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Exploration on the curriculum reforms of "Irrigation and Drainage Engineering"

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Abstract

To meet the requirements of high-speed development of technology, it is necessary to reform the curriculum of "Irrigation and Drainage Engineering". The present study firstly described and analyzed the current configurations of "Irrigation and Drainage Engineering" curriculum in School of Water Resources and Hydropower Engineering (SWRHE), Wuhan University. Then the current reform strategies of SWRHE on "Irrigation and Drainage Engineering" curriculum were indicated from five different aspects. After that, the performance of examinations and feedbacks from students were also analyzed which proved the reforms to be periodically successful. Finally, some issues and suggestions for future reforms were also proposed.

Keywords: Irrigation and drainage engineering, curriculum reform, size of class, project cases, teaching method.

1. Introduction

Irrigation and drainage are two main factors affecting the sustainable development of agriculture [1-3]. With the proposing of "the Belt and Road Initiative", Chinese government is attaching more and more importance to the construction of water conservancy works. Curriculum – "Irrigation and Drainage Engineering" is one of the main course in the field of Agricultural Water-Soil Engineering. About 70 years ago, many related colleges or universities began to offer this curriculum and Wuhan University has also offered this curriculum since 1950s. Compared with other curriculums such as mathematics, chemistry, physics and so on, "Irrigation and Drainage Engineering" contains both theories and practices [4]. Moreover, it also requires an interdisciplinary knowledge reserve. The "Irrigation and Drainage Engineering" curriculum focuses on the analysis and design of systems that both optimally supply the right amount of water to the soil at right time to meet the needs of the plant systems and to remove water or salts from the soil in order to maintain as close to an optimal plant growth environment as possible [5,6]. Furthermore, it also concerns regional water regime changes, waterlogging, drought and the methods for agricultural disaster management [7,8]. Therefore, the main objectives of this curriculum are to teach the basic theory of irrigation and drainage, instruct the planning strategies for different water conservancy projects, and introduce new technologies about this discipline orientation. Due to the development of society and economy, Chinese government has significantly increase the financial support for water conservancy constructions to improve the people's living standard. To achieve the much higher

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requirements for professionals about irrigation and drainage engineering, the present curriculum need a comprehensive innovation. Recently, School of Water Resources and Hydropower Engineering, Wuhan University (SWRHE) has promoted substantial curriculum reforms of "Irrigation and Drainage Engineering". The present study will firstly describe the present configurations of the "Irrigation and Drainage Engineering" curriculum in SWRHE and then present the details about the curriculum reforms in SWRHE. The performance of the reforms will also be discussed and some further suggestions will be proposed in the last section.

2. Present Configurations of "Irrigation and Drainage Engineering" curriculum

There are four majors for under-graduate level in SWRHE and "Irrigation and Drainage Engineering" curriculum is one of the main course for the major about Agricultural Water-Soil Engineering. Presently, the "Irrigation and Drainage Engineering" curriculum contains two parts, one is lecture and the other is design. There are 2.5 credits for the lecture and 2 credits for the design. Furthermore, lecture and design contain 46 class hours and 2 weeks respectively. In addition, there are another 6 class hours for experiments. However, the experiments scores are included in the lecture section. More exactly, the lectures contain irrigation theory, irrigation methods and technology, design of irrigation system, irrigation canal and pipe, drainage theory, drainage ditch design. Experimental section contains infiltration experiment, sprinkler experiment, and ditch drainage experiment. Two design tasks named irrigation system and drainage system could be freely selected by students in the design section.

According to the curriculum configurations, the final score contains three parts. Firstly, the finial examination occupies 60%-70% and regular homework occupies 15% and the residual 15%-20% is determined by experiments. Meanwhile, the scores of design are separate with lecture.

Based on the above descriptions, the present configurations are seems reasonable. However, there are many shortcomings in the actual operations. For example, although the textbook contains many aspects which are very difficult to teach clearly in only 46 study hours, it misses many new technologies due to its very old version. In addition, the lectures are offered for more than 100 students at the same time and it is hardly to ensure the teaching quality. Therefore, the efforts conducted by SWRHE are aimed to solve these above issues.

3. Reforms of "Irrigation and Drainage Engineering" curriculum

3.1. Reduce the size of classes.

As discussed above, previous size of classes is about 100 students, it makes almost impossible for teacher to know each student in the very short study hours. Meanwhile, it also difficult for teacher to adjust the schedule of curriculum by considering the comprehension ability of each student. Therefore, the first step of curriculum reforms for "Irrigation and Drainage Engineering" is to reduce the size of classes. After reform, the previous 100+ students are divided into different (based on the size of the classes in the specific semester) sub-classes and each sub-class has only about 35 students.

3.2. Increase teachers for each sub-class and update the lecture contents

"Irrigation and Drainage Engineering" curriculum requires an interdisciplinary knowledge reserve. It is unimaginable that one lecture can be very familiar with all the aspects of the curriculum. Therefore, the second step for the curriculum reform is to increase the teachers for each sub-class. After the reforms, each sub-class of SWRHE has 5 different teachers. Some advantages has been revealed by this reform.

Firstly, each teacher only give lectures which are closely related to their research interest to students. Teacher has much more time to prepare the lecture and they can illustrate not only the textbook but also some state-in-art knowledges based on their own researches to student.

Secondly, the mode of thinking and teaching also vary with different teachers, which may motivate the both innovative and dialectical mind of students.

Thirdly, different sub-classes have different teachers but use the same paper for finial examination, which also increase the stress for each teacher and push them to contribute more efforts on the teaching and improving the teaching quality.

3.3. Enrich the teaching method

Multimedia teaching has been a popular methods in almost all classes. The reforms of SWRHE requires teachers to thoroughly improve the multimedia quality. Teachers are required to try their best to use inventive materials which can display the knowledge vividly and clearly. For example, 3D and VR technology has been used to display different irrigation methods (e.g. spray irrigation, drip irrigation), the design of ditches, and water-supply method.

3.4. Introduce more project cases in lectures

Previous, project cases are introduced only in the design section. The reforms require introducing more project cases in the lecture section. Firstly, project cases are easy to attract the students' interest. Secondly, project cases can link the knowledge of different chapters together and it is easier to make student understand some new technology in the real project cases. Thirdly, it could also benefit students for their future work.

3.5. Focus on the feedback of students

Because of reducing the size of classes, the reforms also require teachers to increase the classroom interaction and focus more on the feedback of students. Therefore, several study teams are also established in each sub-classes and give the summarized issues to specific teachers in time. This reform has increased the students' ability of both finding and solving problems and make them understand the importance of cooperation.

3.6. Performances of the reforms

Reforms from section 3.1 to section 3.5 has been conducted since September, 2015. Based on the feedback from the first group students, the reforms are approved and successful. Taking the final scores as an example, in the sub-class one, 5 of 36 students had 90+ scores and the highest score was 96 while the full mark was 100. Meanwhile, more than 75% students obtained 70+ scores and only 2 students failed the examination.

4. Suggestions for the future curriculum reforms

Although the reforms has obtained stage success, there are still some improvements needed in the future.

Firstly, the study hours allocated to the "Irrigation and Drainage Engineering" curriculum is too limited. Although the above reforms have been conducted, it is still difficult to complete all the knowledge points in the textbook and practice during the lecture section. Therefore, some knowledge

points have to be left for self-learning by students and this operation is uncontrollable. However, SWRHE has no right for allocation of study hours and supports from the manager level of Wuhan University are needed for future reforms of the “Irrigation and Drainage Engineering” curriculum.

Secondly, the evaluation mode of the curriculum also needs reforms. Due to the wide range of knowledge points and the present reforms, we suggest some novel evaluation methods for the curriculum. For example, dividing the finial examination into some sub-examinations for the knowledge offered by different teachers and increasing some team work presentations during the lecture period. In our opinion, these reforms may avoid the cramming before the finial examination and cultivate good study habits for students.

5. Conclusion

Overall, the curriculum reforms of “Irrigation and Drainage Engineering” is necessary and present reform strategies of School of Water Resources and Hydropower Engineering, Wuhan University are effective and successful. With the development of technology, curriculum reforms should always be ongoing. “Irrigation and Drainage Engineering” is a traditional curriculum and has bamboo histories. Future work should focus on the pervasive and systematical reforms of “Irrigation and Drainage Engineering” curriculum to cultivate more talents.

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