Research and practice of the cultivation mode of application-oriented talents for students majoring in mechanical engineering

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ABSTRACT: This article presents an analysis of cultivation characteristics using the concept of application-oriented talents for students majoring in the field of mechanical engineering. The talent cultivation mode of *platform + diversification* is constructed to foster application-oriented undergraduate talents. An ability-oriented curriculum system is also proposed. Since the implementation of this teaching mode, the mode of *platform + diversification* has had great significance for teaching reform in application-oriented colleges and universities. The mode is most beneficial for the cultivation of high-quality application-oriented talents majoring in the field of mechanical engineering.

INTRODUCTION

With continuing scientific and technological progress along with the ongoing social development, an industrial transformation and upgrade has become a fundamental task for the further economic development of China. Because of the changes in the economic structure, higher demands are being imposed to overhaul the workforce with particular emphasis towards the improvement in technical and occupational quality [1].

The manufacturing industry, as a pillar industry of China's national economy, supports the economic and social development of the country and forms the basis of the nation's economic transformation. Thus, it is imperative to meet the growing demands of the workforce along with the need for high-quality interdisciplinary application-oriented talents. In view of this practical and ever growing market demand for talent cultivation, Yancheng Institute of Technology plans to take advantage of the current development trend to reform its cultivation mode of application-oriented talents majoring in the field of mechanical engineering.

CONCEPT OF APPLICATION-ORIENTED TALENTS

Application-oriented talents refer to individuals who can apply specialised knowledge and skills to professional practice [2]. They are mainly engaged in frontline production, and need to master the basic knowledge and fundamental skills required at the forefront of social engagement. The ability cultivation mode focuses on developing application oriented skills and talents required by qualified individual professionals.

BASIC REQUIREMENTS FOR APPLICATION-ORIENTED TALENTS MAJORING IN MECHANICAL ENGINEERING

As specified by the cultivation objective of undergraduate-level talents, students receive basic engineering training during their academic years. In general, the activities of mechanical engineers can be classified into two broad areas [3-5]. The first is related to their professional or technical activities, such as theoretical research, new product development, mechanical design, manufacturing, operation and maintenance, product testing, etc.

The second area is related to non-technical activities, such as marketing, management, consultation, etc. To perform these activities, the application-oriented talents majoring in mechanical engineering need to be of high calibre with a range of skills and qualities that meet the demands of their responsibilities.

Some of the skills and qualities needed to cultivate talents in this field are shown in Table 1.

Table 1: Abilities of application-oriented talents majoring in mechanical engineering.

Professional abilities	Solid knowledge basis, skilled in mechanical design and testing, manufacturing technology, etc. Broad knowledge of disciplines related to mechanical engineering.
	Strong ability to interpret and express ideas in engineering drawing, strong practical ability.
Non-technical abilities	Good social and professional ethics along with excellent ability to communicate in oral and written expression. Strong ability in organisation and management and high spirit of cooperation.
	Ability to collect and process information along with the ability to acquire new knowledge through available literature and on-line tools.

TALENT CULTIVATION MODE OF *PLATFORM + DIVERSIFICATION*

The mechanical engineering discipline undertakes an important task of cultivating talents to support the development of the local and regional economy. After years of exploration and practice, the mechanical engineering discipline at Yancheng Institute of Technology has been enriched by forming the talent cultivation mode of *platform + diversification*. In this mode, talents are cultivated based on cooperation between teaching practice and platform service enterprises. The implementation of this cultivation mode has demonstrated initial success. The cultivation mode has features, which are characteristic of basic theoretical education and diversified orientation of professional development, along with specific emphasis on talent cultivation. Therefore, it is of great significance for engineering colleges, and universities and would prove to be beneficial to promote the cultivation of modern engineering talents.

The specific meaning of the *platform + diversification* education mode lies within the cultivation objective and requirements of application-oriented talents. The objectives include cultivation specifications of engineers, a scheme for dynamically optimising talents, constructing various project platforms and establishing a cultivation mechanism with normalised procedures. These objectives satisfy students' individual development demands and realise diversified demands towards the cultivation of engineering talents.

The scheme of *platform + diversification* cultivation mode is shown in Figure 1. The mode embraces a pyramidal ability cultivation pattern and establishes a diversified mechanical engineering teaching system. It is based upon the engineering ability cultivation achieved by constructing various ability cultivation platforms. The ability cultivation process of the *platform + diversification* engineering education mode presents an overall pattern of *loose enrolment and loose graduation*.

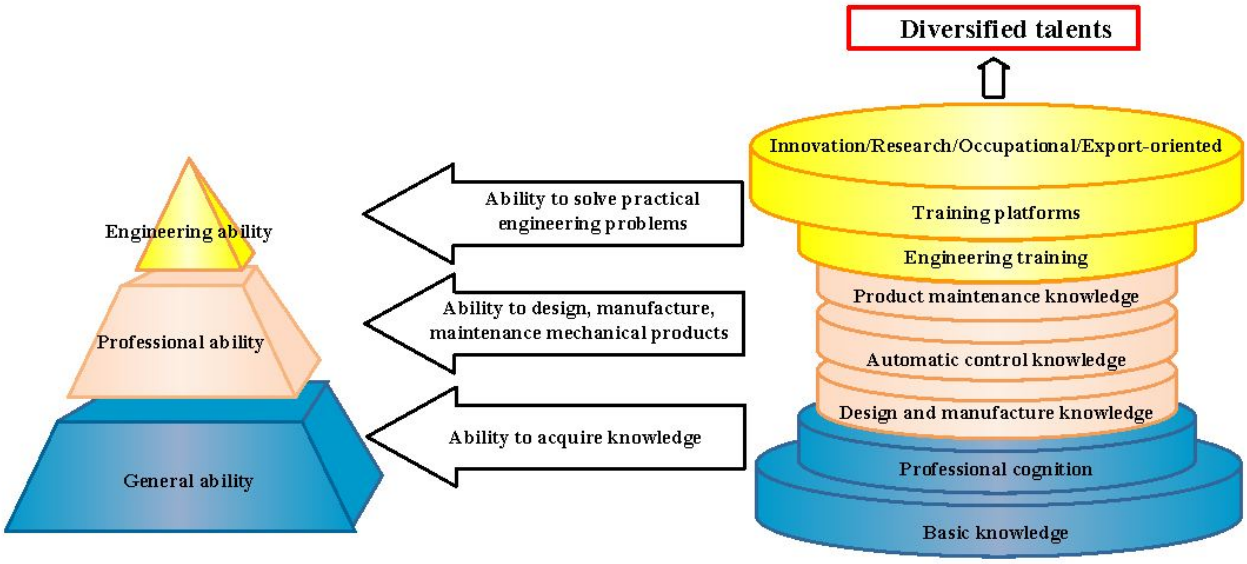

Figure 1: The scheme of *platform + diversification* cultivation mode for mechanical major.

In the junior stage, basic theoretical education and quality practices are reinforced by means of a general education and introductory professional education. This is done so that students gain skills and abilities required in subsequent steps in the cultivation mode, thereby, broadening their knowledge and building a firm theoretical basis. These skills include mathematical and humanistic foundations, computer skills, foreign language ability and knowledge acquisition ability.

In the middle stage, according to the characteristics of the mechanical engineering discipline, basic professional education would be emphasised by a systematic professional modular curriculum. This is done so that students have a solid professional foundation in mechanical engineering skills such as design, manufacturing, quality control and

product maintenance. This allows the transition from general education to specialised professional education, thereby, gradually cultivating professional interests of students and their basic professional abilities.

In the senior stage, in view of the diversified demands imposed by society for innovative senior mechanical engineering technical talents, and based upon the strong engineering and professional foundations, four types of professional talent cultivation platforms are established: innovation, research, occupational and export-oriented. In this stage, individual interests and preferences of students themselves would be taken into consideration, so that they may find an appropriate platform and receive an appropriate education in the principle of teaching students in accordance with their aptitudes and demands. This would allow the students to integrate easily with society and their peers in the field of engineering. In addition, the students would turn into diversified engineering talents with a broad developing space after graduation.

MODULAR CURRICULUM SYSTEM

With the aim of developing student abilities, the ability-oriented *platform + diversification* education mode establishes a structured three-tier teaching system (general ability, professional ability and engineering ability). This modular approach allows for systematic cultivation of both engineering ability and quality. Each step of the three tier teaching system is described in detail below.

General Ability Cultivation

The general ability cultivation system focuses on all-round student development keeping in mind their moral, intellectual, physical and aesthetic education. This cultivates good ideological and moral qualities, cultural ability, scientific skills, independent learning, innovation and practical ability, and enhances their social adaptability along with team spirit. Overall, this training lays a solid foundation for the future and imparts to the students skills for a lifetime of learning and sustainable development.

Professional Ability Cultivation

A modular design would be employed to develop teaching content, which cultivates the student's ability for systematic and innovative design. The structure of the curriculum system for professional ability cultivation is shown in Figure 2.

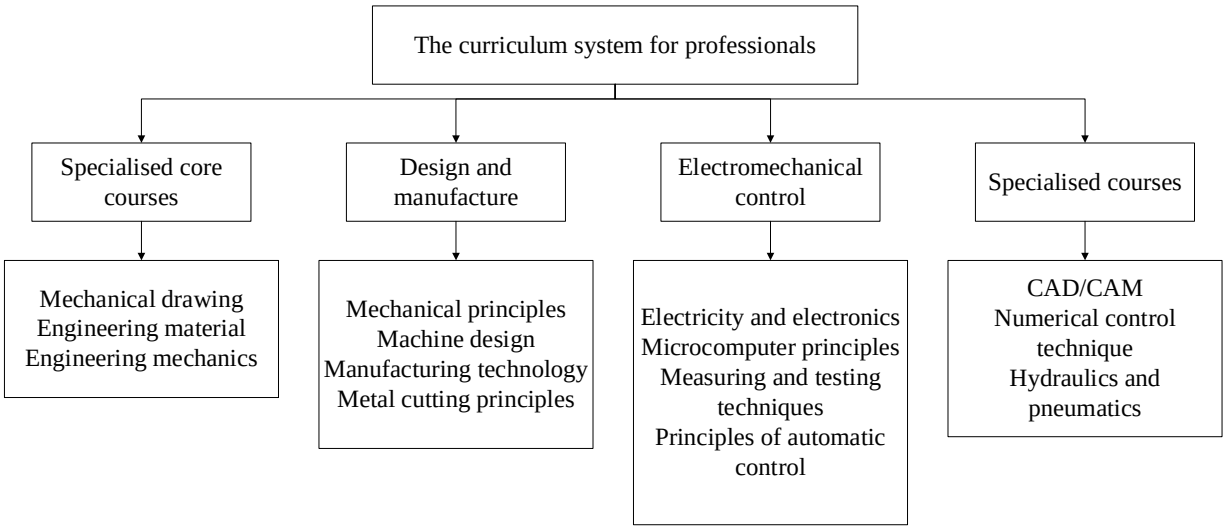

Figure 2: The structure of the curriculum system for professional ability cultivation.

Engineering Ability Cultivation

In the curriculum system, theories will be taught again for deeper understanding through the teaching practice. Outside the curriculum system, teachers with certain practical guidance ability and academic levels will organise and conduct open laboratory sessions to provide engineering project training [6][7]. In addition, these teachers would guide the students with their project design in line with the student's personal interests and individual development needs. This would allow the students to gain practical experience along with developing and improving abilities related to practical work, project system design, comprehensive project operation, and innovative and entrepreneurial activities.

EFFECT ON TEACHING

Application of the *platform + diversification* cultivation mode to teaching has obviously improved its quality when compared with the traditional pattern of teaching. The practical ability of students has been significantly improved and employment rates and quality have improved.

The students received good grades in various subject contests, and there have been more than 50 award-winners in national and provincial innovative games. The students obtained the national first prize in the competition for Mechanical Innovation Design and first prize in the National Challenge Cup in 2013. In addition, the graduates receive acclaim for their outstanding ability. The employment rate and satisfaction degree of employment are shown in Figure 3.

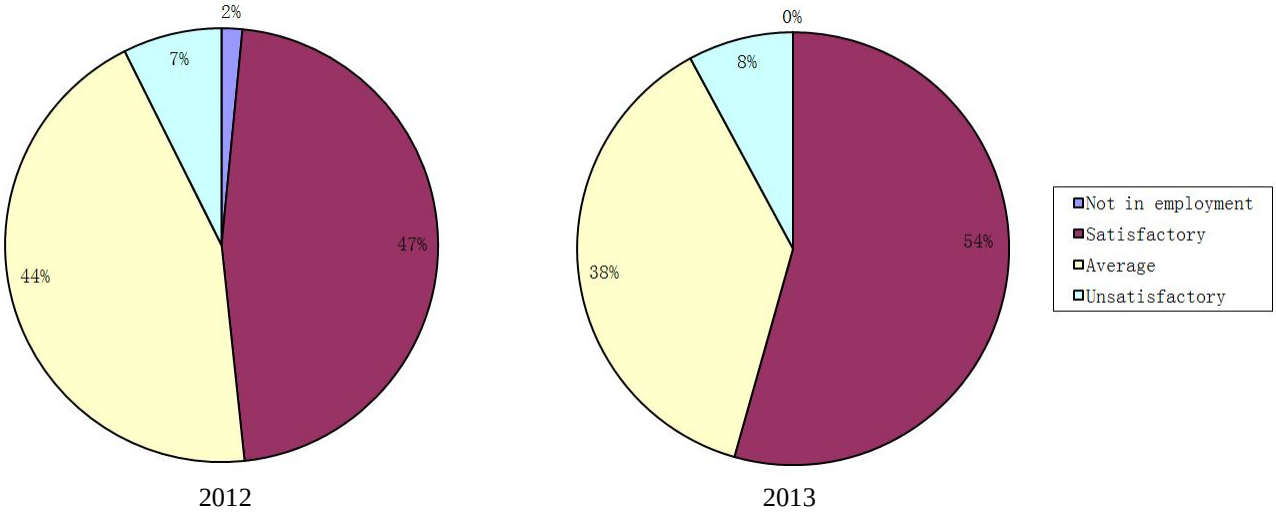

Figure 3: The employment rate and satisfaction degree of employment: satisfactory (work environment and salary level and advancement opportunity are above the average); unsatisfactory (work environment and salary level and advancement opportunity are below the average).

CONCLUSIONS

While focusing on the development of application-oriented talents along with the emphasis on strong foundations of theoretical knowledge, attention was paid to cultivating the ability of students to apply their engineering knowledge in a practical setting. Through the *platform + diversification* education mode, an innovative method for talent cultivation with engineering applications in mind was achieved.

This innovative method has been demonstrated over recent years and has achieved satisfactory results. The use of these methods would allow successfully overcoming the bottleneck in the practice of application-oriented talent cultivation.

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