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STRATEGIES FOR SUCCESSFUL LEARNING IN PHYSICS

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Annotation: Physics has a very important place in science. Therefore, physics education should be done carefully and effectively. As studies have repeatedly shown, classical teaching models are so ineffective in physics education that the gains at the end of the learning process are almost negligible. Therefore, physics education should be based on active learning models that have been proven to be effective and natural.

Keywords: Physics, Physics education, Active learning.

Enter: In the last century, three major revolutions took place in physics, and these revolutions destroyed old paradigms. The most studied fields of physics today are quantum physics, relativity physics, and chaos physics. However, these advances in physics have not yet been reflected in textbooks. Students are still taught classical physics; We teach mechanics, electricity and thermodynamics. There are important differences between the physics students learn from textbooks and the physics based on today's technology. This situation, that is, the outdated curriculum, is one of the main problems in physics education. But here we will discuss a more important problem and its solutions: the classical teaching method in physics education is very ineffective.

So where do we get this judgment? The exams, laboratory exercises, and students' course work lead us to this conclusion. When we look at all of this, we see that students actually learn very little. Although the world we live in and the entire universe obey the laws of physics, the classical teaching methods we use cannot provide an understanding of these laws. The only way to achieve this is to change our teaching techniques. Instead of classical teaching techniques, we should use one of the active teaching methods that have been proven to be effective, adapt to the human brain and take individuality into account.

"I understand the topics covered in the course. But I fail at problem solving." These words have been spoken by the vast majority of students who have taken basic physics courses in the past and are taking basic physics courses today. Everything seems normal and understandable when studying physics in class or from a book alone. But for some reason, students feel as if they are reading a text written in a foreign language when they come across the questions asked in the exam or the practice questions given by the teacher.

In other words, they cannot understand the questions of different structures. So where does this problem come from? How can you tell if a student understands the topics? If a student does well in exams, successfully completes experiments and solves given exercises, we can say that the student has a certain understanding. Otherwise, memorizing the given information and formulas will not provide a certain understanding. Unfortunately, most students fail to understand the subtle difference between knowing and understanding. So what can we as teachers do to help students gain deeper understanding? The main question we need to ask ourselves is, "How can I teach a course if classical teaching methods are insufficient in physics education and in education in general?". Here we answer this question and focus on many alternatives.

Disadvantages of the classical teaching method

In the classical teaching method, the teacher is active, and the student is semi-passive or completely passive. If we consider the teacher as the transmitter, the student as the receiver, and the lesson as the message, most of the message in the learning environment is not absorbed by the receiver. In other words, the classical teaching method fails to provide adequate understanding for the majority of students. Alan Van Heuvelen (Van Heuvelen, 1991a) summarizes the current situation very well in his research: "Historically, we have "We were raised with science. We taught students the physics that underpins the universe." "We teach rules and how to use those rules to solve problems. This method is a very effective way to transfer knowledge because the class time is limited. We teachers teach concepts and techniques. But students do not have this advantage. Research shows that The classical method of teaching is not enough. "The transfer of knowledge is effective, but the student's assimilation of knowledge is hardly noticeable."

Most of today's teachers were trained in schools that use the classical teaching method, and they have the sick side of this method. Now we will list the disadvantages of this method below.

- Physically, a person's concentration time is 10-15 minutes.
- A lesson taught classically can be compared to a raging river. There is no time to think on the river. However, if no thought action takes place, most of the incoming information is recorded in short-term memory and does not leave a deep impression on the learner. If you want, let's test ourselves now. Write down what you remember from the seminar or conference you attended last week, and you'll see how little you remember.
- Most students don't even know how to follow a lesson. Taking notes during class will help you remember important points. But here we run into another problem. Most students take uneven notes; randomly crossed equations, incorrectly written equations, incorrectly drawn numbers, etc. As a result, students can't even take notes properly.
- Most of the courses cover topics already covered in the textbook. There is never time for advanced topics and techniques.
- Most of the courses focus on very technical issues. For example, deriving an equation, calculating an integral, or making a rough prediction about a physical quantity. However, what needs to be done is to focus on the physical phenomena themselves and try to understand these phenomena on a conceptual basis.

Active learning model

We now give a brief definition of the active learning model, and then look at the active learning methods used in physics education. The basis of the constructivist educational philosophy is that students construct their own knowledge. In this model, instead of passively receiving information, the goal is for the learner to construct knowledge by thinking, acting, and interacting with the environment. This is simply called self-regulation. Zimmerman suggests that the process of self-regulation consists of sub-processes such as self-monitoring, self-evaluation, and self-improvement. According to research, the process of self-regulation has a significant impact on academic performance.

A successful active learning application should have the following key features. Students spend most of their class time actively; They spend their time thinking, doing and interacting with other students. The student is in constant contact with other students and the teacher. However, in the classical teaching model, there is almost no interaction between students. In other words, the teacher provides more guidance. Students take responsibility for their own learning. This can be demonstrated by attending classes, studying independently from the textbook, and completing homework assignments on time. For example, after the exam, "This topic was not explained in the lesson. Therefore, I could not answer four questions." Such an objection cannot be accepted.

Before listing the various applications of the active learning model in physics education, let us make a caveat. There is also some interaction in the classical teaching model: students are encouraged to ask questions and are allowed to discuss things with each other. But this noise is never as much as it should be. In a classical environment, only a small number of students, those interested in the course, ask questions and participate in discussions. Most of the rest of the class are passive spectators and listeners. Conversely, due to discussion groups in an active learning environment, interaction both within and between groups is enhanced and each student inevitably participates in the course.

Active learning applications for physics education

As we mentioned earlier, there is no single way to implement an active learning model. All the teacher has to do is to use the method that suits his situation and his school. Some approaches may be used in large classrooms, while other approaches may be used in small classrooms. Some approaches require an assistant teaching assistant, while others allow the teacher to do the work alone. But regardless, the takeaway from Hake's research is that all active learning approaches produce good results. Any approach in which the student actively participates in the lesson is more effective than the classical method.

OCS approach (overview, physics examples)

This approach was developed by Alan Van Heuvelen. Although this approach was developed for large classes, it works equally well in classes with fewer students. The topics covered in the semester are divided into three major parts. Like Newtonian Physics, each track begins with a period of qualitative review that exposes students to alternative understandings and allows concepts to be reinforced. After this period, the topics are examined quantitatively and students learn problem solving techniques. At the final stage, a case study is conducted, which requires the integration of many techniques and concepts. Case studies show students how different quantities are interrelated and allow them to build a coherent structure of knowledge.

Here, the teacher can spend part of the class time showing how to use different methods. But the lessons are never formally taught. Students spend most of the class time solving various exercises and problems given to them. These problems and exercises are selected from ALPS (Active Learning Problem Sheets). In the first stage, the problems are conceptual and qualitative and do not require mathematical processing power. Over time, in the second stage and case studies, the problems become quantitative in nature. Students first work on their own, then discuss their results with the students next to them. The teacher periodically asks the class how many people got the right answer or if someone solved the problem differently. If there are differences in the answers, students are invited to defend their views. Finally, after a certain time, he enlightens the students by telling the correct answer. As we said above, the lesson in OKS is divided into three stages. Quantitative data is studied during the development phase. The ALPS exercises used in this phase require problem-solving strategies that an expert may have. Students first begin with a clear definition of the problem. Then, the problem is solved by following a series of processes; Determining the coordinate system for solving the problem, drawing free-body diagrams, etc. are analyzed. In the final step, the problem is represented by equations.

Summary: Physics is perhaps the most difficult and universal science to understand. Natural phenomena occurring in our immediate surroundings and in the farthest corners of the universe can only be understood thanks to the science of physics. On the one hand, physics allows us to understand the universe we live in, and on the other hand, it allows us to produce technology by imitating nature. From this point of view, physics education is very important. Unfortunately, physics lessons taught by classical teaching methods cannot give students a deep idea about the workings of nature. We can explain this with a simple analogy: let's take an apple. In the classical teaching method, an apple is always depicted. Apple red, yellow, green; It grows on trees, is round in shape, contains a lot of vitamins, etc. However, if the student has not held the apple in his hand, examined it, smelled it, bitten it and tasted it, there is no point in describing it to him. Therefore, in physics education, it is necessary to abandon the descriptive approach of classical teaching and adopt the corresponding active learning approach. It is evident that since there are active learning techniques to suit any situation, it is the need of the age for teachers to switch to active learning as soon as possible.

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