Scholar Publishing Group
International Journal of Educational Innovation and Science
https://doi.org/10.38007/IJEIS.2020.010106
ISSN 2789-7184 Vol. 1, Issue 1: 70-78

Exploration and Practice of Innovation and Entrepreneurship Education in the Design of Mechanical Design Courses

Wei-Jen Lee*

Ecole Normale Superieure di Pisa, Italy

**corresponding author*

Keywords: Mechanical Design, Teaching Reform, Innovation and Entrepreneurship Education, Curriculum Construction

Abstract: The key to the construction of mechanical design courses in the field of innovation and entrepreneurship lies in the setting of teaching objectives, the concise teaching content and the establishment of practical systems. The system combs the characteristics of the mechanical design course and establishes the curriculum teaching goal of integrating innovation and entrepreneurship. This paper discusses the teaching objectives and teaching methods of innovation and entrepreneurship education in the experimental section, and takes the mechanical design curriculum design reform as an example to cultivate students' analysis problems, team formation and collaboration, communication, active learning, design, and design through the curriculum design practice. Practice of innovation and entrepreneurship, such as judgment, opportunity assessment and development. Through the mechanical design curriculum design process, students gain some of the core knowledge and abilities required for innovation and entrepreneurship.

1. Introduction

The cultivation of college students' innovative and entrepreneurial ability is an important measure for higher education to face the society and face the market economy. The mechanical design major belongs to the traditional engineering disciplines. The students trained in this major should have a wide range of basic theories and solid professional knowledge. They must have strong hands-on ability and logical thinking. They can actively combine theory with practice and have the potential for innovation. How to construct a practical teaching system that meets the needs of mechanical design majors and build a platform suitable for students' innovation and entrepreneurship training is a new topic facing colleges and teachers. This paper takes the mechanical design profession as an example to explore the construction of a new practice teaching

Copyright: © 2020 by the authors. This is an Open Access article distributed under the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (https://creativecommons.org/licenses/by/4.0/).

system model. Relying on the mechanical innovation laboratory and engineering training center, the National Machinery Innovation Design Competition, the college students' innovation and entrepreneurship training project as the carrier; through the classification guidance, layered teaching, diversified personnel training, industry-university-research cooperation education, create a new internship The series of teaching reforms such as the practice base have improved the students' engineering practice ability, and realized the close integration of the theoretical curriculum with the practical operation and the deep integration of the innovative entrepreneurial concept and the mechanical design professional education.

2. The Characteristics of Mechanical Design Courses

In accordance with the orientation of the school's mechanical professional training program, the mechanical design course aims to develop students' engineering design and comprehensive analysis capabilities, including basic knowledge and skills in system analysis, design, selection, operation, maintenance, maintenance, etc., to help students establish correctness. The design thinking and the ability to improve the connection between student theory and practice. According to the experience of long-term mechanical design teaching and scientific research, the paper analyzes the mechanical design teaching materials and summarizes the following characteristics of the mechanical design course.

(1) The teaching content of mechanical design involves a wide range of topics, and each knowledge point needs to be broken one by one. In other words, the course requires more, more formulas, more categories, and more charts.

(2) Mechanical design learning to strengthen practicality. Although the course is the basic theory and method of studying mechanical design, rather than a specific mechanical device, these theories and methods are for engineering services.

(3) Mechanical design teaching emphasizes emphasis and emphasizes non-focus. The content of the course has no emphasis on the surface, but it is the focus. The reason is that the mechanical design work must be exhaustive, and any minor negligence can lead to serious consequences.

(4) Mechanical design learning emphasizes the establishment of engineering awareness. Mechanical design problems involve many factors, and the solution can be solved in a variety of ways, and the solution is generally not unique.

(5) Mechanical design learning should understand the relationship between this course and other courses. For example, mechanical drawing can provide graphical representations for design, engineering materials and heat treatment can provide material selection methods for mechanical design, engineering mechanics can provide solution analysis for parts, and mechanical manufacturing can provide processes for cold and hot machining of parts, tolerances The technical measurement can solve the precision design problem of the part, and the mechanical principle can solve the analysis problem of the machine motion plan.

(6) Mechanical design learning and practice must correctly handle multiple relationships in design. For example, the design and selection of parts is the two main ways of mechanical design; work capacity calculation and structural design show that design is more than just calculation, should pay attention to the study of structural design; experience design and modern design are important, but the former is the latter Foundation; specific design methods and general design capabilities, the former is the form of learning, the latter is the purpose of learning.

Analysis of the characteristics of the mechanical design course found that the overall learning process of the course plays an important role in strengthening the awareness of innovation and

entrepreneurship of mechanical students. However, in order to improve the students' innovative ability and entrepreneurial thinking, it is necessary to construct a reasonable curriculum system around the characteristics of the curriculum, set appropriate teaching objectives, select teaching content and optimize the engineering design training system.

3. The Overall Thinking of Teaching Reform

1) Mechanical design is a compulsory technical basic course for mechanical and near-mechanical majors in engineering colleges and universities. It is a very practical course. It provides students with new knowledge and self-learning ability, problem analysis and solution. Problem ability, use of modern tools, engineering practice, innovation and application development capabilities of mechanical products have obvious supporting effects. In order to meet the requirements of mechanical cluster transformation reform and innovation and entrepreneurship education, cultivate applied and innovative practical talents. According to the teaching status of mechanical design courses, the author believes that the mechanical design curriculum teaching reform should follow the following ideas:

(1) Carry out the teaching ideas that are applied in accordance with the principles of practice, closely link with the actual work of the project, and carry out the teaching based on the “training of engineering practice ability and innovation ability”.

(2) Change the status quo of teaching methods and methods behind, and adopt the problem, case, and project as the carrier to implement the task-driven teaching mode, so that students are interested, research, and practical.

(3) In accordance with the "theory teaching, experimental teaching, curriculum design, the second classroom, a game of chess", strengthen the practice links, focus on guiding students' independent learning and research exploration, and gradually and systematically increase engineering practice ability and innovation ability.

2) Pulse volume acquisition algorithm

The pulse signal volume of the engineering machinery has the engine speed signal and some other sensor signals, and the system design has 2 PI acquisition circuit. There are two main collection algorithms for pulse signal: counting and timing, both of which require the timer capture (CAP) functions of the microcontroller.

(1)counting process

The counting method refers to the method of calculating the captured pulse signal and calculating the signal frequency, as shown in formula 1. The proposed method has high accuracy with a high signal frequency.

For example, when detecting the engine speed, the set time interval is T1 milliseconds, the number of captured pulses generated per turn of the N, engine is P, and the counting engine speed V (rpm per minute) is:

$$V = 60 \times N \times 100 / (T1 \times P) \tag{1}$$

(2) Time iming

The timing method is the method of calculating the signal frequency by detecting the time between two continuous pulses of the signal. As shown in formula 2, the method has high accuracy with a low signal frequency.

For example, when detecting the engine speed, the time interval between the two continuous pulses is T2 milliseconds, the number of pulses generated by the engine per revolution is P, the

engine speed V (rpm: rpm / min) is:

$$V = 60 \times 1000 / (T2 \times P) \quad (2)$$

4. Mechanical Design Courses Innovate the Way to Implement Creative Education

4.1. In Order to Contest for the Carrier to Achieve Professional and Training Courses

The combination of innovation and entrepreneurship competition encourages students to apply their professional knowledge to participate in various mechanical innovation design competitions and college students' innovation and entrepreneurship training program. Applying student works to classroom teaching not only solves the problem of lack of teaching aids, but also trains students' innovative consciousness and hands-on ability, fully embodies the role of innovation and entrepreneurship education in strengthening and promoting professional courses, and achieves "competition through practice". The purpose of promoting teaching by competition. Transform students' achievements and innovative entrepreneurship training programs into curriculum design and graduation design, and realize the integration of innovative entrepreneurship and practical teaching. For example, carbon-free cars, various wheel train teaching models, fitness washing machines, multi-functional seats and other majors of interest to students have been successfully transformed into mechanical design and mechanical design courses. The rolling mill mechanism teaching model, the correcting machine teaching model, and the development of the shearing machine teaching model have been included in the graduation design project. At the same time, the outstanding achievements of the competition have been pushed to the market, allowing students to experience entrepreneurship as early as possible and achieve good results.

4.2. Using the Project as a Means to Optimize the Content of Practical Teaching

Introduce scientific research training into the classroom in the form of special series lectures, so that students can understand the frontiers of mechanical design and the high-end research development at the current stage. The special training session is set up in the lecture, and the research project is decomposed into several sub-topics. The students are grouped as units, and each group is responsible for the research of a sub-topic.

In the process of uniting and cooperating to complete the project, the students spontaneously learn professional knowledge, give full play to the individual's creative thinking and innovative ability, expand the students' ideas, and constantly propose more and better solutions. For example, the comprehensive mechanical principle and mechanical design curriculum design requires the manufacture of a vibration-assisted magnetic grinding machine. The teacher divides the students into principle design, virtual simulation, procurement processing, experimental debugging, patent application, etc. according to the process of equipment design and debugging. Groups. The principle design team should figure out the working principle, determine the mechanical composition and optimal configuration of the equipment, and finally design the entire equipment. The virtual simulation group uses Solidworks or Pro/e software to perform 3D solid modeling of the finished 2D equipment drawings, check whether there is interference between the parts, and then simulate the actual working conditions for dynamic simulation, so as to ensure that before the equipment is processed, the error loss is minimized. In the absence of any errors, the procurement processing group purchases the standard common parts required for the equipment according to the requirements of the design team, and then assembles the equipment. The experimental debugging

group was commissioned and tested after the equipment was assembled to determine the grinding ability of the machine. Finally, the patent application team formed a written text on the designed grinding machine and applied for a patent in accordance with the relevant requirements of the utility model patent.

In the above process, the instructor keeps track of each link, and is truly student-oriented and supplemented by teachers. Through a series of trainings, students' teamwork ability, innovative and entrepreneurial ability are trained and improved, and the teaching effect is much better than the traditional course design mode. In the graduation internship and graduation design session, the instructor will regularly communicate with the students, organize students to go to the company for internships, guide them to participate in project research and development and solve practical problems on the spot, and lay a good foundation for future entrepreneurship and employment.

4.3. To Play the Role of Internal and External Practice Teaching Base

The practice teaching base is an important teaching and research place for the university to connect theory with practice and cultivate comprehensive talents. It is an important support for accomplishing the goal of talent training. Make full use of the school machinery innovation laboratory, engineering training center, university science park, key laboratory, and establish cooperative relations with enterprises to build a platform for innovative training and practice for students. The School Engineering Training Center undertakes the practical teaching tasks of undergraduates. Here, students improve their hands-on ability by operating equipment and processing parts. The School Science and Technology Park has established a comprehensive cooperation alliance of “production, learning and research” to attract enterprises and research institutes to provide venues, projects, funds, policies and other support for college students' innovation and entrepreneurship, and to provide students with more opportunities to participate in the application of innovative and entrepreneurial projects. In the Science and Technology Park, students participate in entrepreneurial activities through various practical methods such as participating in relevant research projects of teachers, self-employment, and internships in science and technology parks. While completing the daily teaching and research tasks, the school's key laboratories are open to the university students' innovation and entrepreneurship practice base, and provide support for students' innovation and entrepreneurship practice.

4.4. To Establish A Flexible Multi-Course Evaluation Mechanism

Reform the examination methods for mechanical design courses. Due to the engineering and practical characteristics of the mechanical design course, the focus of the reform should be on the assessment of students' application ability, practical ability and innovation ability. For example, the mechanical design course adopts the combination of “normal + experiment + special training + paper + written test +comprehensive defense”. The assessment increases the proportion of practice links, and also takes into account the students' usual classroom performance and strengthens process management. This kind of assessment method evaluates students' various abilities in many aspects and in many aspects, which can more objectively reflect the students' learning situation, and is conducive to students' engineering application ability, innovation ability and comprehensive quality improvement. For students who publish papers, apply for patents, and participate in the Innovation and Entrepreneurship Competition, take credits or replace some of the assessment methods to encourage students' enthusiasm for innovation and entrepreneurship, and make the assessment method more flexible and flexible.

4.5. Questionnaire Survey

1) Evaluation of Innovative courses

To build the basic mode of innovative curriculum evaluation, it is necessary to seriously think about the internal value of innovative courses. Through such courses, students can gain the curriculum experience of research learning, the skills and methods of subject research, the improvement of innovative spirit and practical ability, and the comprehensive application of interdisciplinary knowledge. The course evaluation has guidance, diagnosis, adjustment, incentive, recording and other functions, which can truly and objectively reflect the teaching effect. Therefore, when designing innovative curriculum evaluation mode, quantitative evaluation should pay attention to quality evaluation; evaluation should pay more attention to process, application, experience and development, and needs to make breakthroughs and updates in the existing evaluation methods. In order to study the evaluation of mechanical innovation courses, a questionnaire is conducted.

According to the survey content of the above survey setting, analyze the evaluation status of mechanical innovation courses, collect and organize their data, and investigate the evaluation methods of innovative courses and the learning time of innovative courses. The final confirmed 50 questionnaires were issued, 48 valid questionnaires were recovered, and the questionnaire recovery rate was about 98%. This process lasted approximately 2 weeks, with the collected questionnaires being data summarized and analyzed and the findings made.

Table 1. The main evaluation methods of the innovative courses

Evaluation method	Proportion
Target evaluation	30%
Project evaluation	30%
Process evaluation	55%
Result evaluation	65%

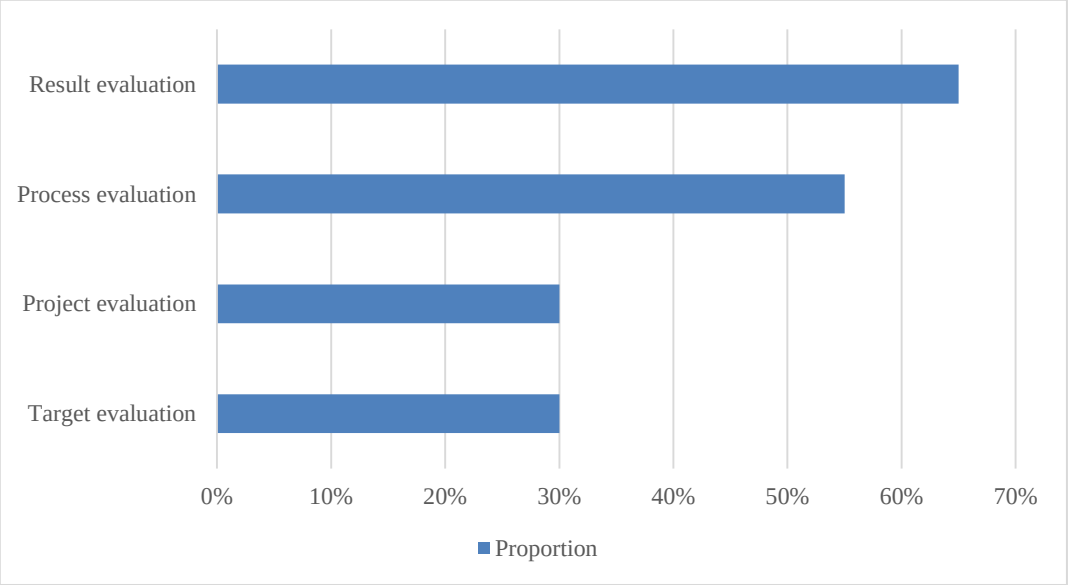

Figure 1. The main evaluation methods of the innovative courses

It can be seen from Table 1 and Figure 1 above that the evaluation of innovation courses can not only look at the scores and teacher comments after the end of the course, need to combine the actual situation of the school and the development of students, various aspects, in the existing evaluation methods, build strong operability, clear framework and rigorous indicators of relatively fixed evaluation system. The implementation of evaluation should run through the whole process of course learning and research implementation, give consideration to multiple evaluation subjects, and examine the multi-negative evaluation indicators.

2) Learning time for innovative courses

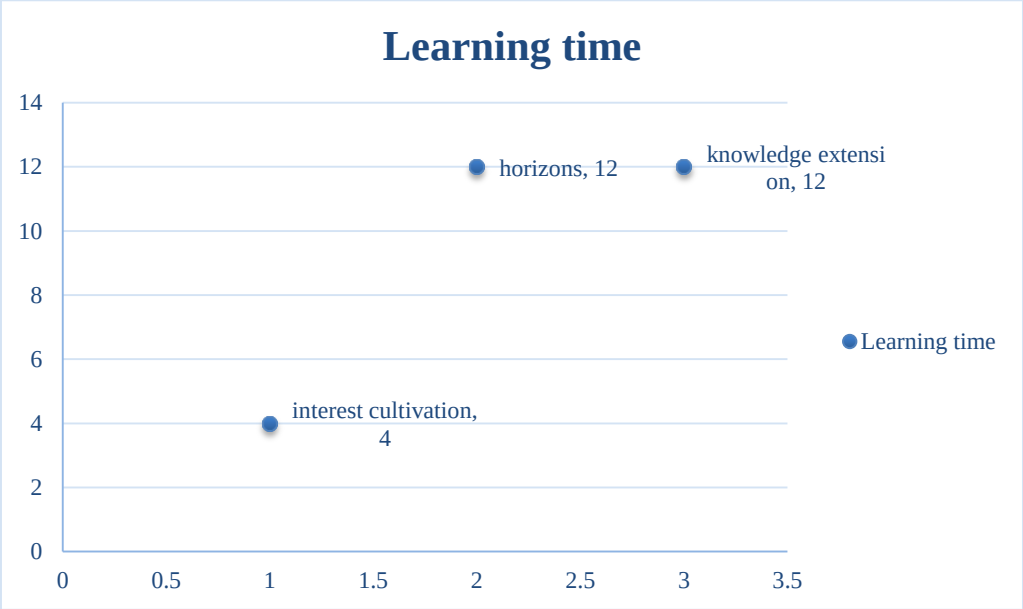

Figure 2. Study time for innovative courses

Figure 2 shows the innovation curriculum with students ' interest, through the integration of mechanical design curriculum learning, project led practice and high level of communication display, build a personalized curriculum system, from personality vision, operation, thinking level and other dimensions to lead student development personality, development potential, let students master innovative knowledge skills, master the ability to solve problems, and break through the talent training "exam-oriented education" and "discipline competition" in the general sense of the ability selection reprocessing mode, the innovation curriculum from general education, physical and mental cultivation, knowledge development, and innovation practice.

5. Conclusion

Through the study of mechanical innovation design and practical courses, students' theoretical learning ability and hands-on practical ability are improved. Based on the subject competition activities, students can build a practical platform for students to make their own works according to their interests, hobbies and the characteristics of academic competitions. In the process of production, problems are encountered and the study is carried out and the problem is solved. Finally, the joy of successfully solving the problem is realized. These processes improve students' independent thinking ability, practical ability, teamwork ability, stimulate students' innovative thinking and innovative consciousness, and thus improve their innovation and entrepreneurial

ability.

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] Echempati R. Integration of innovation and entrepreneurship topics in design courses - Experiences and lessons learned. 2011.

[2] Gao Y. Design of Innovation and Entrepreneurship Experience Courses in Higher Vocational Colleges. Logistics Technology, 2016.

[3] Qin F. Teaching Practice of Integrating Innovation and Entrepreneurship Education into the Chemistry Basic Course. Guide of Science & Education, 2016.

[4] Pech R, Lin B, Cho C S, et al. Innovation, design and entrepreneurship for engineering students: Development and integration of innovation and entrepreneurship curriculum in an engineering degree. Global Engineering Education Conference. IEEE, 2016. https://doi.org/10.1109/EDUCON.2016.7474583

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

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

[7] Zhang L J. Software Testing Innovation and Entrepreneurship Specialty Course Construction Research and Practice. Computer Knowledge & Technology, 2017.

[8] 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

[9] Lugo J E, Zapata-Ramos M L, Perez-Vargas M J. Promotion of Innovation and Entrepreneurship in Engineering Design by Synchronizing Engineering and Business School Courses// ASME 2016 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference. 2016:V003T04A021.

[10] Jiang X. Research on building a practice platform for innovation and entrepreneurship in mechanical industrial design. Research Journal of Applied Sciences Engineering & Technology, 2014, 7(2):343-347. https://doi.org/10.19026/rjaset.7.260

[11] Liu Y R, Zhang J, Han T, et al. Exploration and Practice of the Cultivation of Excellent Materials Talents under the Guide of Innovation and Entrepreneurship Education Philosophy. Value Engineering, 2018.

[12] Zhang R. The Research on Construction and Practice of Innovation and Entrepreneurship

Education in Animation Design Major of Higher Vocational Colleges. Journal of Jiamusi Vocational Institute, 2018.

[13] Chen Z, Huang Y. Study on the Training of Design Students' Innovation and Entrepreneurship Ability from the "Design Management lab" Course of Politecnico di Milano. Furniture & Interior Design, 2016.

[14] Xuan C X, Ying W, Amp I. Exploration on Fusing Innovation and Entrepreneurship Education With Computer Courses Hierarchically and Progressively. Computer Knowledge & Technology, 2017.