Instructional Design of the Course Based on the Mechanism and Process for the Cultivation of Application-oriented Talents

Guangchun Yang

School of Intelligent manufacturing, Panzhihua University, Panzhihua, Sichuan, 617000, China
1297208354@qq.com

Abstract. This essay starts from the analysis of the characteristics of the course of “Mechanism Technology”, reconstructs the teaching content of the course, breaks the boundaries of the textbook chapters and deals with them according to the order of practical engineering application, combines the classroom teaching method of “teaching-analysis-discussion-application”, and organically combines the classroom theoretical teaching and practical links. Practice has proved that teaching around the cultivation of students' engineering application ability will greatly improve student’s engineering application ability.

Keywords: mechanism technology; course teaching; capacity building; instructional design.

1 Introduction

As an application-oriented local undergraduate college, it is necessary to focus on cultivating students to have basic knowledge and application ability of mechanical design and manufacturing, and be able to engage in design and manufacturing, technology development, engineering application, production management, technical services and other high-quality professionals in professional fields and related interdisciplinary fields after graduation[1], and the cultivation goals of Panzhihua University “cultivating application-oriented talents who meet the needs of economic and social development in southwest Sichuan and northwest Yunnan, and have strong innovative spirit, entrepreneurial awareness and professional ability”[2], Firmly grasp the main line of "engineering application" to systematically design the course teaching content, in the design of course teaching, not only include the teaching of basic knowledge, but also include the cultivation of engineering skills, so that school education and the society's demand for mechanical manufacturing technical talents meets.

L. Chang et al. (eds.), *Proceedings of the 2024 8th International Seminar on Education, Management and Social Sciences (ISEMSS 2024)*, Advances in Social Science, Education and Humanities Research 867,
https://doi.org/10.2991/978-2-38476-297-2_49

2 Features and Objectives of the Course

2.1 Course Features

This course mainly enables students to master the basic theory of machining technology and the conventional process of typical parts processing, and have the preliminary ability to compile the machining process specification of parts of medium complexity. It has the following characteristics:

(1)Very strong comprehensiveness. It involves the comprehensive application of several early courses such as engineering graphics, metal materials, tolerances and fits, metal cutting principles, and comprehensive applications of machine tools.

(2)Very strong practical and theoretical. It is very closely related to engineering applications, involving the research of process theory and the formulation of process regulations.

(3)Very strong engineering applicability. Learning needs to be understood and mastered from the perspective of engineering application.

2.2 Course Teaching Objectives

The course is based on Panzhihua, facing Sichuan and radiating the whole country, adhering to the concept of cultivating people with virtue and new engineering, taking students as the center, highlighting the integration of industry and education, and the theme of application first, combining education and learning, and guiding values in knowledge transfer and ability cultivation [2].

Course Objective 1: Students will be able to use the relevant knowledge of mechanical manufacturing process regulations to analyze the problems of general parts in machining process design.

Course Objective 2: Through classroom teaching, classroom analysis and discussion, application and other links, students can realize that there are a variety of solutions to solve the design problems of machining technology regulations in the manufacturing process of mechanical parts, and will seek reasonable ideas or solutions to solve engineering problems in machining technology through literature research.

Course Objective 3: Students can use the basic theories and methods of mechanical manufacturing process to correctly select machine tools, tools and cutting quantities, compile machining process specifications for a given type of mechanical parts, and comprehensively compare and propose the best solutions.

3 Restructuring of the Curriculum Teaching System

Constructivist learning requires the curriculum system to be reconstructed in a context that can stimulate students' learning motivation, to design teaching tasks into one or more specific tasks, and to organize students to complete the tasks, and students to construct their own knowledge system in the process of completing specific tasks [3],

so as to cultivate students' ability to think innovatively. The reconstructed mechanism and process part of the curriculum system are shown in the Fig.1.

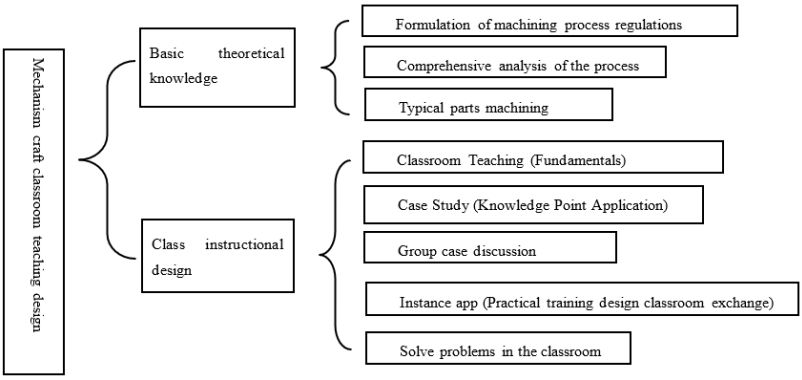

Fig. 1. The reconstructed mechanism and process part of the curriculum system are shown

4 Handling of Teaching Materials

The mechanism and process part mainly involves three parts: the basic theory of process design, calculation methods, and process analysis, and the content of the textbook is designed according to the knowledge points. Teachers should take the practical thinking of application first, boldly deal with the teaching materials, break the boundaries of the textbook chapters [4], decompose and reconstruct the content and practical content of the textbooks, and take the typical parts of mechanical equipment as the case in theoretical teaching, and reconstruct the "chapter-section-knowledge points" of the teaching materials according to the actual production process of modern enterprises. The course design is decomposed step by step according to "project-module-task point", and at the same time, the knowledge points and task points are required to correspond to each other and be carried out synchronously.

In the part of typical surface processing routes, the textbook is segmented according to economic accuracy, and the corresponding processing routes of three typical surfaces are introduced, we know that parts are composed of different types of multiple surfaces, in order to ensure the processing quality of parts, the processing methods and routes of each surface must be organically combined, which is a difficult point for students. In this regard, when explaining this knowledge point, the course teaching is organized by embedding the basic theoretical knowledge points in a heuristic and guiding way by taking the processing routes of two or three typical parts (such as rocker or fork frame) as the main line. For another example, the heat treatment arrangement of the processing sequence part can organically combine the production mode and characteristics of the blank and the selection method with the requirements of the processing process, which is very beneficial to the coherence and systematic learning of students' vertical and horizontal knowledge.

In the part of blank selection, the textbook only introduces the types of blanks and the problems that should be paid attention to when selecting blanks, and lacks typical

examples of drawing methods of blank-parts comprehensive drawing, which is not convenient for students to apply and operate in course design. In order to cultivate students' engineering application and practical ability.

5 Teaching Methods and Means

5.1 Break the Traditional Way of Teaching

At present, due to the large content of theoretical courses and the small number of teaching hours, teachers generally adopt the "full classroom" teaching method, and it is difficult for students to pay full attention and keep up with the teacher's teaching rhythm during the lecture. At the same time, students are also accustomed to the learning-dependent learning mode of "teachers speak, students listen", which is not conducive to cultivating students' ability to think and solve problems. [4] In this regard, the new teaching model of "teacher-oriented" to "teacher-led and student-oriented" requires that students' learning activities must be combined with tasks or problems, so as to guide and maintain learners' interest and motivation in learning by exploring problems, and create a real teaching environment for students to learn with real tasks, so that students can have the initiative in learning. [5] For example, when teaching the principle of rough datum selection, a specific part is shown for students to do structural analysis, and a number of scenarios are set up to guide and inspire students, and finally the best solution is derived.

5.2 Classroom Teaching Methods that Combine Theory and Practice

The classroom teaching is based on the typical mechanical parts manufacturing process, task-driven, focusing on basic theories and basic concepts, diluting process derivation, and highlighting engineering applications, so as to improve students' hands-on ability and vocational ability, and stimulate students' intellectual curiosity and innovative spirit. [4]

Course Content Requirements.

The teaching content mainly includes the theoretical level and the practical level. The theoretical level is mainly the basic principles and discipline frontiers such as machining process regulations, assembly process regulations, fixture design, etc., and at the same time cultivate students' interest in mechanical manufacturing, so that they are familiar with simple analysis and research application methods. At the practical level, it is mainly to cultivate students' ability to apply engineering and think innovatively. It has built a multi-faceted collaborative practice system that combines “theory and practice, knowledge and skills, methods and processes, in-class and extra-curricular, professional and industrial”, actively participated in discipline competitions and college students' innovation and entrepreneurship projects, further improved students' professional ability and comprehensive quality, and completed the transformation from “absorbing knowledge” to “practical application”.

Carry out Project-driven Instructional Design and Develop the Ability to Apply Innovative Thinking.

Combination of theory and practice[6], project-driven: Based on the typical legend of Panzhihua's characteristic equipment manufacturing, one week after the start of theoretical teaching, the course design is issued in the form of a project, the number of groups is determined according to the complexity of the parts, and each group makes a preliminary module decomposition and refinement according to the parts they take, and divides the design project into a number of small tasks according to each knowledge point, and the theoretical knowledge points correspond to the small tasks one by one, and the tasks are completed in stages and tasks, and the analysis and discussion in the design process. Stimulate students' curiosity and desire for knowledge, and cultivate students' collaborative spirit and systematic and innovative thinking ability. Regular inspections ensure that students have clear and reasonable design ideas and overall concepts throughout the design process, as well as the design tasks of the corresponding small modules, and can effectively apply the knowledge they have learned to solve complex engineering problems. Guide students to reflect and summarize the design project, so that students know why they want to learn, how to apply what they have learned, and where they should apply it, so as to promote their learning and improvement.

Based on the Teaching Method of Combining Theory and Practice, Improve the Ability to Solve Complex Problems.

It mainly adopts a variety of teaching methods such as the combination of professional and industry, heuristic and interactive, simple parts and more complex parts, classroom teaching and application practice, and in-class and extra-curricular combination, so as to improve students' interest in equipment manufacturing, cultivate students' ability to solve complex engineering problems in mechanical manufacturing, innovation ability and comprehensive analysis ability, as well as the cultivation of core values, so that they can work after graduation with strong engineering application ability.

Classroom teaching includes four aspects: the first is "teaching", that is, the introduction of the basic concepts and basic theories of the manufacturing process of mechanical parts, as well as the outline of common analysis ideas and analysis methods; The second is "analysis", that is, using classic part legends to analyze and explain; The third is "discussion", that is, classroom discussion, with the typical legend of enterprise production, to carry out simple and necessary analysis, discussion or students on the podium in small groups[7], etc., the teacher first said that the enterprise in the development of the part of the consideration and the final process route, and then the student analysis and discussion results to supplement or correct the deviation, as well as related application development; Grouping mode: First, the instructor is grouped according to the order of the student list, and second, the number of students in each group is determined according to the complexity of the parts. The fourth is "application", that is, classroom and after-class application practice, in which students make a preliminary module decomposition according to the parts they take, and fol-

low the progress of theoretical teaching to complete the design tasks of the corresponding small modules, while the instructor participates in the necessary tutoring. [4]

Combination of rationality and practice, step-by-step implementation: Break the separation of theoretical and practical teaching content, decompose the corresponding practical courses, correspond to the knowledge points one by one, and complete them step by step and module synchronously, so as to help students improve their ability to solve practical problems.

6 Conclusions

Combined with the characteristics of local application-oriented colleges and universities, this paper discusses the practical path of classroom teaching of mechanical manufacturing technology with the cultivation of engineering application ability as the guide. The results show that the teaching content can be reconstructed, the knowledge points and task points are refined, and the teaching implementation plan is synchronized with the mechanical parts manufacturing process, which can effectively improve the students' design ability and problem-solving ability. In order to cultivate application-oriented talents to serve the local economy, the course team will continue to pay attention to new ideas and new methods of curriculum construction, in order to achieve better results.

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