Optimization and Design of Teaching Sections in College Teaching Competition—Taking College Physics for Example

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Abstract. College teaching competition, one of the important methods of teaching practice, provides a platform for college teachers. It’s a significant point to select appropriate teaching sections and optimize teaching designs in competitions. College physics, a basic course of science and engineering, is employed as an example in this paper to describe the teaching section optimization and design, including the selection of teaching sections should be universal and representative, the design of teaching sections should be academic and extensive, and the design of teaching sections should be educational and diversified. To meet the requirements of teaching competition and regulate teaching, we should think more about teaching and "promote teaching through competition", to continuously improve the basic teaching skills of teachers and promote the steady improvement of teaching quality in colleges and universities.

Introduction

With the continuous expansion of the higher education scale and the number of teaching staff, the improvement of teaching quality is particularly important. Nowadays, various kinds of teaching capacity improvement projects and teaching competitions for college teachers spring up like mushrooms. As the backbone of college teaching, the teaching team with Ph. D degrees play an important role in college education. Young doctoral teachers have made great achievements in a certain professional field and have a rich understanding of the frontier of science and technology of related disciplines. However, in terms of education and teaching, they can’t do good as in scientific research due to the lack of systematic training in teachers’ majors. The teaching competition for young teachers in colleges and universities, as a competition platform for improving and exercising teaching ability, provides help for college teachers to broaden their teaching vision, improve their teaching ability and consolidate their teaching foundation. By taking part in the teaching competition, young teachers not only think more about education, but also learn more abilities to match with different disciplines in the field of communication in the process of research complement. By reading more teaching materials, they can enrich teaching, exercise and refine their teaching characteristic and teaching style, which enhances the teaching ability, teaching mode and teaching style.

There are different types and scales of teaching competitions, such as national, provincial and municipal teaching competitions for young teachers in colleges and universities according to the categories of subjects (arts, science and engineering). According to the subdivision of the subject teaching competition, including the national college physics basic course teaching competition, the national basic mechanics young teachers teaching competition, college ideological and political teaching skills competition. According to different media types of teaching competition, including national university micro-class teaching competition, information teaching competition, university digital creative teaching skills competition. Although different forms of teaching competition have special emphases, they all put forward higher teaching requirements for young teachers from different aspects, and have a good promotion for their teaching characteristics and teaching level.

Teaching ability can be enhanced by attending teaching competition, but the competition process is complex, which requires full of creativity, diversity, specialization of teaching knowledge, and therefore the choice of teaching in curriculum and teaching section the optimization becomes the key...
question. In this paper, based on the experience and understanding of the fourth young teachers teaching competition of Shandong province, we analysis the selection and optimization of the teaching section in College Physics, then further clarify how to optimizing the teaching content, to design the teaching process, and to improve the teaching effect.

The Selection of Teaching Sections Should be Both Universal and Representative

"College physics" is a very common professional basic course of students in science and engineering, which content contains the mechanics, electromagnetism, thermotics, optics, modern physics. There are both fundamental knowledge and professional formula theorem. It needs to have both the physical knowledge framework and mathematical theory thought. The teaching competition section should cover as much knowledge as possible. Furthermore, it is good for the selected sections to teach in a good process with some highlights. Many participating teachers tend to focus on several physical theorems, such as momentum theorem, gauss theorem. They are the key difficult points in physics, so that it’s a good choice. In the process of teaching, teachers can take the explanations as the process of reasons, results, and application, resulting in complete and smooth teaching design.

During the teaching competition, the writer selects the ‘Gauss theorem’ as one of the teaching section. We teach it from the Coulomb force of the charge to the electric field. By introducing the electric field line as a description tool, we show the relationship between the field lines and the electric field intensity step by step. The concept and basic theory are well-prepared for teaching. During the derivation of Gauss’s theorem, considering the complexity of the mathematical derivation formula, we start from a simple model, that is, ‘can the electric field intensity around the charged body be directly calculated by the number of electric field lines or the electric field intensity flux?’ Thus, the conditions that electric charges in the center of the sphere, even at any position inside the sphere, or in any closed surface, can be seen as a ‘bag’ equipped with lights (electric field line) of pearl (electronic). By changing the position of pearl in the bag, the shape of the bag, the fact that the light emits out of the bag is still doubtless. Therefore, the content of Gauss theorem is simplified from the qualitative analysis, and it is easy to understand. Based on that, the uniform spherical electric field intensity is calculated then to any closed surface. The mathematical formula of Gauss theorem was solved, from easy to difficult, and from understanding the phenomenon to deduce the theorem. This teaching made students clear and easy to understand, which received a good teaching effect.

For basic physics knowledge such as mechanics and kinematics, it is difficult to teach smoothly only by introducing concepts. At this time, we focused on the characteristics of the content and physical ideas for explaining. For example, the "velocity of particle movement" in the teaching section is mainly the description of the concept and application of velocity. If it starts directly from formula derivation, it is easy to cause the classroom teaching boring. However, it is possible to start from the phenomenon of movement and then the concept elaboration is carried out. It’s the teaching method of the ‘case teaching method’. Starting with an active video case, such as the video of Xiang Liu running in the 110m hurdles in the 2004 Olympic Games, and the visual impact of the speed can be felt during the process of playing. Then, the concept of the speed is introduced to describe the running fast, and the concepts of average speed and instantaneous speed are given. Then, by using the analogy teaching method, the concept of speed learned in middle school physics is used to explain the speed problem. In that case, the limitation is put forward, that is, it cannot describe how fast or slow the movement is at a certain moment. So we need another tool which is the instantaneous speed. During explaining the instantaneous velocity in the process of derivation and interpretation, we pay attention to the prominent calculus thought. It is the first part of ‘College physics’, so that besides the content itself, we should teach the student how to think about these problems and how to use the mathematical tools to resolve them. It is important to provide methods of calculus with physical thought, achieving the objectives as an old saying in China that ‘Give a man a fish and he ends for a day’.
The Design of Teaching Section Should be Academic and Extensible

Different from the middle school classroom, the content of teaching in university is not simple retelling and content transmission, but it needs to have a certain professional discipline, reflecting the academic nature of the university classroom. As the teaching competition section, it should reflect the academic content and expansion. The section is only knowledge, but the detailed way of teaching organization, teaching contents, teaching extension knowledge should be combined with the latest academic progress. The teacher should teach not only basic knowledge, but also professional knowledge as well as the latest academic progress in the teaching design. Thus, the process of curriculum knowledge in the competition is very full, leading to a good teaching effect.

We select the teaching sections in competition based on the phenomenon of observation—thinking and analysis, knowledge review—details precision analysis—extensions and applications—knowledge summary. It is important to combine discipline characteristics and the context of knowledge content in detail precision analysis, and combine with the research progress in science and technology application. In the section of ‘the polarization of light’, it’s essential to explain the types of light, the property of polarized light, the judgment of polarized light and Malus law. However, most of the content is theoretical knowledge, the student can not reach the effect of three-dimensional understanding. Thus, details precision analysis and the expansion of application, with the starting point of the polarization theory, we combine with the present popular imaging principle of 3D movie, then tell the student how to make 3D movies using the different polarized beams and how to watch them by a pair of 3D glass. Therefore, we change the dry knowledge into multiple materials, which comes from life but highlights the knowledge content. The combination of academic knowledge and extend application is realized, giving students a much more deeply concept and theory of the polarization.

The Design of Teaching Sections Should be Educational and Diversified

To achieve a breakthrough in the teaching competition, the designed teaching sections must be meaningful, effective, educational and diversified. Education-oriented is the completeness of teaching knowledge. Although it is a fragmented part of knowledge, it can promote the construction and perfection of the whole knowledge system through learning them. Diversification means that the teaching content should be rich and colorful, involving concept, theory, calculation, application, practice and other aspects. A section of the class is short, but the teaching process and content are still comprehensive, which could provide the audience with the best learning experience in limited knowledge teaching.

During teaching ‘Doppler effect’ in College physics, we start with the life applications. For this knowledge, a lot of people are familiar with it because someone takes B ultrasonic diagnostic in the physical examination. But most of them don’t know clearly of the specific principle of the Doppler effect and the specific way to achieve color doppler. In the design of this section, the deduction principle of the Doppler effect is provided through the known concept. By analyzing the whistling of the coming and leaving train, we qualitatively explain the relationship between the speed and frequency, and adopt "physical model method" to build a new model with the relative quantity altering gradually. Then different frequency calculations and derivation of the formula are shown. According to the given situation, it can be divided into two cases, including the wave source and observer moving respectively, and moving simultaneously, and the effect of actual frequency change can be reflected by the physical formula. If this is the end of the class, the content is complete, but not perfect. For the better exhibition, we return to the beginning of the case, using the derived formula to solve the given problems. In this condition, a closed loop of knowledge is formed. Therefore, this section design for formula deduction and frequency changes are part of the knowledge, but the doppler color ultrasound and the effect of the Doppler velocity become the key problems to the teaching as an extension of the diversification. Through explaining the imaging process and speed measurement, we make lifeless formula into a fresh application instance. During the teaching class of the competition, the audience's understanding of the Doppler effect was also suddenly clear, and they
exclaimed, ‘oh, so the road camera measures speed like this...’ This kind of teaching style is easy to achieve twice the result with half the effort.

**Summary**

The selection and design of the teaching sections of the competition need to select with knowledge and design with content both for basic courses and specialized courses. We need to take more factors into the heart from the aspect of the listeners and scholars, how to make learners better understand knowledge, master principle, know the application. Furthermore, to gain a better teaching effect in the teaching competition, the teacher should form their distinct teaching characteristics, teaching style, language expression in addition to the perfect teaching design. In the process of teaching, we should restrict ourselves with the requirements and norms of teaching competition, think more about how to teach, promote teaching through competition, and constantly improve the teaching effect in the process of educating students.

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**References**


