

Reform of the teaching method of the hydrological survey experiment projects for the *Hydrology and Water Resource Engineering* major

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ABSTRACT: A reform of the teaching content, teaching methods and teaching means of hydrologic experiment-based projects at Xi'an University of Technology and elsewhere, is outlined in this article. The aim of the study is to cultivate talented individuals who are of a high quality, and to stress their practical abilities. In order to accomplish such a teaching reform, the authors have designed an investigative questionnaire. The questionnaire was evaluated and used to guide the teaching reform, as well as to provide suggestions for improving teaching in the Hydrology and Water Resource Engineering major.

INTRODUCTION

With the emergence of educational reform since the 1980s, evaluation has become a hot topic in educational research [1]. Hydrologic Survey is a compulsory basic course of the *Hydrology and Water Resource Engineering* major. It includes two parts; namely, the collection and measurement of various hydrologic features, as well as the organising of hydrologic data. The main task is to collect and research the hydrologic features of various surface waters, and to organise collected hydrologic data into complete and systematic hydrologic data in a specified form, using appropriate methods. Those data are printed and bound into volumes, which will be employed by various Government departments, as well as in construction planning and the design of hydraulic engineering projects [2]. Experiment-based teaching serves as an important teaching method in higher education, and also serves to verify, complement and expand on the taught theory [3].

At present, hydrology-related courses at some universities in western countries mainly include physical hydrology and engineering hydrology, which focus on experiment-based teaching. In the engineering major at Utah State University in the USA, as an example, experiment-based teaching accounts for 50% of the major. Students can pursue the curriculum independently and there is a complete experiment-based teaching system with rich content.

However, in general, practical teaching in China accounts for only 25% in engineering majors [4]. There are fewer experiment-based teaching courses concerning hydrologic surveys in China, which is a negative factor both for developing students' practical ability and for improving innovation. Experiment-based lessons play an extremely important part in the teaching of hydrologic information collection and hydrologic data processing.

Through experiments, students can further understand the methods and principles of operation of the instruments. Moreover, it deepens theoretical knowledge, thus, developing the practical and innovative abilities of students [5].

Most experiment-based teaching in China uses experiments that are demonstrations that replicate results, rather than being more challenging. Lack of innovative experiments hinders not only the development of students' innovative capacity, but also their initiative [6]. There are various theoretical equations and empirical formulae concerning hydrologic surveys, which cannot be fully mastered and applied by students.

Furthermore, there is difficulty with memorising the necessary information, let alone its practical application [7][8]. Besides, experiment-based examinations in China always take the form of written laboratory reports by which to check the accuracy of students' experimental data and to verify students' mastery of experimental methods [4]. There are deficiencies with this examination method, which do not check students' operational and practical ability [9].

MATERIALS AND METHODS

Subjects of the Investigation

Sixty four students of Xi'an University of Technology, who have studied the course hydrologic survey were subjects of this investigation. Their majors were related to hydrology and water resources, and a questionnaire survey was conducted including this group of students. Females accounted for 48% of the total and males 52%.

The Questionnaire

The questionnaire relates to the classroom, interest in the course, learning, teaching methods, and influence on future career. Figure 1 shows the detailed flow.

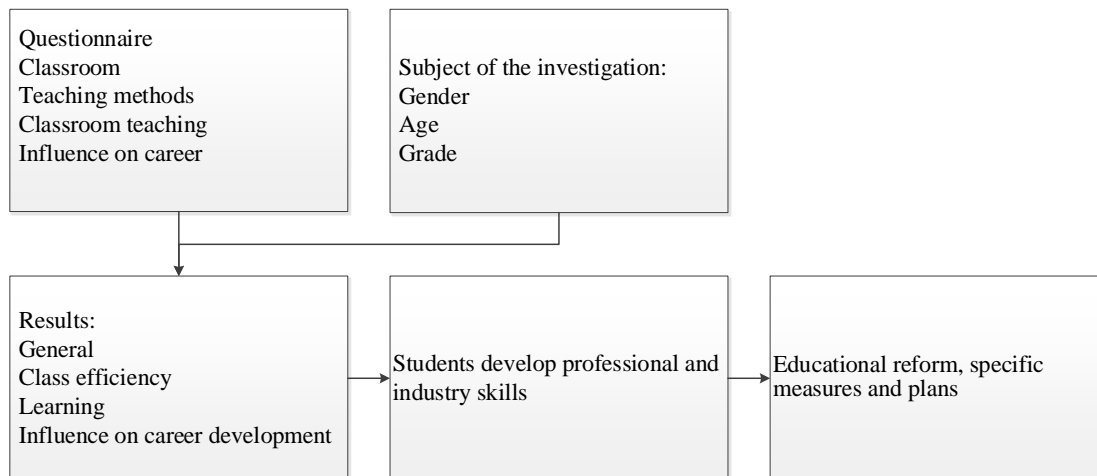


Figure 1: The detailed chart of the education reform questionnaire.

Analysis of Questionnaire Results

The statistical package for the software sciences (SPSS 11.5), was used to analyse the data. Of the subjects, 55% were interested in the hydrologic survey course, 21% showed a general interest and 24% showed a clear indifference to the course. As for the reasons to pursue the course, 38% thought it might be useful in their future work or they were just interested in the content.

Eighteen percent of the students believe that changing teaching method will allow them to more actively participate in the course, thus, increasing active learning; 16% of the students are guided by their teachers; 28% of students hold the view that multimedia teaching is easily understood and will increase the interests of students. When facing difficulty during learning of molecular biology, 33% of the students seek advice from course teachers, 37% ask their classmates, 25% go to the library or look up materials on-line and 5% just let matters slide. When it comes to the influence of the course on future careers, 89% say that the course will exert a direct influence on future jobs, while only 11% say there will be no influence.

RESULTS AND DISCUSSION

Analysis of Students' Interest in the Course

Statistical analysis shows there has been no clear improvement in the course except for students' career prospects. However, students are provided with rational analytical skills, which improve learning.

The current learning changes the focus on the leading role of the teacher to an emphasis on learner autonomy and positive learning attitude is crucial. But, there is general lack of necessary patience and perseverance, with an undue emphasis on quantity and speed. The direct motivation of focusing on grades has been weakened and the indirect motivation of pursuing knowledge and a sense of achievement has been strengthened.

Experiment-based Learning

College teaching focuses not only on theoretical knowledge but also on practical skills. There is structural change in the demand for educational courses with practical courses more in demand, and purely theoretical courses less so [10]. There is more teaching, with more practical and operational content [11]. Experiment-based teaching should follow the mantra of *theoretical guidance - teacher demonstration - do it yourself*, along with the assessment method of *laboratory report - open response - demonstrate correct approach*.

It is worth noting that experiments can include design and innovation. The following measures need to be addressed regarding the experiment-based teaching content:

- Video collection for each project needs to be formed.
- Hydrology experts and staff working in hydrometric stations should deliver lectures.
- Multimedia resource libraries for projects should be established.
- Relevant lectures, as well as video data, are sorted according to the project and research type.

With the emphasis on practice, the students are led to improve their practical abilities autonomously or to design new instruments and equipment [12].

All-around Assessment Method

Assessment by *laboratory report - open response - demonstrate correct approach* is used during experiment-based teaching. Teachers *making an open response* is aimed at students' experiments. The teacher pointedly inspects and critiques the student's test results and asks key questions about the experiment. The student's answers reveal their mastery of the experiment. *Demonstrate correct approach* refers to selecting one or two students, who demonstrate the experiment, which the class will observe and, hence, identify the faults that may occur.

Impact of Teaching Reform

Surveys show that, due to the expansion of class size, there are fewer chances for students to participate in discussion. The rapid increase in enrolment leads to increased pressure on college teachers. There is more teaching and, hence, less research. Gradually, in most colleges, teaching has become just a means of *imparting knowledge*.

Increasingly, students are selecting their courses according to their interests and social demand, instead of under the guidance of teachers. However, students increasingly are interested in classroom discussion, which will have a far-reaching influence on both classroom teaching and students' learning.

CONCLUSION

Experiment-based teaching is important in undergraduate teaching. Experimental-based teaching reform is a long term, gradual process. During experiment-based teaching, teachers should try new methods and means. This includes optimising and reforming the teaching and the evaluation methods. By these means students' learning interests and practical abilities are cultivated.

In the experiment-based teaching of hydrologics, the teaching should be active. If so, students not only will grasp the theory, but also have the ability to operate measuring instruments.

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