Scholar Publishing Group
International Journal of Educational Innovation and Science
https://doi.org/10.38007/IJEIS.2021.020403
ISSN 2789-7184 Vol. 2, Issue 4: 15-22

Course of Mechanical Innovation Design and Practice Based On the Cultivation of Innovation and Entrepreneurship Ability

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Keywords: Mechanical Design, Innovation and Entrepreneurship, Practice

Abstract: The mechanical innovation design practice course and the cultivation of innovation and entrepreneurship ability are very important. In order to meet the market demand, to cultivate a batch of mechanical design professionals with innovative consciousness and innovative ability, we must reform the existing teaching mode. Modern mechanical design has gradually entered the stage of intelligent design, requiring mechanical product designers in addition to solid advanced design concepts, but also needs rapid market response capabilities, forward-looking innovative thinking and rich practical design capabilities. The traditional design tutorials and teaching models are difficult to adapt to the rapidly growing market demand. From this point of view, this paper discusses the construction of a new practical teaching system model. Through innovation and entrepreneurship education and mechanical integration education, we have created a series of teaching reform measures such as new-type internships and practical bases. We have improved students' engineering practice capabilities and achieved a deep integration of theoretical courses and practical operations, as well as innovative entrepreneurial concepts and mechanical design professional education.

1. Introduction

The cultivation of college students' innovative and entrepreneurial ability is an important measure for higher education to face the society and market-oriented economy. In recent years, the party and the country have attached great importance to innovation and entrepreneurship education for undergraduates, and the Ministry of Education has launched construction projects such as the “Students' Innovation and Entrepreneurship Program Training” and the “Students Training Model Innovation Experimental Zone” to promote innovation, entrepreneurship, and management of high-level talents. Many colleges and universities also actively carried out innovation and entrepreneurship education and achieved certain results. However, on the whole, there are still some problems. Firstly, the understanding of the connotation and essence of innovation and

entrepreneurship education is not deep enough, only focusing on the student's innovation and entrepreneurship knowledge and skills imparted, while ignoring the students' awareness of innovation and entrepreneurship and ability training. Secondly, the teaching system of innovation and entrepreneurship education is not perfect, the types of courses and teaching methods are single, and the theoretical courses are out of touch with practice. Thirdly, innovation and entrepreneurship education is not deeply integrated with professional education and it is not targeted. Therefore, this article takes the mechanical design profession as an example to discuss the construction of a new practical teaching system model. By relying on mechanical innovation labs and engineering training centers, the National Innovation and Design Competition for Machines, and the Innovation and Entrepreneurship Training Project for Undergraduates are the carriers; Through a series of teaching reforms such as conducting classified guidance, layered teaching, diversified training of talents, cooperative education of production, teaching and research, creation of new types of internships, and practice bases. It improves the students' engineering practice ability, realizes the close integration of theoretical courses and practical operations, and deeps integration of innovative entrepreneurship concepts and mechanical design professional education.

2. Problems in Mechanical Innovation and Entrepreneurship Education

2.1. Traditional Teaching is Too Passive

The traditional teaching model is based on teacher's teaching. Students receive knowledge passively. Even if there is interaction, the theme is the concept explained by the teacher. It is not attractive to students. For theory-based courses, this teaching mode is impeccable. As long as teachers can grasp the course's main line in the classroom, combine the interaction of students and the consolidation of homework, they can fully achieve the teaching objectives.

2.2. Combination of Theory and Practice

After the mechanical innovation design scheme is completed, the next step is to carry out detailed product design and component drawing. This is precisely the short board for many instructors and students. After the product design is completed, the function of the product needs to be achieved through processing and assembly. In the past, when many innovative works got to the factory, they found that many works could not be produced. Although some of the works could be produced, the design drawings of the students were not standardized, and the understanding of tolerances and processes was not enough for the workers to process. The drawings cannot reflect the design intent, but also require the students to explain on the scene, which greatly affects the progress of the design and processing of innovative works.

2.3. Poor Student Ability

The mechanical innovation design practice course also allows students to move toward the workshop, truly see the realization process of their own innovative works, and enhance the perceptual knowledge of product design. The theoretical design of mechanical products and the manufacturing of actual products were previously out of line. Students only stayed at the drawing stage for product design. As for how the products are produced, they lack the necessary understanding and understanding. Some classmates see their own works in kind, it is difficult to connect with their own design, and some design drawings based on design theory, but the product is

actually unaware of how to manufacture, of course, it will cause a phenomenon that theoretical design and production and processing is not matching.

2.4. Insufficient Institutional Development

The innovation and entrepreneurship work has been highly valued by the party and government leaders of the college, the academic committee of the college can actively organize and carefully plan, and the majority of students can also participate actively. However, relevant professional teachers are not completely unified with the school's guiding ideology in terms of understanding of science and technology innovation. In the process of implementation, there is not enough execution force, which leads teachers, especially high-level experts, to actively participate in lacking enthusiasm.

3. The Construction of a Course Teaching System Guided by Innovation and Entrepreneurship

Starting from curriculum training, innovation and entrepreneurship education, innovation and entrepreneurship competition, and scientific research training, the emphasis is on improving the overall quality of students through curriculum teaching, cultivating students' practical abilities and innovation and entrepreneurial awareness, so that students have a certain degree of innovative design basis and innovative ideas. Then they will create innovative and novel works and further guide entrepreneurial practice.

3.1. Course Training

Opened a mechanical innovation design course to enable students to master and skillfully use computer-aided 3D design analysis software such as Solidworks, Pro/e and Ansys to complete mechanical structural innovation design tasks and master integrated design methods. This is the basis for innovative design. At the same time, the concept of innovation and entrepreneurship education is integrated into the professional curriculum teaching and practical teaching to cultivate students' sense of innovation.

3.2. Innovation and Entrepreneurship Education

Held innovation and entrepreneurship lectures, exchange of old and new students, outstanding alumni and experience exchanges for successful entrepreneurs to enhance students' interest in innovation and entrepreneurship. The exhibition of achievements in innovation and entrepreneurship will be displayed in the form of physical objects and exhibition boards in order to broaden the horizons of students and strengthen the confidence of students in innovation and entrepreneurship.

3.3. Innovation and Entrepreneurship Competition

Organize students to participate in various innovation and entrepreneurship competitions, including the mechanical innovation design competition, the engineering training comprehensive ability competition, the university student innovation and entrepreneurial competition, the China-Japan-Korea mechanical innovation design contest, and the fischer model competition.

Through competitions, we invigorate the passion for innovation and entrepreneurship, test the achievements of innovation and entrepreneurship, and guide students to continue to participate in innovation and entrepreneurial activities.

3.4. Research Training

Organize students to participate in innovation and entrepreneurship training programs, experience the whole process of a mechanical product creative - design - simulation - processing - debugging - apply for patent - marketing, and writing scientific papers. Absorbing part of the students to participate in the teachers' research projects, undertaking some design tasks, it will integrate the knowledge they learned during the university, and improve the overall quality.

4. Specific Ways to Implement Innovation and Entrepreneurship

4.1. Using Competition as a Carrier to Realize the Combination of Professional Course Training and Innovation and Entrepreneurship Competition

Encouraging students to apply their professional knowledge to participate in various types of mechanical innovation design competitions and undergraduate innovation and entrepreneurship training programs. The application of student works to classroom teaching not only solves the problem of lack of teaching aids, but also trains students' innovation consciousness and hands-on ability, it fully embodies the strengthening and promotion of innovation and entrepreneurship education for professional teaching, and achieves “to promote practice through competition”. The purpose of the competition is to promote teaching." It transforms students' entry results and innovation and entrepreneurship training programs into the topics of curriculum design and graduation design, and realizes the integration of innovation, entrepreneurship and practical teaching.

4.2. Using Projects as a Means to Optimize Practical Teaching Content

The scientific training will be introduced into the classroom in the form of special series lectures to let students understand the frontier and high-end scientific research development of the mechanical design profession at this stage. Thematic training sessions were set up during the lectures and the research projects were broken down into several sub-topics. Students were grouped and each group was responsible for the research of a sub-topic. In the process of uniting and collaborating to complete the project, students spontaneously learn professional knowledge, it gives full play to individual's creative thinking and innovative ability, and expands the students' ideas, and constantly propose more and better solutions.

4.3. Play the Role of Practical Teaching Base inside and Outside School

The practical teaching base is an important teaching and scientific research place for integrating the theory with practice and cultivating comprehensive talents in universities. It is an important support for accomplishing the goal of personnel training. Make full use of the school's mechanical innovation laboratory, engineering training center, university science park, and key laboratories, establish cooperative relationships with enterprises, and build innovative training practice platforms for students. The School Engineering Training Center undertakes the task of undergraduate students'

practical teaching. Here, students use their own equipment to process parts and improve their hands-on skills. The school science and technology park has established a comprehensive cooperation alliance of “producing, learning, and researching” to attract enterprises and scientific research institutes to provide support for college students' innovation and entrepreneurship with venues, projects, funds, and policies, and provide students with more training opportunities to participate in the application of innovation and entrepreneurship projects. In the science and technology park, students engage in entrepreneurial activities through various practices such as participating in teachers' related scientific research projects, independent entrepreneurship, and internships in science park companies.

4.4. Establish a Flexible and Diverse Curriculum Evaluation Mechanism

Reform of examination methods for mechanical design major courses. As the mechanical design major courses are characterized by engineering and practicality, the focus of the reform should be on the assessment of students' application ability, practical ability and innovative ability. For example, the mechanical design course adopts the combination of “flat time + experiment + special training + paper + written test + comprehensive defense”. The assessment increases the proportion of practice, and also takes into account the students’ usual classroom performance and strengthens the process management. This assessment method evaluates students' abilities in a variety of ways and in many ways. It can more objectively reflect the students’ learning situation and is conducive to the improvement of students’ engineering application ability, innovation ability, and overall quality.

4.5. Questionnaire Design

In order to understand the current situation of mechanical innovative design and practice course in Colleges and universities, this paper adopts in-depth interviews, questionnaires and other forms of research. This paper investigates the mechanical innovation design and practice course based on the cultivation of innovation and entrepreneurship ability in order to comprehensively understand the situation of College Students' innovation and entrepreneurship practice course. In this paper, the field and online and other channels for the distribution and recovery of the questionnaire. On the basis of the effective data, the statistical software SPSS. 19.0 and the questionnaire star platform are used for data statistics, processing and analysis. The statistical methods used in this paper are mainly descriptive statistics and cross analysis.

4.6. Reliability Test of the Questionnaire

In order to test the reliability and stability of the questionnaire, the variance of the questionnaire results was first calculated, and then the reliability of the returned questionnaire was tested by the method of "half-half reliability" test. The test results confirm that the questionnaire is reliable.

$$S^2 = \frac{(M - X_1)^2 + (M - X_2)^2 + (M - X_3)^2 + ... + (M - X_n)^2}{n} \tag{1}$$

$$r = 1 - S^2(1 - r_1)/S_n^2 \tag{2}$$

$$r = \frac{2r_{ban}}{1+r_{ban}} \tag{3}$$

5. Innovation and Entrepreneurship Extracurricular Practice Teaching Implementation

5.1. Team Unit Composition

Each team unit consists of 3 students and the team is completed within 2 weeks of the start of the course. In accordance with the principles of "interesting guidance, knowledge complementation, consideration of achievement, free integration, and appropriate adjustment", a project team unit is formed to enable students to select projects according to their own interests, and to give full play to each person's role and team spirit in the team.

5.2. Instructor Assignment

Practical teaching is completed by 7 to 10 teachers. The teacher is responsible for overall planning and coordination, and provides guidance on the design of plans, application for patents, design, production, debugging, experimental testing, and the preparation of papers and research reports.

5.3. Practice Location

Using the school's Engineering Experiment and Practice Center and the College's Disassembly and Assembly Laboratory, Mechanical Design Innovation Laboratory, Robot Innovation Laboratory, College Student Innovation Studio and Innovation Production Studio, it is reasonably arranged and relatively centralized according to project type, which is convenient for guidance and management.

5.4. Practice Assessment

Table 1. Proportion of practice assessment

	Percentage
Normal assessment	20%
experimental assessment	30%
teamwork focus assessment	10%
research results focus assessment	40%

According to Table 1 and Figure 1, we can see that focusing on the assessment of teaching objectives, teaching contents, and practice links, we will focus on actual capabilities and establish a multi-assessment and evaluation method of “Utility + experiment + teamwork + research results”. Normal assessment focuses on assessment, investment, initiative, creativity, performance, and the timeliness of the completion of designated tasks, accounting for 20%; experimental assessment of

the assessment of theoretical knowledge of the application of capacity, program design capabilities, hands-on ability, accounting for 30%; teamwork focus assessment collaboration , communication, responsibility, dedication, organization, etc., by the players in accordance with the sort of mutual evaluation, accounting for 10%; research results focus assessment results, performance, reply quality, report quality, etc., accounting for 40%.

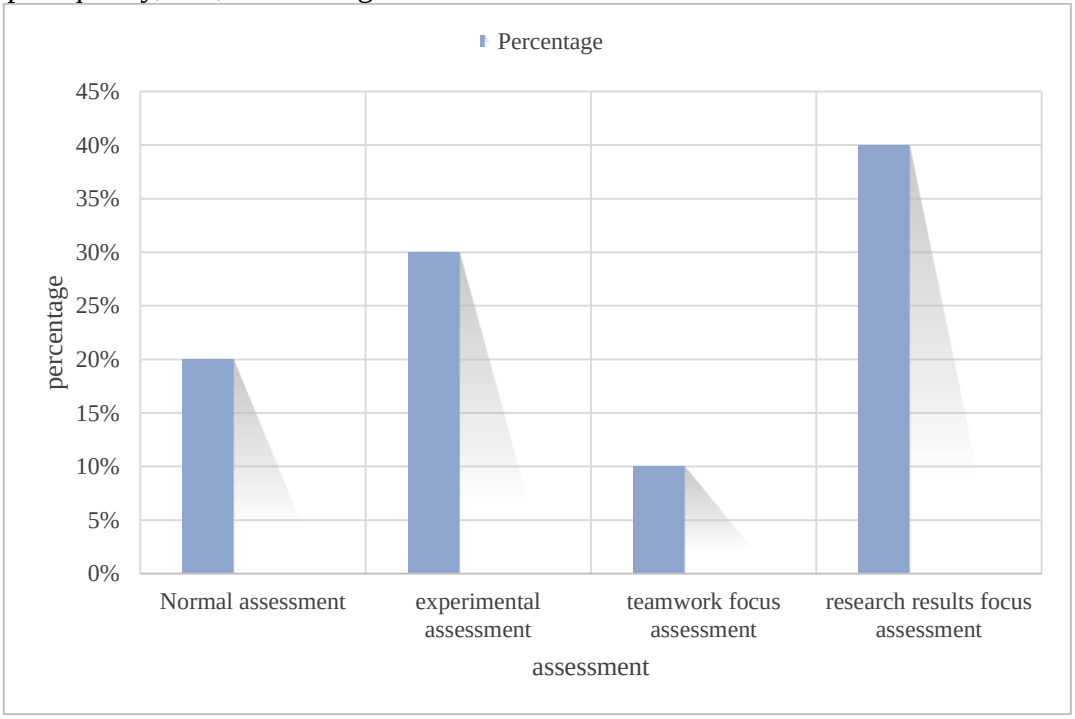

Figure 1. Proportion of practice assessment

6. Summary

The teaching of mechanical innovation design and practice courses must be innovative, take a variety of flexible teaching models, abolish the one-size-fits teaching concept, and form a set of perfect innovative ideas and methods to improve the teaching effect of the curriculum. This article takes innovation projects as the carrier, students as the main body, and enterprises as the base to establish a complete innovative curriculum teaching system. The formation of the system will inevitably promote the perfect combination of innovative theory and practice, expand the university students' sense of innovation and innovative thinking, exercise their actual design capabilities and overall quality of mechanical products, and truly achieve learning and use. This will provide a set of teaching methods that can be used to apply for the school's excellent undergraduate construction.

Funding

This article is not supported by any foundation.

Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

References

[1] Seiculescu C, Variu L. Visual design: What makes a company logo successful?. Psychologie Et Sociologie, 2007.

[2] Zeiler W. Integral design a perquisite for 0 impact buildings and environments// 2012.

[3] Nicoli N. Creative Management, Technology and the BBC. Technology for Creativity & Innovation Tools Techniques & Applications, 2011. https://doi.org/10.4018/978-1-60960-519-3.ch014

[4] Soares F O, Sepúlveda M J, Monteiro S, et al. An integrated project of entrepreneurship and innovation in engineering education. Mechatronics, 2013, 23(8):987-996. https://doi.org/10.1016/j.mechatronics.2012.08.005

[5] Dietz D. Porte des Savoirs, Embodied experience of immersion and information flow / Presentation of research by design results. Bmc Plant Biology, 2014, 11(5):59-59.

[6] Lee T C, Prandoni P, Vetterli M. Analysis and Design of Large-scale Online Classes. Epfl, 2014.

[7] Sysid P. Closed-loop identification methods for LQ control design. Proc Sysid Ifac Symposium on System Identification.

[8] Pech R M. Achieving the innovative edge in technology, engineering design, and entrepreneurship. Journal of Innovation & Entrepreneurship, 2015, 5(1):6. https://doi.org/10.1186/s13731-016-0035-y

[9] Jiang X, Sun Y. Study on constructing an education platform for innovation and entrepreneurship of university student. Research Journal of Applied Sciences Engineering & Technology, 2015, 9(10):824-829. https://doi.org/10.19026/rjaset.9.2630

[10] Li T, Ding X. Exploratory practice of innovation and entrepreneurship education in mechanical design course exercise. Experimental Technology & Management, 2016.

[11] Rose J, Jones M, Furneaux B. An integrated model of innovation drivers for smaller software firms. Information & Management, 2016, 53(3):307-323. https://doi.org/10.1016/j.im.2015.10.005

[12] Zhang Z G, Sun L X. Innovation and Entrepreneurship Education Background of Mechanical Design Course Teaching Reform. Pioneering with Science & Technology Monthly, 2017.

[13] Richard M, Clavel R. Modular methodology to design high precision parallel robots and application to a 5-Degree of Freedom flexure-based manipulator. IEEE Transactions on Robotics & Automation, 2017.

[14] Yang J, Polytechnic G R. Exploration of Cultivating Innovative and Entrepreneurial Talents of Mechanical and Electrical Major Based on the Studio Platform of Double-qualified Teachers. Journal of Southern Vocational Education, 2017.