Improving the practical ability of civil engineering students

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ABSTRACT: Students' practical ability, especially civil engineering students' hands-on practical ability, is an important factor for measuring the overall quality of students. It is also an important indicator for assessment of students by recruitment companies. Internships are the best way to integrate theory with practice. A common phenomenon in Chinese institutions is that the emphasis is on learning theory, with practice to improve students' practical ability lagging behind. As a result civil engineering majors have, in general, performed poorly. The changes in performance before and after on- and off-campus internships is presented and discussed in this article, to highlight that this is key to improving working skills and ability.

INTRODUCTION

College students should learn theory but also have a strong practical ability. With the increase in college enrolments, more and more students are faced with the difficult problem of finding employment. College students must possess the necessary practical ability to meet job requirements. Innovative capability is essential for the graduate and innovative capability is developed on the basis of practical ability. As a result, it is the role of institutions and educators to enhance the college student's practical ability [1].

However, China's traditional higher education emphasises teaching theory. Moreover, the evaluation of the student is mainly based on a written test on theory. Students' practical and creative abilities have been neglected resulting in a lack of practical teaching to test theoretical content. Consequently, a student with a good academic performance often has poor practical ability [2].

Civil engineering students are a major force in China's national economy and their practical ability directly determines the success or failure of civil engineering construction in the national economy. Thus, enhancing the hands-on ability of civil engineering students is of paramount importance. However, actual teaching practice does not play its due role in improving civil engineering students' hands-on skills.

KEY ISSUES IN INTERNSHIPS FOR CIVIL ENGINEERING STUDENTS

Emphasis on Theory, Neglecting Practical Skills

In recent years, the number of college graduates has been increasing rapidly each year. By contrast, employment prospects have not improved in the same way and students' lack of hands-on ability is one of the main causes. At present, China's higher education has not completely eradicated the elite education system of the past. For example, students studying civil engineering spend most of their time learning basic theories. This long, basic theory-learning process can make students lose interest. Most teachers at universities and colleges, do not have experience of the real business world and do not understand the updated requirements for skills. They focus on teaching theory of knowledge, while ignoring the practical aspects of education.

Campus Study Ignores Learning off Campus

Civil engineering students rarely go off campus to learn. The main reasons are: first, the school offers internship facilities on campus and so students can practise without going outside. Second, campus internships are preferred by the schools and teachers because of safety concerns for the students off campus. However, this means students are

constrained and limited by the practical abilities of the instructors, who are unlikely to be aware of the latest technologies and practices.

Emphasis on Safety, Overlooking Content

Practical training for students in most colleges is very safe and controllable, while avoiding risks that are of great value to students' practical ability. As a result, students cannot master all the required practical skills.

Analysis on Key Issues of Civil Engineering Student Internships

The year 2007 was a watershed for students in the area of internships. Before 2007, inadequate practical skills resulted in poor student performance. The situation was reflected in the students' results (Table 1) and poor off-campus performance (Table 2). The results directly affect the students' future career prospects. At the time, theory accounted for 90% of the assessment, while practical work accounted for just 10% (Figure 1). On-campus school internships accounted for 95% of internships, whereas off-campus internships accounted for just 5% (Figure 2). Students' poor practical ability was directly related to the practical teaching situation before 2007. In addition, there are several other reasons for poor practical ability:

Table 1: Statistics of results in school.

Grade	Very Good	Good	Average	Bad
Proportion	6%	32%	46%	16%

Table 2: Outside the enterprise - the students' practical ability.

Grade	Very Good	Good	Average	Bad
Proportion	4%	25%	31%	40%

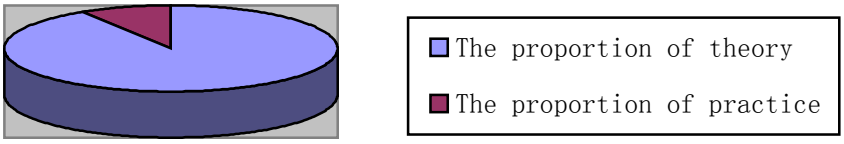

Figure 1: The proportion of theory and practice before 2007.

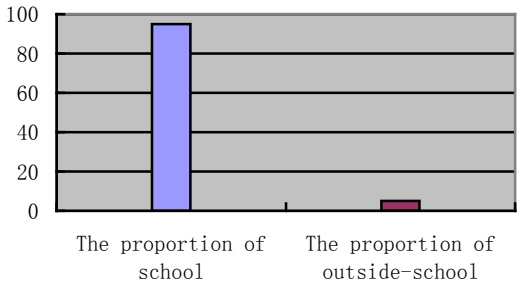

Figure 2: The proportion of school and outside-school of internships before 2007.

Student Characteristics

Because of the tradition of highlighting theory and neglecting practice in the past, most students developed a habit of putting theory ahead of actual practice. They could even lack a strong interest in practice. Students take great effort and time to gain certificates to demonstrate their abilities. But for many years the examination-oriented education focus on theoretical knowledge meant that only a small proportion of the effort and time was spent on the practical aspects of the subject. Without encouragement, students did not show a great interest in participating in internships.

School Characteristics

There are significant flaws in terms of ability and creativity of college students:

First are the limitations caused by school conditions. With the rapid expansion in enrolments, there is a shortage of faculty, teaching and research facilities, which has put tremendous pressure on universities. Lack of enough educational

resources, teaching equipment and laboratory equipment makes it difficult to offer enough on-campus internships. The proportion of practical teaching time is inadequate, resulting in the lack of practical ability by students.

Second are the constraints of the training in school. This is key to determining whether or not the knowledge students have learned can be applied in practice. However, the training model currently used is mainly classroom-based. The teacher teaches theory at the blackboard and students take notes. Real hands-on practice is minimal and very limited. This training method develops the memory of students, but not their ability to apply knowledge. As a result, students trained in this way have little practical and creative ability in actually using knowledge. This explains employer complaints about under-performance. Foreign university training models are not perfect either, but they do emphasise independent thinking and innovation so that the graduates are better suited to employers. Obviously, there are also many areas in need of reform regarding integration with social needs, to meet employer requirements.

Third is with regard to teaching evaluation. Teaching evaluation has a dual function. On the one hand, it measures a student's learning outcomes, on the other hand, it can guide the direction of teaching. If schools attach importance to the written examination, students will particularly value lecture notes and memorisation. If schools pay attention to practical ability and innovation, students are encouraged to go to the laboratory to do experiments or investigations to develop their own practical ability and creativity. Unfortunately, this country's evaluation system relies on written examinations, which mainly sees if students can regurgitate material from textbooks that teachers have covered. Real practical ability and creativity are rarely required by the testing system. As a result, students are most concerned about how to pass the examination and get a diploma. It is hard to achieve a breakthrough and change this system [3].

Teacher Characteristics

Most teachers are mainly theorists and lack the ability to teach practical skills. University teachers have fewer opportunities for improving their practical ability. For example, a teacher teaches business management but has never been involved in real enterprise management. Teaching remains at the theoretical level without practical knowledge, resulting in a theory and practice gap [4]. If students are taught by teachers with actual experience in real businesses or institutes they will be more welcomed by the employing companies.

Social Characteristics

Employment pressure drives college education to focus on the short term and be utilitarian, while students have to focus on getting a certificate. Even if some want to improve their practical ability to better adapt to society, for various reasons as discussed in this article, the schools cannot provide them with the opportunity to grow to their full potential. Therefore, social factors constrain students' ability to improve their practical skills [5].

HOW PRACTICE CAN IMPROVE STUDENTS' PRACTICAL ABILITY

After 2007, with the reform of the national education system and emphasis on the students' hands-on ability, the state began to increase the proportion of education devoted to practical training (Figure 3). Also, changed was the teaching, with more emphasis on outside internships, aimed at substantially improving practical training (Figure 4). The balance between theory and practical skills training is more reasonable. The teaching has become more standardised and more scientific so that students get hands-on practical training, which has dramatically improved students' results (Table 3). An external evaluation by outside enterprises has also improved greatly (Table 4).

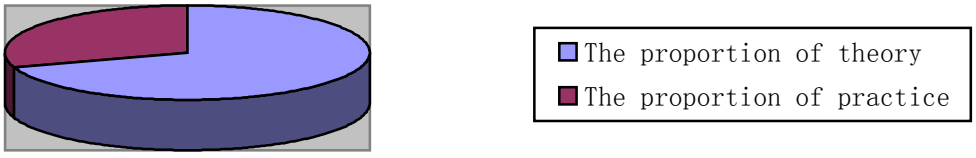

Figure 3: The proportion of theory and practice teaching after 2007.

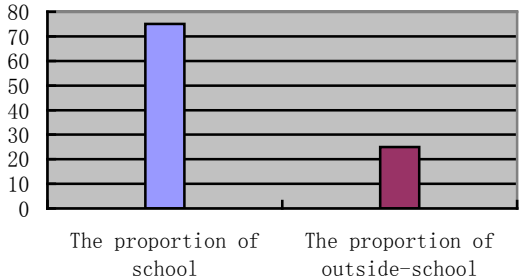

Figure 4: The proportion of school and outside-school internships after 2007.

Table 3: Statistics of results in school.

Grade	Very Good	Good	Average	Bad
Proportion	26%	40%	25%	9%

Table 4: Outside enterprise - results for students' practical ability.

Grade	Very Good	Good	Average	Bad
Proportion	34%	36%	22%	8%

Businesses' assessment of students has improved. This means students have greater potential within the organisations. This, in turn, means students will have increased opportunities, such as being promoted into management positions. In summary, greater contributions being made by students are playing an important role in enterprises and institutions. After 2007, students have greatly improved and achieved better results. The study indicates the following reasons for these improvements.

Taking on Innovative Ideas and Establishing a Comprehensive View of the Education System

In traditional education, there are many good ideas and methods worthy of being carried forward; for example, the emphasis on teaching basic theory and knowledge transfer. But when facing the demands of the future economy resulting from the rapid development of technology and China's market economy, traditional education and its teaching philosophy gradually become unsuited to the requirements of modern society. Thus, quality, comprehensive education should be developed. Schools should pay attention to the cultivation of a student's capability and skills, develop a student's practical ability and focus on developing innovative talent [6].

Strengthen Practice Teaching

In order to improve the practical ability of college students, it is important to carry out effective practical teaching. However, practical teaching in many schools is relatively weak. Colleges and universities should strengthen their practical teaching by investing in improved practical teaching facilities, improving teacher development and increasing the proportion of practical teaching in school [5]. Schools should vigorously improve the practical ability of college students by taking various measures, as discussed here, to strengthen this kind of education.

Establish a Mechanism for Evaluating Scientific Teaching

The aim should be for examination content and format to have a thorough and comprehensive assessment in order to evaluate students' achievements. The traditional way of testing focuses on the assessment of students' academic knowledge, but does not guide them in active learning and development [7]. Therefore, schools should pay attention to the evaluation of classroom teaching, but equal attention also should be paid to the theory and assessment of practical ability. Schools should have an objective and thorough assessment process [8].

CONCLUSIONS

Before 2007, college graduates' practical ability was poor and so the graduates could not play their due role in the real world, hence, limiting their career development. Recognising this problem in China, reforms were implemented, innovative ideas adopted, practical teaching was increased and the evaluation mechanism improved. The practical ability of this country's college students has been improved significantly and this has been recognised by employers. This not only benefits students in developing their careers, but also contributes to the development of the economy and society.

In conclusion, the hands-on training of civil engineering students to improve their practical ability has had a significant effect. Through internships, students as practitioners become directly involved in industry. They can add to the knowledge learned in class actual technical skills and management skills. Furthermore, through internships, students can consolidate, enrich and enhance their theoretical knowledge. Therefore, theory and practice are integrated. Students trained in this way should become more competitive in modern society and achieve more; thus, making a stronger contribution.

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