Cultivation of College Student’s Innovative Ability Based on OBE

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ABSTRACT

In order to further cultivate college student’s innovative ability, that OBE theory, refers to design the education goal as the student’ learning outcomes would be adopted in the study. A questionnaire was designed, students’ opinions on the current training mode were collected, and the problems and reasons of the current lack of innovation ability of college students were summarized. Through the analysis of survey data, the problems and key factors that affect the promotion of college students' innovation ability in engineering practice have been obtained.

Some cultivation methods for the cultivation mode of engineering practice and innovation ability are introduced specifically. The methods that are more in line with OBE education concept were adopted in the class. The results indicated that student’s mechanical innovation ability has been improved, and the students are very satisfied with these cultivation methods.

1. INTRODUCTION

To train talents with research and innovation ability is an important task of personnel training in colleges and universities. However, the traditional theory of engineering education is facing unprecedented challenges and hard in the promotion, and theory of OBE can break through these limitations. The theory of OBE (Outcome-Based Education) proposed by the engineering education circle has
become the mainstream of teaching reform. Three core concepts are emphasized by professional certification of engineering education: student-centered, outcome-oriented education (OBE), and continuous improvement. These ideas which represent the direction of engineering education reform are advanced education ideas. That OBE theory emphasizes the reality of education output, teaching as an important cultivation index of engineering practice’s ability and has been applied to the teaching. There are many engineering colleges and some related teachers for cultivation methods of innovation ability to have carried out a wide range of research work [1-9]. The related research has a certain scale and depth, but there are still some problems. There is not much research on the training mode of engineering innovation ability of application-oriented university students combined with OBE concept. Based on the previous research and according to many years of our own teaching practice, the current situation of engineering practice innovation ability of our students and the key factors affecting the cultivation of engineering practice innovation ability are briefly analyzed, some feasible training methods for college students' innovation ability would be discussed specifically and carried out practical research in this paper.

2. PROBLEMS AND REASONS

2.1 Questionnaire Design

In order to analyze the problems existing in the current training mode of engineering innovation ability of college students, a questionnaire was designed as shown in TABLE I:

| Question | Description |
|----------|-------------|
| Question 1 | Have you participated in any competition related to innovative design of college students? |
| Question 2 | Do you think universities pay attention to the cultivation of students’ innovative ability? |
| Question 3 | Do you know the educational concept of OBE? |
| Question 4 | What are the ways to cultivate your innovative ability and spirit? |
| Question 5 | What are the innovative design competitions organized by your university? |
| Question 6 | Do you think the university has a strong culture of innovation and entrepreneurship? |
| Question 7 | What preferential policies for innovation and entrepreneurship have you enjoyed in your university? |
| Question 8 | Does the teacher introduce OBE concept in the teaching process? |
| Question 9 | Do you know the way to check patents? |
| Question 10 | Have you ever written a patent? |
| Question 11 | Have you ever participated in an enterprise project? |
| Question 12 | What are your ways of communicating with teachers? |
| Question 13 | Do you often want to make inventions that can bring convenience to others? |
| Question 14 | Can you think of protecting it quickly with your innovative design? |
| Question 15 | Can you keep in mind and abide by academic ethics and norms when you innovate? |
| Question 16 | Do you dare to do things that many people have not succeeded in? |
| Question 17 | There are often innovative ideas, but few of them are actually done. |
| Question 18 | Have you ever questioned teachers or the knowledge of textbooks? |
| Question 19 | Does the teacher often improve the teaching content and teaching methods according to the students' learning situation in teaching? |
| Question 20 | Does the teacher pay attention to process evaluation in curriculum assessment? |

### 2.2 Survey Results

The questionnaire surveyed 240 students from three classes and collected 200 survey results as shown in TABLE II:

| Question/number | YES  | NO  | Know a little | Not at all | Know it all |
|-----------------|------|-----|--------------|-----------|-------------|
| 1               | 20   | 180 |              |           |             |
| 2               | 90   | 110 |              |           |             |
| 3               | 173  | 27  |              |           |             |
| 4               |      |     | 132          | 25        | 43          |
| 5               |      |     | 145          | 21        | 34          |
| 6               | 97   | 103 |              |           |             |
| 7               | 35   | 165 |              |           |             |
| 8               | 72   | 128 |              |           |             |
| 9               |      |     | 95           | 84        | 21          |
| 10              | 17   | 183 |              |           |             |
| 11              | 58   | 142 |              |           |             |
| 12              |      |     | 33           | 28        | 139         |
| 13              | 87   | 113 |              |           |             |
| 14              | 27   | 173 |              |           |             |
| 15              | 129  | 71  |              |           |             |
| 16              | 39   | 161 |              |           |             |
| 17              | 147  | 53  |              |           |             |
| 18              | 37   | 163 |              |           |             |
| 19              | 57   | 143 |              |           |             |
| 20              | 114  | 86  |              |           |             |

Through the analysis of survey data, the current situation of college students' innovation ability and influence factor of the lower innovation ability of college students would be briefly analyzed. The main unfavorable factors in innovative ability’s Cultivation are as follows:

1) There is a lack of cultural atmosphere for the cultivation of college students' innovative ability.
2) The understanding of OBE's advanced educational concept and its implementation in the teaching process are not deep enough.
3) Many college students lack innovative spirit, persistence and willpower.
4) Poor communication between teachers and students.
5) The ability of patent writing and searching is poor, and the consciousness of protecting inventions and creations is weak.

6) The cultivation of students' innovative ability lacks effective guidance of university teachers' innovative quality education.

Aim at the unfavorable factors in the cultivation of mechanical innovation ability, some cultivation methods are introduced specifically in the next part.

3. CULTIVATION METHOD

3.1 Face up to Lack of Innovation Ability and Know the Needs of Enterprise Talents

1) Extensive research has been carried out to obtain students' opinions on the current talent training mode, and to analyze the basic status quo of the current college engineering practice innovation ability training mode together with students, so that college students can face up to their lack of innovation ability. Thus, how to improve the engineering practice innovation ability of college students is explored.

2) The current situation of the industry and the needs of employers have been fully investigated through in-depth investigation into enterprises and universities. Furthermore, our university often invites experts from enterprises to hold a series of lectures so that teachers and students can grasp the specific needs of enterprises in time and adjust teaching activities in real time.

3.2 Building Cultural Atmosphere for the Cultivation of College Students' Innovative Ability

A good cultural atmosphere is conducive to the cultivation of innovation ability, while a poor cultural atmosphere will limit the cultivation of talents. The college of innovation and entrepreneurship education was formally established in July 2017 by our university. The main duties of the college include the construction and management of college students' innovation and entrepreneurship bases, the establishment of the college students' innovation and entrepreneurship curriculum system, the development of educational activities, incubation and transformation of college students' innovation achievements, organization and implementation of college students' science and technology competition activities, college students' science and technology innovation activities, college students' entrepreneurship activities, etc. The integrated teaching of learning, research, training and competition has been implemented. Taking projects as the starting point, practical training in entrepreneurship has been carried out to enhance the innovative and entrepreneurial ability of college students. In recent years, the college has stepped up its efforts to guarantee resources and create conditions. What is more, it enables college to makes the reasonable incentive mechanism for teachers to guide the students.
Teaching methods such as "promoting learning through competition", "promoting teaching through competition" and "promoting reform through competition" have been adopted. Therefore, the enthusiasm and initiative of all students are stimulated. All kinds of competitions will be transformed into teaching, and the benefits of students will be expanded by taking the proposition of competitions and the results of competitions as teaching cases of curriculum groups and incorporating them into practical teaching links such as curriculum design, engineering training and graduation design.

### 3.3 Introducing OBE Advanced Educational Concept

OBE is paradigm shifting from conventional education to result oriented learning. It provides new wave of observing world and occurrences. Based on the core concept of OBE, the cultivation of innovative spirit, entrepreneurial awareness and innovative entrepreneurial ability should be integrated into all aspects of the whole process of talent cultivation. The specific design and implementation of the innovative ability training mode in our university are as follows:

1) The connotation of OBE education mode is analyzed, its theoretical basis and characteristics are mastered, and the teaching mode of "project-oriented, student-oriented, teacher-assisted, school-enterprise cooperation" is implemented around the ability index point of expected learning output.

2) Based on the core concept of OBE, teaching objectives are formulated according to the needs of enterprises, OBE reforms are carried out on relevant courses and teaching activities are organized. Monitoring, teaching evaluation and continuous improvement of students' learning results will be carried out to construct a new teaching mode aimed at improving the quality of innovation.

3) Taking students as the center, the links of teaching, experiment, curriculum design, cognitive practice, professional practice and graduation design are designed. Taking the result orientation as the requirement, the teaching of courses related to innovation theory is increased. It is helpful for college graduates to better integrate into the work of enterprises, timely communicate with enterprise leaders, university teaching and scientific research managers, front-line teachers and students to find problems, feedback channels are constructed, continuous improvement is made, closed-loop feedback is formed, an evaluation system for training innovative talents is established.

4) Taking the professional certification of our university as an opportunity, extracurricular innovation and entrepreneurship practice, professional practice, social practice and student group activities have been expanded to cultivate students' ability to discover, analyze and solve problems. Engineering innovation education should be run through the whole process of personnel training activities, and a training mode system for engineering practice innovation ability should be constructed, which is more in line with OBE education concept.
4. WRITING PATENT

According to the survey results of questions 9, 10, 13-18, the ability of patent writing and searching is poor, and the consciousness of protecting inventions and creations is weak. So a series of explorations have been carried out on the writing of university students' patents.

1) In order to stimulate students' interest in innovation, every college student would look for some creative models and videos in their lives through various channels, so that they can understand that inventions and creations are nearby and not out of reach. Inventions and creations are very meaningful and can benefit others.

2) Based on OBE concept, every college student in the class is encouraged to participate in patent inquiry, patent conception, patent discussion and patent writing activities. The teachers are responsible for introducing the writing methods and techniques of patent, encouraging students to learn thinking and write patents. The teacher organized the whole class discussion and debate after the completion of the patent, which usually develop a perfect environment to develop critical thinking skills, and where many problems can even be solved unconsciously. Finally, some excellent patents would be chosen to declare by the teacher and whole class, which greatly stimulated the enthusiasm of the students to write the patent.

3) Experts and students with experience in patent writing are invited to give a series of lectures to enable all students to learn the skills of patent writing and the requirements and specifications of patent application, so as to cultivate students' awareness of patent protection and abide by academic norms and ethics. All the students in the class were required to participate in patent writing, thus eliminating the act of only thinking and not acting. The college student's questioning spirit is gradually cultivated. Every college student is required to make an organization creative model and put innovative ideas into practice.

4) In the past three years, our students have won 978 provincial and ministerial awards, including 50 national first-class awards and 80 second-class awards. The number of students who won the awards has reached 2362. Many patents applied by students have been authorized.

5. CONCLUSIONS

Through the implementation of the above innovative ability training methods, the subjective consciousness of the improvement of college students' innovative quality is stimulated, and the self-expectation of the improvement of college students' innovative quality is greatly improved. The students' initiative to temper their innovative character is actively guided. The research results can provide reference to
improve the level of college students’ innovation ability based on OBE educational philosophy.

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