicability of experimental equipment to mechanical and electronic discipline competition is discussed. Finally, students are assigned to write their experiences, make their thinking, and combine the course content with the discipline competition.

3.3. Course Assessment

The course assessment is divided into experimental operation, course design, and experience report. The points are allocated in the form of 20%, 50% and 30% respectively. The course mainly evaluates students' understanding of the whole set of production and processing process of the workpiece, and also examines students' ability of analogy and innovation, so as to stimulate students' enthusiasm for discipline competition.

3.4. Expected Results

The assessment of the course content is mainly by analysis and research and supplemented by practical operation. Inspire students to create, and implement in the discipline competition and graduation thesis with their creativity. By the form of participating in the discipline competition, students are encouraged to innovate, and make a research for manufacturing method, control method and other aspects, and write the invention patent or utility model patents. Encourage students to analyze and study the performance of the prototype, discuss the improvement of the prototype, and promote the enthusiasm of students to write the research paper.

4. Conclusion

The main application of this science innovation course is for the undergraduate mechanical and electronic students, and can be extended to other engineering majors with strong applicability. For students, this course can promote students' innovation, and motivate students' learning enthusiasm, and then inspire students to write patents, academic papers and participate in discipline competitions. For teachers, this course can improve quality of teaching, inspire enthusiasm to write educational reform papers and apply for educational reform projects and other activities. For enterprises, a number of talents with enthusiasm and innovation have been cultivated in advance. The research scheme of this teaching reform project can be applied to other engineering major teaching activities with strong applicability. It has strong extensibility and can flexibly change the teaching objects according to the actual needs of enterprises. Through the training of enterprise, obtain the enterprise's financial support. For the new technique, new demands can be flexibly changed in the teaching content, so that the course content will not be outdated due to the passage of time, which is not suitable for the development demands of students, which would reduce the enthusiasm of students. For the training of students in discipline competitions, students can also be partly trained according to the program in this paper.

Acknowledgements

The authors would like to express their sincere thanks to the supported by The Educational reform project Foundation of Huizhou University (No. X-JYJG2021008).

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