A study of methods to stimulate students' problem awareness during university physics lectures

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Abstract: In the context of the active promotion of quality education, the analysis of the current process of cultivating the comprehensive ability of science and technology college students from the teachers' perspective often reveals many problems. Many students have half-understood knowledge, which is ultimately caused by the lack of problem awareness and independent thinking. If we want to develop students' physical thinking and improve their overall quality, we need to adjust our teaching methods. This paper carefully analyzes the possible problems of teachers and students in university physics teaching and their causes, and gives scientific and reasonable improvement measures, in order to promote the comprehensive development of college students.

Keywords: university physics teaching; problem awareness; atmosphere creation; context setting; incentives

Introduction

Nowadays, more and more students are dreaming of joining the country's research field. For them, the ability of innovation is indispensable. How to cultivate the innovation ability of science and technology undergraduates naturally comes into the view of teachers. Often there are problems that lead to innovation, and the process of solving problems is likely to bring innovative results. Due to the inevitable limitations of exam-oriented education - the relative lack of cultivation of students' abilities, many students are easily stuck in the first step "problem identification". The subsequent problem-solving process, which involves the exercise of practical skills, is even more difficult to advance. Therefore, in order to cultivate a steady stream of innovative talents, teachers should first guide students to discover problems and learn to ask questions, and then help them solve problems together with appropriate teaching methods. Ultimately, the purpose of cultivating students' innovative spirit is achieved.

1. The current situation of lack of problem awareness among college students

1.1 It is difficult to teach everything in large classes and there is a constant backlog of problems generated by students

As a bridge between natural science and engineering technology, this course is indispensable in the process of stimulating students' innovative spirit and developing their problem-solving ability. In today's society, higher education is gradually popularized, and applied undergraduate programs are facing transformation. As schools have expanded their enrollment, the number of classes of the same type and major has increased, and the co-teaching mode has emerged, so that the "subjectivity" of teachers in the teaching process has been magnified as never before. In addition, the achievement of students' learning outcomes is the combined efforts of both teachers and students. So, when we analyze the teaching process of university, the teachers' workload seems to be reduced after the class is combined. But in fact, the most direct problem caused by the increase in the number of students is that the teachers are unable to understand the specific status of each student's knowledge in a timely manner, and it is difficult to solve the real problems of students in their respective learning process, which ultimately fails to achieve the expected teaching effect. As the main body of learning, what students need to do is to maximize their own initiative and be the master of learning. However, in such a process, what the teacher feels more than anything else is that the students' listening efficiency and learning attitude are not as good as they used to be in secondary school. During the class, the teacher is lecturing to all the students in the classroom, but only some of them listen carefully, take notes and follow the teacher's rhythm of thinking. The rest of the students are inefficient. If we stretch the learning timeline further, we will find that the top students are getting better and better. In addition to fully mastering the book, they are often able to extend themselves and take the initiative to learn about knowledge outside the classroom. The underachiever can't keep up. They don't concentrate enough in class or review after class. And they do their homework perfunctorily, which makes them lag behind the top students by a large margin. First-year students are in the bridging stage, there is no big difference for the time being, the further the gap becomes bigger. The phenomenon of "all of students cannot receive enough appropriate education" is getting more and more serious. It is obvious that they are going through the college entrance examination selection together, and students with similar foundation are sitting in the same classroom. So it is necessary for teachers and students to reflect on this problem together.

1.2 The "grade theory" is prevalent, and the evaluation mechanism of students' real level is not yet perfect.

Traditional university physics courses judge students' mastery of physics knowledge through their final exam results. In order to adapt to this mechanism, students focus on problem solving rather than on thinking. It is right to want to get good grades, but if students are caught up in many concepts, theorems and formulas without practical experience. They will slowly lose their interest in physics over time and find it difficult to learn actively. Such an evaluation method is contrary to the initial goal of the new engineering curriculum, which emphasizes the application of knowledge and the ability to analyze and solve problems. Also it does not realize the importance of cultivating students' overall development. In response to such a status quo, many schools have made improvements with considerable benefits, but still focus on the analysis of theoretical achievements and lack of quantitative evaluation.

1.3 Students have psychological scruples and lack the courage to ask questions

Some students are afraid that the questions they ask may be too childish, and that they will be treated differently; some students are afraid that the questions they ask will be difficult for the teacher, and that the teacher will be offended or even reprimanded; some students have low self-esteem and feel that their ability is average, and that the questions they ask are not up to par, and that the teacher will waste time and energy because of the questions they ask. For all these reasons, students are afraid to ask questions. In addition, students don't know the angle and method of asking questions, so they can't ask questions; even more, they don't think deeply about the questions given by the teacher and leave them behind, they don't thinking over and over again in time. Finally they don't seize the opportunity to ask valuable and nutritious questions after careful consideration.

2. Measures taken by teachers through observation

2.1 Guiding students to ask questions by setting up problem situations

Problems are not accidental, but permeate all aspects of life and can be easily discovered by students in an appropriate context. Therefore, in order for students to be able to find problems in life, to question them based on their own knowledge, and to discover them in the process of experimentation, it is necessary to create a suitable teaching atmosphere.

Although college students nowadays have a certain knowledge reserve in high school, what they encounter in life is often the embodiment of classical mechanics. Students may be able to grasp some elements of its laws, but their understanding of the problem rests only on qualitative research, but they cannot start quantitative research. In addition, in secondary school, teachers often teach theoretical knowledge, but students do not know anything about its application and practice, so they do not master it thoroughly. Thus, teachers can start from this perspective, by leading students to pay attention to real life, they can make them think about the physical phenomena and ask questions about them. For example, "At the same height, when a feather does free fall, does it fall faster in the air or in the vacuum?" For this question, of course, students will use their previous knowledge to make their own correct answer, then the teacher can combine with the actual, remind students to pay attention to friction and gravity and other factors, appropriate to raise the life everywhere but easy to be ignored a bit of physical phenomena, to achieve the effect of theory and practice. In addition, students need to change their fear of studying physics in college, otherwise they will be sowing hidden dangers for their future studies. For example, in the chapter of rigid body rotation, a few textbooks will give several common formulas for rigid body rotation. When students are first exposed to new and seemingly difficult and long formulas, if the teacher chooses to be straightforward, the result is often that students are more difficult to restrain. At this point the teacher can give a few examples of life need to use the rigid body rotation inertia formula calculation, let the students themselves through the calculation to confirm the conclusion, the process to help and encourage, enhance student confidence in learning. At the same time, it can also be used to develop the habit of arguing for existing conclusions, improve student learning initiative and enhance students' awareness of the problem.

2.2 Encourage, be patient, and always guide students when they ask questions after class

Wanting to ask, daring to ask, and knowing how to ask is a process in which students engage in thinking. This process is the key to improving students' thinking agility. How to reasonably and better help students to complete this process also requires teachers to empathize with students on a more psychological level and to effectively encourage them. A question that arises, whether it is naive or not, always represents a thought process, and that is good. The teacher can point out a certain way of thinking, what is good and what is not, so that the student will feel recognized. At the same time, teachers who want to lower the barriers that students face in trying to communicate with the teacher need to be kind and gentle with each student who comes in with a question. By leaving an image of a gentle and good teacher in the classroom, perhaps students will have far fewer concerns.

After the questioning environment is optimized, teachers can give students some other guidance to improve their thinking agility. First, teachers can ask students to distinguish whether the kinds of questions they are asking are high-level or low-level questions. Low-level questions allow students to understand the most basic fundamentals of college physics that they need to master; high-level questions allow students to better expand on their knowledge and improve their own knowledge, allowing them to steadily improve their problem awareness through exploration and reflection. Students who are able to classify themselves and solve problems after screening not only means that the teacher's burden will be greatly reduced, but also means that this student's learning is on the right track. In addition, the teacher should induce the appropriate pointers and teach the students ways to identify problems. Teaching students to "bite words and chew characters" rather than drill them, and to properly delve into the art of words will also subconsciously improve their literary skills. It is also important to lead students to explore new ways of doing things that are not limited to the methods told in books and the inherent ways of thinking. Physics is not a convention; everyone should be creative and exploratory. It is also possible to discover subtle and little-known mysteries in the original contradictions and confrontations, and to discover different perspectives to think about. In fact, training students should not only focus on the results, but should focus on the results more than the process. Each student has a unique sparkle, and education is only truly meaningful if it is based on the development of the student's own strengths and potential, and extends to the development of all other aspects of the student's abilities.

2.3 Conclusion

To sum up, the cultivation of students' problem awareness requires more efforts from teachers and more active cooperation from students. Only with the continuous guidance and encouragement of the teacher can students strengthen their foundation and take every step forward. Of course, the teacher needs to be a good role model and lead the students to ride the wave on the way of learning university

physics. College physics is a required course for university science and technology majors, and although its content is relatively dry and difficult to understand, it is not irrelevant to today's scientific research trends and innovative technologies. By linking physics knowledge with contemporary science and teaching physics, it will undoubtedly play a significant role in improving students' scientific literacy and cultivating innovative thinking, as well as stimulating students' interest and exploring more potential top talents for the country. Planck once said, "The laws of physics cannot be obtained by 'thinking' alone, but should also be devoted to observation and experimentation." So physics learning must not be confined to the learning of physics knowledge points, the analysis of physics textbook content and the practice of after-school exercises, the formation of good thinking, the improvement of thinking analysis, the establishment of thinking framework is far more important than the mastery of fixed formulas and knowledge points, which is both the main goal of current physics teaching and an important part of today's quality education.

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