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Consideration On Construction and Development of University Engineering Training Center

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Abstract

Now Engineering Training Center is in an important development stage, thus it is of great significance for the higher education reform and construction of an innovative society to improve the construction of engineering training center, teaching quality, effectiveness of engineering training as well as to cultivate students' innovative spirit and ability. The reasonable and effective management system and operation mode of it are discussed in this paper. To give some enlightenment of the construction and development of university engineering training center, studies are made from the following aspects: full use of various resources, construction of scientific engineering training system, strengthening teachers' construction, improving teaching methods, reforming teaching means and so on, and then the related proposals are put forward.

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Key words: Engineering Training; Administration Mode; Resource Integration; Professional Feature; Teachers' construction; Transformation of Education

1. Introduction

As China has become the processing center of the global manufacturing, the complex and creative engineering talent is needed in contemporary society. Promoting quality education, strengthening technological innovation, developing high science and technology and realizing industrialization are the requirements of the higher engineering education in the 21st century. Thus, deepening the engineering

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education practice reform and strengthening the cultivation of students' engineering practice ability and innovational ability are the responsibility of the university engineering education to adapt the development of the new era. Recently, to meet the requirement of personnel training of new century, engineering practice education reforms are being promoted in universities and colleges. Among them, positive and useful exploration and reforms have been made in cultivation of students' all-round qualities, innovative abilities, major project awareness and practical abilities. The transformation of engineering education from traditional metalworking practice to modern engineering training has been gradually realized and the depth, width and breadth of it have been gradually expanded, which plays an important role in the promotion of students' practical abilities and all-round abilities and the cultivation of innovative awareness. As a major carrier and platform of engineering practice teaching, engineering training is an important practical teaching of the university, the important means of innovative education and quality education and also the bridge connecting practice and theory for the college students. Thus it is of great significance for the higher education reform and construction of an innovative society to improve the construction of engineering training center, teaching quality and effectiveness of engineering training as well as to cultivate students' innovative spirit and ability.

2. A reasonable and effective management mode is the prerequisite.

Recently, according to teaching requirements of modern engineering training, the department which is in charge of university engineering training center has been basically determined. Most of the centers belong to the teaching units. Some are directly belonging to universities; others are directly belonging to related colleges or the educational administration department. There also quite few belong to industry. In the early construction, the engineering training center can rely on the related colleges in administration, which can help straighten the relationship of the different department and acquire development time and opportunity to realize sharing of teaching resources and the comprehensive use of technology, field and equipment. Therefore the teaching content of the engineering training can be improved. At the same time, the combination of the theoretical advantages of the college and the practical advantages of the training center can make the engineering training center in favorable conditions in teaching and research. As there are differences in management mode between the college and the engineering training center, the shortcomings of that mode appear with the further development of the center. Under this mode, the college has to put a lot of effort into the management of the center; on the other hand, the engineering training center can be restricted in developing the engineering training programs of the other colleges or departments because of its subordinate role. Thus, when the construction is in a relevant-perfect condition, the engineering training center can be a teaching unit as the direct department of the university. The relative-independent teaching system should be set up and correspondingly the full-time and part-time management personnel should be established, including the teaching and equipment management staff. At the same time, the self-contained management system and appraisal system should be established and improved [1-2]. Through this, the attention can be focused on the construction and other kinds of tasks. The management mode that makes the training center as a department of the industries can not be adopted, for it can not be helpful for the development of teaching activities. It can be as a transitional mode in a short time but it must be changed in the long run.

Generally speaking, the training center has three functions: practice teaching, research and production. The practice teaching is the main function and the other two are just secondary. Teaching is the core while research and production serve the teaching. Research and production can make teachers and students get the training in practice and enrich the content of engineering training. The economic benefits receiving in research and production play a positive role in the sustainable development of the center. The management system and operation mode which are characterized by teaching-based, research-improving

and sustainable development of the center by production, can be helpful in the following aspects: creating a modern engineering background closer to society, improvement of research of teachers and project quality, the maintenance and improvement of teaching equipment and the self-improvement and self-development of the center.

3. Full-use of the various resources is the basis.

3.1 Resources integration of the university

During the construction of the center, the existing resources of the engineering training in the university should be taken into account to avoid the redundant construction and reduce capital investment. The dispersed engineering training resources belonging to the colleges exist in universities and the effective and reasonable integration of these resources is the key to accelerate the construction of training center. The ownerships of practice projects, teachers, equipment and fields are concerned in the integration and the reasonable use of the resources, which needs the resolution and unified scheduling of the university. To make full use of the various effective resources, the traditional separation of experiment and engineering training teaching and the “fragmented” state of the specialized laboratories of the university should be broken, as well the separated traditional experiments between different disciplines and the engineering training teaching thought, mode and operation mechanism should be broken [3]. And a new open engineering training teaching management system should be established.

3.2 Full-use of society resources to realize the co-construction by universities and enterprises

It is unavoidable for the equipment of the training center to fall behind the development of the enterprise technology. To ensure the advanced and reasonable conditions of equipment of the center and reduce the capital investment, the center can be built by universities and social enterprises, using the existing equipment and personnel of the training center and attracting the investment of enterprises in advanced equipment, production, technology and capital. Thus, the advanced equipment and software of the center reflecting the contemporary manufacturing can be ensured and the true practical environment of the production can be built. And then the virtuous cycle of operation and the win-win situation of the university and enterprise can be created and the personnel training mode needed by society can be formed.

4. The construction of systematic training system is the key.

4.1 Construction of multi-level training platform

With the expansion of the content of the engineering training, the engineering training has been transformed from the traditional purely mechanical manufacturing and processing training to the engineering design, engineering manufacturing, engineering management and innovative practice. So the advancement, openness and innovation should be focused in the set of the engineering training programs. The traditional metalworking practice should be reduced and the modern manufacturing should be added. At the same time, the engineering practice should be focused and comprehensive innovation should be highlighted. The integrated and systematic training courses whose core is the integration of machinery, electronics, computer and management, should be built. And it characterizes as integration and practice, including engineering design, manufacturing, management and innovation. At the same time, the training

programs of major-project awareness emphasizing the technical and non-technical factors should be built, too.

The training subjects have transformed from the originally technical and economic management majors to the technical and humanities majors. The relevant training platforms are constructed according to their majors and the need of the personnel cultivation. The training modules of diverse needs will be formed through the integration of the training platform and training content from the point of levels and categories. The targeted training programs should be selected according to the different majors of the students.

4.2 Special training highlighted based on industry background

Basing on the basic engineering training, the engineering training of the industry-university should strengthen the special training consistent with the professional settings and the specialties of the university relying on the industry background. And it should carry out a real and effective skills training targeting the typical production process in industry engineering fields [4]. And then, the systematic comprehensive training and creative training including machinery, electronics, control, and management should be carried out making the industry typical system as carrier.

4.3 Introduction of “Enterprise culture” training

The “Enterprise culture” training must be introduced into the construction of the modern engineering training course system to enhance students’ enterprise cultural awareness. In practice training, the introduction of “Enterprise culture” education can make students acquire the basic knowledge of the modern industry production mode and processing technology and receive the training of management capacities of processing technology in the quasi-factory environment. The design of training practice program should focus on the needs of society and production and the practicality and makes processing technology control, raw materials and production-cost control as the prerequisites [5]. Thus, students can have a better understanding of the operation process of the enterprise and gradually realize and establish awareness of quality, safety, innovation ,management and team work and the importance of non-technology factors can be realized during the whole design and training process.

5. Strengthening construction of teachers’ team is the forceful guarantee.

Qualities of practice teachers can directly affect the quality of engineering training, so the construction of a high quality teachers’ team in which teachers know not only the theories but practice is the forceful guarantee of the engineering training construction and development. The educational background and skills of the practice teachers are different due to historical reasons. And a newer and higher requirement of the quality of the teachers are made with the improvement of the teaching equipment ,the adjustment of training programs and update and improvement of the training methods.

5.1 Strengthening teachers training

Recently, personnel with an educational background of vocational, undergraduate or graduate degrees have been imported or employed according to the actual situation. Technical staffs with practical experience have been hired as a part-time staff in some universities, thus the education and title of practice teachers have been greatly improved. Though the young teachers with an undergraduate or graduate degree have rich theory knowledge, most of them lack the capacities of engineering practice and

management [6]. Only by strengthening teachers training and cultivation of practice abilities, can the teaching requirements of modern engineering training be met. Teachers' learning and training system should be established and improved and the planned-arrangements for the teachers' training and further study in the enterprise should be made every year; to truly improve the professional skills, the pre-service training and practice in production process of the new-comers should be made; the practice teachers should attend the skills training and skills identification to obtain the appropriate qualifications.

5.2 Support given by University in Policies

Recently the newly-imported teachers must be have a high degree and high title in most of the universities and these teachers are mainly allocated to the theory-teaching and research; the number in engineering training teaching is so small that it can not meet the needs. Universities should plan in the long run and make some special strategies and at the same time take some temporary measures to introduce personnel with different degrees and enrich the engineering training teaching. In management, practice teachers should have the opportunity to participate in research and improve engineering and practice abilities through research. At the same time, practice teachers should be treated equally in title promotion and appraisal; sometimes the conditions can be softened due to its special. Thus the stability and quality of teachers can be ensured and also the training teaching quality can be improved.

5.3 Improvement of practice teachers welfare by creation of income

The practice training workload is heavy and the work conditions are poor in the center and most of the practice teachers have lower income. To stabilize the teachers, teachers' welfare must be improved self-reliantly through creation of income by scientific research, production and external training under the conditions of finishing teaching tasks in quality and quantity and the permission the universities policies. The research and production of the universities can be taken by the center because of its advantages in resources and personnel; the center can train the technical staff of the enterprise and the students in non-government institute and Certificate them NC skill. Through research, production and training, not only the qualities of teachers are improved, but incomes are increased of the center. And the incomes can be used as an incentive to improve teachers' welfare.

6. Teaching-mode reform and improvement of teaching-method are the bridge.

6.1 Teaching-mode reform

During teaching process, research of students' features and needs should be emphasized and the subjectivity and creativity of students should be aroused to make students as the teaching subjects. Heuristic teaching and discussion teaching are advocated. The open-teaching mode is carried out and in this teaching mode the choice of training content and time can be realized by "reservation- approval" and the space for the students' self-development and individual representation can be provided to make them design, program, build modes, process and finally finish the task. A real engineering environment is created and the team spirit, cooperation and management are cultivated in the process of training.

6.2 Improvement of teaching method

The teaching-instruments such as projector, video, CAI course software and multi-media technology are made full use to enhance audio-visual effect; The models are shown vividly and directly to improve

practice effect; The simulations designs are made by full use of various soft wares to make the students better understand the design parameters' influences on design result. The NC machine DNC network is established to realize the training of design, material selection and processing; The engineering training center website is established based on the campus net to realize the teaching information communication including students' reservation and training content and resources-sharing between universities.

7. Conclusions

The construction and development of engineering training center is an important subject in the university practical teaching reform of the new time and also a systematic project needing probes in practice. According to the author, the followings should be emphasized and strengthened: effective and reasonable management system and operation mode; establishment of systematic engineering training teaching system by full use of various resources; special training by strengthening major-set; introduction of "enterprise culture" training; strengthening construction of teachers team; reform of teaching mode and improvement of teaching instruments. Enhancement of the things above can make the training adapt to the teaching reform and meet the needs of cultivation of personnel in innovative society, which has a general meaning.

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References

- [1]Hui Zhang. Management Mode and Operational Mechanism of Engineering Training Center of Universities. *Journal of Nanjing University of Aeronautics (Social Science Edition)* ,2006(3), p.72-75.
- [2]Dachao Hu, Yiming Cheng,Yunming Huang,Huiting Zhu. Reflection and Constructing Mode of the Engineering Training Center of Universities. *Research on Higher Education of Engineering*, 2006 (3), p.33-36.
- [3]Yinling Wang, Xianming Yin, Hua Zhang,Yong Wang. Integrate the Advantages of Resources, Construct Distinctive Feature of the Engineering Training Center. *Research on Universities Laboratory Work*. 2006(3) p.72-78.
- [4]Yang Zhao,Zhiguang Peng.Construction and Practice of Engineering Training Center in Some Universities with Vocation Character. *Reserch and Exploration on Laboratory*. 2008, p.79-81.
- [5] Xianwen Miu,Yanhong Zuo.The Actuality and Develop Route of Domestic and Overseas College Engineer training . *Journal of AnHui Institute of Architecture & Industry*. 2007(12) p.45-48.
- [6]Shuigen Fu,ShengLu Li.Analysis on Teaching Engineering Practice and Its Developing Trend. *Journal of Changzhou Vocational College of Information Technology*,2005(9), p.1-5