Preliminary Study of Current Situation and Development of College Physics Class Demonstration Experiment

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ABSTRACT: This paper discusses the role played by the College Physics Class Demonstration Experiment. The class demonstration experiment can not only stimulate student's interests for study, help them build the physics concepts and understand the physical laws, but also cultivate the profound insight and ability to analyze problems; this paper also analyzes the situations of the class demonstration experiment conducted in colleges and universities in China and puts forward the practical and feasible solution by drawing on the experience from other foreign universities.
KEYWORDS: College Physics; Demonstration Experiment; Class Teaching

1 THE ROLE PLAYED BY DEMONSTRATION EXPERIMENT IN THE COLLEGE PHYSICS TEACHING

Physics is a basic science based on the experiments, so in the Physics development process, the establishment and discovery of each physical concept and law can have the solid experiment foundation. The experiment plays a huge promoting role or even a decisive role in Physics development process and is absolutely irreplaceable; so in the Physics teaching process, the demonstration experiment should be an indispensable and important part as it is the most dynamic content in the physics teaching as well as one of the most effective teaching methods[1].

The purpose of the physics demonstration experiment is to clearly demonstrate the physical phenomena under research to the students to cultivate their interests for effective study and instruct them to observe, think and understand the physics concepts and physics laws[2-3]. The major roles played by the demonstration experiment in the physics teaching process are boiled down to the following aspects:

(1) Greatly and effectively create the lively and vivid classroom atmosphere, stimulate students' learning interest and desire for knowledge. In the Class Teaching process, where teachers present the visual demonstration to the students, the phenomena and the process related to the teaching contents will be vividly demonstrated in class to create a true physics environment and stimulate the students' great interest and enthusiasm in the class teaching contents, thus creating the active classroom atmosphere and attracting the attention of the students, so it is a vital approach to enhance the class teaching effect.

(2) It is important to intuitively demonstrate the physics phenomena and physical laws to the students to leave a deeper impression on them and enhance the persuasive power and assist the students in building the concepts and understanding the physical laws. Physics concepts and laws are the accurate generalization and abstract summary of the objective physics world. The physics teaching should proceed from the true world, the students' current experience and perceptual materials, so the demonstration experiment just provides the students with the lively and vivid description of the physics phenomena and process, also provides the direct and true evidence of the mutual impact and reaction among all physics parameters together with the abundant physical appearance and perceptual experience to the students, particularly provide the necessary contents and foundation for the logic thinking and rational cognition activities as the effective approach to help the students for the true understanding and command of the physics knowledge.

(3) Positively cultivate the students' capacities in observing problems and analyze them, develop their abstract thinking capacity and the creative capacity for specific application. It is necessary to conduct the comparison, classification, analysis, summary, generalization, deduction, verification and confutation of the experiment phenomena and

process to form the concepts based on the perceptual knowledge for better judgment and reasoning and distinguish the authenticity and falsehood of phenomena and effectively understand the necessity and contingency, thus obtaining the ability in recognizing the essence and law of the development of things.

(4) It can provide the students with the experimental demonstration, which will facilitate the establishment of the rigorous scientific attitude and train the experiment skills. The accurate and skilful commissioning and operation of the experiment instruments and equipment by the teachers in the demonstration experiment coupled with their meticulous attitude and respect for the experimental facts will exert the better experimental demonstration effect on the students and impress on them the seriousness of the physics experiment, which calls for the meticulous scientific attitude and rigorous work style. The experiment is used to verify and interpret the basic principles to facilitate the students to clearly understand that physics is an experiment-based science as the principles and laws arise from the experiment and the production and life facts. The conjecture, imagination and assumption play a vital role in the scientific discoveries, which, yet, should be verified and testified through the experiment and practice.

2 CURRENT SITUATION AND FEATURES OF THE COLLEGE PHYSICS DEMONSTRATION EXPERIMENT IN CHINA

The class demonstration experiment plays a vital and irreplaceable role in the teaching process. However, we are pessimistic about the class demonstration experiment conducted in colleges and universities in China as most colleges do no have the college physics class demonstration experiment[4-6], with the following features:

(1) The class demonstration experiment is conducted on a smaller scale focusing on the fewer and better ones. Yet, compared with the US universities, the domestic physics demonstration experiment is conducted on a smaller scale highly focusing on the fewer and better ones. With the limited conditions, we only conduct the most valuable demonstration experiments.

(2) The animated demonstration is quite universal in our class teaching activities and the corresponding animated demonstrations are inserted in the theory lectures to demonstrate physical phenomena and verify the physical laws, so it is easy to interpret the concretization and visualization of the abstract theories, thus increasing the students' perceptual awareness and helping them for better understanding of the relevant concepts and livening the classroom atmosphere.

(3) There appears such a trend that the animated demonstration is likely to take the place of the demonstration experiment. The proper proportion of the animated demonstration to demonstrate the complicated physical process is an integral part of the class demonstration experiment as well as a vital supplement to the demonstration experiment. However, most colleges and universities do not have the class demonstration experiment for various reasons, but they use animated demonstration instead. But we are greatly worried about this trend, but actually the demonstration experiment, after all, should play a leading role in class teaching.

(4) Colleges pay more attention to the students' experiment instead of the demonstration experiment. Colleges and universities usually invest huge amount on the students' experiment with the full staffing and full availability of the experiment equipment, but they do not have much financial investment on the materials and staffing for the demonstration experiment; Most colleges and universities have fewer demonstration experiments, and those on a smaller scale with the backward equipment, and many colleges and universities even cancel the demonstration experiment.

(5) With the fast development of China's higher education, a lot of younger teachers engage in the class teaching activities. However, they are heavily burdened with the teaching tasks, and they, in general, pay more attention to the class theory teaching and scientific research but pays less attention or even ignore the class demonstration experiment as they face the heavy pressure for the professional title and scientific research.

(6) In the class teaching, the classrooms do no have the necessary demonstration experiment equipment. Due to the limited class space, the demonstration experiment equipment can not be stored in the classrooms; if a teacher wants to conduct the demonstration experiment, he has to take the experiment equipment into the classroom from the other laboratory, which causes much inconvenience to the class teaching, which is a vital objective factor restricting the demonstration experiment in class.

(7) The current demonstration experiment equipment has become old and damaged due to the excessive use in the past years, so the number of the demonstration experiment becomes less and less due to the lack of the necessary funds and the untimely upgrading of the equipment, which is another objective factor restricting the college physics class experiment demonstration.

(8) The theoretical teaching and experiment teaching hours for college physics are generally shortened. Due to more contents and the pressing time, teachers usually think that the class demonstration experiment is likely to negatively affect the teaching schedule for fear of affecting the

completion of the teaching tasks, which can also affect the enthusiasm of the teachers to introduce the demonstration experiment into the class teaching.

(9) Leaders' concern and attention is the decisive factor for the class demonstration experiment.

The overall development of the college physics demonstration experiment in China's colleges and universities is unbalanced. The experiment equipment for some 985 universities are comparatively advanced while many other colleges and universities do not have much equipment for the experiment equipment, or even lack the necessary equipment; Some colleges and universities have their the necessary experiment equipment laboratories, yet actually they stay practically useless, only for the purpose of coping with the inspection of the upper authority, not exerting the necessary effect at all. In the theoretical teaching process, the number of colleges and universities that can fully introduce the experiment equipment into the class teaching is few and far between. Even if some universities have the experiment equipment laboratories, it is not satisfactory to conduct the class experiment equipment.

3 PRELIMINARY STUDY OF COLLEGE PHYSICS CLASS DEMONSTRATION EXPERIMENT

The major factors affecting the class demonstration experiment involves three aspects, respectively the lack of funds, experiment place and the awareness of the demonstration experiment importance. With a view to further improving the teaching quality, we have conducted the beneficial exploration for the problem related to the introduction of the demonstration experiment into the class teaching, which has won the vigorous support from the university officials, college leaders and the relevant teachers.

In view of the current problems, we adopt the various measures to solve the relevant problems.

(1) To raise the awareness of the class demonstration experiment importance on the part of the relevant teachers, course responsible leaders and department dean

The relevant teachers have been organized for the on-site inspection tours to the peer universities on many occasions, participate in the activities, say, the college physics forum and conduct the repeated discussions. Now the teachers have reached the consensus that it is quite necessary to introduce the physics demonstration experiment into the class teaching as it is quite beneficial to the further improvement of the teaching quality, so they have the full discussion over the implementation plan and work out the specific and detailed implementation solution.

(2) Delicately select and identify the experiment suitable for classroom demonstration

Through the inspection tours and different investigations, we have delicately selected and identified more than 50 sets of demonstration experiment equipment out of more than 300 sets of equipment provided by the relevant equipment manufacturers. The relevant equipment has the following common features: firstly, they are closely related to the class teaching contents, more pertinent with visual images and strong interests, easy for operation, higher safety factor; secondly, they are highly integrated, concise and forceful, small in volume and suitable for being stored in the equipment cabinets in the classroom.

(3) The experiment place

Due to the limited space for teaching activities on campus, it is almost impossible to build the special demonstration laboratories. Furthermore, even if the special demonstration laboratories are built on campus, it fails to solve the problem related to the introduction of the experiment into the class teaching; As the demonstration experiment can not be generally separated from the space of the classroom and where the demonstration experiment is conducted, the students should go the laboratories for it, students can not be allowed to do experiment in the laboratories each time in the actual teaching process, so to speak, the special demonstration experiment laboratories can not solve the problem of introducing the experiment into the class teaching.

If we can pool our ingenious ideas together, we can finally figure out the practical methods to introduce the demonstration experiment into the class teaching. Many of our lecture theaters on our campus have the comparatively large vacant space in the back. Through the field survey, we have reached the consensus that these classrooms can be the ideal ones for the demonstration experiment. We can place the equipment cabinets in the back of the classrooms. So we can solve the problem for the experiment place and can achieve the goal for introducing the demonstration experiment into our class teaching, and at the same time, there is another advantage: it does not affect the proper use of these classrooms. After class, the experiment equipment can be stored into the cabinets and the classrooms can be continuously used for other courses.

(4) Fund problem

With all these preparations, we submit to the university management an application for introducing the demonstration experiment into our class teaching, particularly involving such problems as the necessity, feasibility, place and funds, etc., and the university management pays great attention to our application which immediately gets approved by the university management and the relevant functional authority to completely solve the

problems related to the funds, place and the Preparation rooms for the demonstration experiment.

All relevant work is being done according to the work schedule. If everything goes smoothly as expected, the class demonstration experiment can be put into operation in the second semester in the school year 2014-2015. We look forward to the new atmosphere in our teaching activities after the introduction of the demonstration experiment into our class teaching, which will bring our teaching work up to a new height.

4 CONCLUSION

Class demonstration experiment plays an extremely important role in university physics teaching process and each teacher in our teaching faculties should be fully aware of this point as it is the prerequisite for us to smoothly conduct our teaching work.

Each specific job will have the same problem, but as long as the entire team can make the active efforts, we can finally identify the proper solution. Through the unremitting efforts made by us, we are bound to solve the relevant problems one by one. As we all know, the key lies in the consensus reached by the entire team to strive for the common goal; another point is of particular importance for us: the concern and attention paid by the department responsible leaders will play a key role in solving the problems and achieving the goals.

The Ministry of Education pays closer attention to the improvement of the teaching quality for undergraduates and all colleges and universities will identify the teaching quality for undergraduates as the their education essentials; Therefore, as long as the team can put forward the comparatively feasible solutions, they can generally obtain the support from the college or university management.

Last but not the least, the selection of the demonstration experiment must be instructive and interesting so that the students are greatly interested in the demonstration experiment with great enthusiasm, and this kind of teaching activities can reach the results as expected.

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