Research and Practice of Chemistry Experiment Teaching Methods

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Abstract: This paper analyses the status of chemistry experiment teaching, points out the existing problems and discusses the methods to solve the problems and reform the chemistry experiment teaching from the areas of teaching plans, teaching effectiveness, green experiment, assessment methods, and so on. These methods are conducive to training students thinking of scientific research, innovation capability.

Keywords: Chemistry Experiment, Teaching Method, Teaching Reformation, Innovation Capability

1. Introduction

Chemistry experiment is an important basic experiment lessons for agricultural colleges. It is the verification and complementarity for the theory teaching, the bridge that connects theoretical knowledge and practical application, an important way for the agricultural colleges to promote the implementation of quality education and the transformation from knowledge to the ability. The purpose is to enable students to master experimental operation skills and skilled use of modern equipments and information tools, and to train students of observation, innovation and realistic scientific attitude. The major task is to provide a solid foundation of theoretical knowledge and practical ability for agronomy, forestry and other agricultural professional follow-up courses. Moreover, through this course of study, it can also stimulate students to learn actively and the interest to engage in agricultural innovation and research. In practice teaching, agricultural characteristics should be prominent. According to the features of agricultural professionals, abstract chemistry should be combined with agricultural professional courses and its application in order to overcome the students’ tedium psychology which dull monotone teaching causes and inspire students to study professional actively and extend their vision and lay a good foundation for the students to participate in university students practical innovation activities.

2. Existing Problems

There are about ten colleges which have chemistry experiments in our university. And the levels of students are uneven. Now, most of the agricultural colleges still use the traditional teaching mode in chemistry experiment teaching, in which a teacher make a demonstration and explanation first and then the students practice. In fact, course teaching and experiment teaching are two areas of teaching activities. They promote each other and complement each other[3]. As the students as the main awareness in the whole process of teaching have been in a passive state, their initiative and enthusiasm are hard to play, which goes against the teaching standards and quality improvement. Mainly reflected in the following areas:

First, the organization of the experiment curriculum is unreasonable. It is not suited the needs of the development of modern science, lacks age atmosphere, and has excessive pursuit of the results of the experiment. The level is low. The same level content is repetitive. The experiment is still at the level of the past and static, and lacks coordination with the scientific and technological progress of the times. They are extremely unfavorable for the training of personnel.

Second, although the traditional way achieved certain results in training the capacity of operation,
observation, memory capacity, it limits the students thinking, imagination, analysis, innovation capabilities. Some of the experiments are not difficult enough. Most are some confirmatory test. Reliance is very serious. And students can not carry out the right reasonable judgment on the analysis of some of the practices and emerging issues and always stay at a junior level. Comprehensive experiments are few. Students lack of autonomy and independent thinking ability. We can not train students’ access to literature, experimental plan and design their own data processing and summed up the capacity.

Third, most of the reagents for organic chemistry experiment are volatile, toxic substances which are pollution-charring. Some of experiments can not be carried out due to the restrictions.

Fourth, the teachers lack integrated assessment methods for students’ basic skills of quantitative analysis.

Fifth, laboratory is not opening up enough. Opportunities for students' operation are little. It shackles the students' practical ability and innovation capacity development.

For the students learning chemistry of agricultural colleges, the chemistry experiment is an important part of training students' ability to innovate and the spirit of science, and is the cornerstone of the follow-up courses. Therefore, reforming the past experimental teaching methods, exploring new mode of teaching is very necessary. To this end, we had a chemistry experiment teaching reformation.

3. Improvements

According the problems above, topic team use following methods to improve teaching methods:

First, adhere to collective lesson preparation and pre-experiment. Through collective lesson preparation and the common exchange, can improve everyone, grasp the major, difficult issues and attention of the experimental teaching, to achieve the unity of understanding, action; Reduce the arbitrary and random of teaching. It's an important way to achieve the standardization of teaching and good results of the experimental teaching. Adhere to pre-experiment before the lesson done are essential to the teachers that no matter how long he teaches, how much experience he has. Because of experiment is effected by chemical equipment, reagents and other factors, it is only through the pre-experiment can test the readiness of experiment, for example, Equipment's situation and possible problems. If such problems can be the early discovered, early solved, teachers can prepare for anything may happen. Even students in the experiment encountered unforeseen circumstances, teachers can immediately find out the reasons, give a positive response to resolve, not caught unprepared, helpless.

Second, Research and develop multimedia courseware, save teaching time and enhance teaching effectiveness. For some dynamic process which difficult to express, or strong technical, experimental teaching content, use video and multimedia animation software, with visual, direct way to make the teaching process vivid, realistic, and avoid boring lectures, help students understand and improve their interest in learning so that students can master teaching content, to achieve the desired teaching effect. Software use large-scale of the icon editing and control, point-to-point movement, hyperlinks and buttons, audio of reading aloud, and make Special effects of each graphics editing, mobile positioning precision control, the steps between Jump, erase and timely recovery, etc. become true. Forming animation assembled apparatus and experiments process. At the same time supported by Flash animation, digital video and other media forms to complete complex operation and phenomenon, in order to achieve a simple, intuitive, clear purpose. Courseware will be divided into two types: teaching and assistant. So that students can easily preview and review, assist hands-operation experiment (Figure 1) with courseware, give students deep impress.
Third, according to the students’ actual situation, adjust the outline of the content within the framework. Because students’ chemical basis is different, according to the Department of the students are divided into three levels, first class undergraduate and second class undergraduate students are the highest level, three class students and the general specialties followed, a specialist of a college student in the village of the students lowest. The first levels of students complete the necessary verification experiment first, and pay more attention to the quantity and quality of outstanding design. The second levels of students complete the verification experiment first. Then add some appropriate comprehensive experimental and design experiments. The third levels of students complete the main test basic skills training, certification and important experiment reaction experiment. Provide students with the opportunity to think and operate independently. Make them conscious access to the literature. Chose experimental method and develop experimental steps according to the comprehensive use of theoretical knowledge and skills test. Students in the experimental process are fully in the status of the initiative. They can give full play to their imagination and creativity. It is very important to cultivate their independent scientific research capabilities [5].

Fourth, Green chemistry experiment. Chemical serves as an experimental science. Its important status in training students in the chemical quality can not be replaced by any other theory teaching content. However, the University chemicals, organic chemistry experiment in particular, contain toxic and harmful substances in emissions. It results environmental pollution problems which have not been a long time due attention. So the University organic chemistry experiment must be implemented green [6]. Chemical technologies and methods reduce or eliminate materials, catalysts, solvents and products, by-products such as the use and generation on from the source which are bad to human health, social security and the ecological environment. Sound the use of the drug-free raw materials or renewable resources. Carry on the chemistry experiment under non-toxic harmless conditions.

Fifth, pay attention to the contents of professional and agricultural characteristics combination. The University chemicals, especially organic chemistry and agriculture, life sciences and other subjects are mutual cross-penetrative, so pay attention to organic agricultural knowledge and the relevance of the content of teaching is very necessary, So that students can stimulate interest in learning, develop their vision.

Sixth, provide open laboratory. Laboratory provides strong ability students with a platform to
further enhance the practical ability.

Seventh, develop a reasonable assessment system; change the original single final exam approach to: peacetime achievements (50%) + result of the written test (10%) + operation examination (40%); peacetime achievements include attendance (10%), classroom performance (10%), laboratory report (30%), operation of the examination to take the drawing of lots, students draw the experiment, from the laboratory to find the corresponding experiments, teachers according to student understanding of the equipment, assembly of the proficiency test given to such areas Points.

4. Effect

Two classes were taken from three levels of students for comparison, after two years of practice and the survey are as follows:

<table>
<thead>
<tr>
<th>Items</th>
<th>Comparison group</th>
<th>Not improving</th>
<th>Improvement Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent rate</td>
<td>10%</td>
<td>19%</td>
<td></td>
</tr>
<tr>
<td>Failure rate</td>
<td>9%</td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td>The consolidation of basic skills</td>
<td>91%</td>
<td>95%</td>
<td></td>
</tr>
<tr>
<td>recognition rate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The operational capacity improve</td>
<td>71%</td>
<td>85%</td>
<td></td>
</tr>
<tr>
<td>recognition rate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>innovative thinking</td>
<td>9%</td>
<td>31%</td>
<td></td>
</tr>
<tr>
<td>recognition rate</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>environmental awareness</td>
<td>68%</td>
<td>89%</td>
<td></td>
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<tr>
<td>Raise</td>
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</tbody>
</table>

Can be seen from the statistics, teaching methods improved significantly improve teaching effectiveness, while increasing the sense of innovation and student awareness of environmental protection.

5. Conclusion

Practice has proved that the improvement measures fully mobilize the different levels of students learning initiative and enhance the students’ interests in chemical experiments. Students' practical ability is markedly improved. Their achievements are obvious. Environmental awareness has been strengthened. At the same time, it improves teaching efficiency and reduces consumption of the experiment.

References