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The Research on Physics Generative Teaching Class of Middle School Based on Core Literacy

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ABSTRACT
Under the background of the new curriculum reform, the traditional presupposition middle school physics class can hardly meet the requirements of cultivating the core literacy of students in physics. In order to change this situation, on the basis of studying the relevant knowledge of generative teaching, this article combines the characteristics of physics with generative teaching knowledge, summarizes and concludes the physics generative teaching strategies, which are based on core literacy. This article guides middle school physics teachers to conduct physics class teaching with the viewpoint about dynamic generation on the basis of presupposition, so as to solve the current problems in middle school physics class, to achieve the improvement requirements of the core literacy of students, which is raised by ordinary physics course standard of high school.
Keywords: *middle school physics, core literacy, generative teaching*

1. INTRODUCTION

In the context of the new curriculum reform, it is difficult to meet the requirements of cultivating students' core literacy under the new situation in the presupposition physics class, which is based on indoctrination teaching. There are many problems such as single teaching activity, low student participation and lack of interest in traditional presupposition physics class. It is difficult for such a class to achieve the requirements of the new curriculum reform to develop students' physics concepts, physical thinking, experimental exploration, scientific attitude and responsibility [1]. Therefore, it is necessary for physics teachers to combine presupposition with generation organically in physics teaching so as to solve the problems that exist in physics teaching class.

The practice of generative teaching predates the theory. In the 1980s, the great Italian educator Reggio has carried on the generative teaching practice in the preschool education. Although the concept of generative teaching appeared relatively late, it sprung up earlier. Piaget's theory of children's cognitive development marks the transition of teaching from simple knowledge imparting to helping students to construct their cognition，which is the foundation and rudiment for the production of generative teaching. Dewey's "Life Education Theory": also emphasizes that "education is growth". As an activity during the growth process of students, education has many variables and possibilities that cannot be preset, so education is generated on the basis of preset [2]. Generative teaching ideas continue to mature with the changes of time. In 1975, Stenhouse raised the "process model" theory [3]. He believed that curriculum development is not simply to make a set of plans according to the goals, but should be dynamic and continuous. Therefore, the curriculum is generative, especially in physics class, where students' thinking is ever-changing, and teachers are required to seize the teaching opportunity, in response to students' questions and mistakes, conduct generative teaching.

The development of generative teaching in China began with Ye Lan, a famous educator in China. Her theory broke the inherent view of "special cognitive activities". She viewed class teaching from the viewpoint of dynamic generation at the height of life. Due to students' different experiences and the students' different ways of thinking, the "soil" of teachers' creative teaching is different, which will naturally produce unpredictable class teaching process [4].

In recent years, there have been some new researches on generative teaching of physics. In 2018, Wei Hua emphasized that in the process of generative teaching, teachers must respect students, be good at listening to students' answers, which is the basics of choosing and adjusting their own presets, and improve their specialty literacy continually, so the generative teaching can be guaranteed to conduct[5]. In 2019, Wu Jiudan explained

how to practice generative teaching in actual physics class based on living examples, and concluded four steps about generative teaching design: "Fully prepared and paving the way", "Flexible presets are conducive to generation", "Dynamic adjustment, promotes generation", "Rethinking and upgrading, summarizing and sublimating" [6].

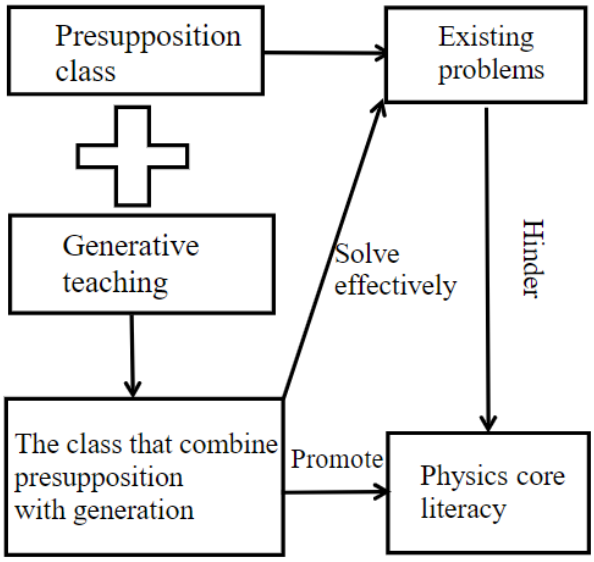

Figure 1 The relationship between physics core literacy and generative teaching

2 THE PHYSICS GENERATIVE TEACHING STRATEGIES OF PHYSICS BASED ON CORE LITERACY

2.1 Based On Preset, Leave Blank For Generative Teaching

Presupposition is the basis for a good class. Besides the presupposition, we should also leave space for generating in the class. In physics teaching, instructional design is very important. To carry out instructional design requires teachers to interpret the physics curriculum standards, then understand the key points, difficult points and goals of this lesson, to design appropriate teaching activities and teaching evaluation forms. On the basis of having a "framework" of preset, the "flesh and blood" of generation can be meaningful, and then we can cultivate the students' physics core literacy better. In the teaching process of teaching design, teachers are accustomed to presupposing the teacher-student dialogue, but in actual class teaching, the dialogues of teacher-student and student-student are uncertain and unpredictable. Excessive presupposition of teacher-student dialogues will lead to thinking set of teachers. The thinking set of teachers is not conducive to adjust the teaching activities, so it is easy to miss teaching opportunities and it is difficult to contribute to the construction of students' knowledge.

In the teaching design of "Scientific Verification: The Law of Conservation of Mechanical Energy", teachers often preset the teaching content of the error analysis in advance. As a result, when the teacher gave a new class, we could find that students had various ideas about the causes of errors. When the teacher taught students how to analysis the errors, students were immersed in the excitement of conducting the experiment, and couldn't pay attention to the error analysis at all. So in the teaching design about error analysis, the teacher could leave appropriate blanks to guide the students to discover that the decrease in gravitational potential energy was not the same as the increase in kinetic energy, which was inconsistent with the law of conservation of mechanical energy. Cognitive conflict would lead students to have different ideas: "Is the air resistance too large? Is it affected by friction? Is there something wrong with the ticker-tape timer?" These questions were valuable generative resources. The teacher assigned the work of raising the possible sources of errors to the students, reduced the teacher's language intervention, left appropriate "blank" with an attitude of open and free, to leave a "stage of the class for students to generate freely". "Silence is better than voices at that time", used teaching tact properly to confirm the corrected guess appropriate and reversed the wrong thinking dexterously, then enhanced students' impression on the knowledge and exercised students' physical thinking abilities.

2.2. Create A Teaching Situation, Use Experience To Generate Skillfully

In physics teaching class, create a teaching situation related to student experience, regarding previous concept as a"scaffolding"correctly for students to learn new knowledge, to help students obtain more generative resources in class. In order to create an open class environment for students to speak out freely in such an environment, the teacher creates a vivid physical situation by enumerating the physical phenomena that the students had seen or used to be interested in life, the relevant examples about the frontier of technological development and the history of physics can also be used in teaching class, so that students' thinking can be opened, the students' interest and curiosity can also be stimulated. Students are free to share their experiences and ideas in class, because of the students have different experiences and different ways of thinking, having collision of thought. Teachers grasp the shining points that can be extended and diverged in the students' speech, building a bridge between the students' original cognitive level and new knowledge, which is conducive to the construction of students' physics concepts.

The teacher introduced new knowledge by using the history of physics in the teaching of "Newton's First Law". They allowed students to substitute the positions

of scientists and debate the views of Aristotle and Galileo on the relationship between force and motion, then expressed their opinions freely. When they gave out the examples that could support their views, the teacher captured the reasons for their mistakes and their obscure knowledge, so as to "generate" in the class at the right time, and correct their wrong ideas with appropriate language, such as an example to contradict that "force is the reason for maintaining an object's state of motion ", which could make students change their views naturally in this context. If the teachers only follow their presupposition and ignore the students ideas, explain "force is the reason for changing the state of movement of objects, without thinking students' misunderstandings in thought. It is difficult for students to reverse their mistakes from the thinking level, and it is also difficult for students to remember knowledge deeply.

2.3 Building A Harmonious Class, Cooperative And Open Inquiry

Building a harmonious and open class atmosphere is the basic condition of generative teaching, especially in the experimental teaching of inquiry, teachers and students are required to conduct group cooperative inquiry teaching with an open and inclusive attitude. In this link, student's participation is relatively high, and there is more space and freedom for generative teaching. Among them, the guess hypothesis and group cooperative experiment links are prominent. In the conjecture and hypothesis link, teachers should encourage students to say their own hypotheses and conjectures boldly, then guide them to tell the basis behind the conjecture, and build a "stage" for teachers' generative teaching. When students have omissions or mistakes, teachers should not show their knowledge to students directly, but should give them reasonable prompts and "set limits" appropriately. In the guess hypothesis of "equilibrium principle of two forces" teaching process, it was difficult for students to guess the balance condition that "the two forces must act on the same straight line". The teacher reminded the students what the "three elements of force" were, and then the students could obtain the equilibrium condition: The two forces must act on the same straight line by their own thinking, students' abilities of experiment and inquiry has been further improved.

The students' physics experiments operation is highly uncertain and unpredictable, and the "unexpected events" often occur. Teachers should not be panic when facing with situations outside of their presupposition, teachers also can't reprimand students severely to make the class atmosphere become serious and tense, teachers could use them as a case to re-emphasize the importance of relevant knowledge. For example, when connected the sliding rheostat, the student slipped the sliding rheostat to the minimum resistance value by mistake, which caused the current to be too large in the circuit, so the bulb burned out, the teacher should give guidance and correction timely, and let the students who had operated wrongly to demonstrate the process of connecting the sliding rheostat with the circuit in front of the class, so as to emphasize the importance of circuit experiment safety for the whole class, realized the generation, enriched the class, and cultivated the students' scientific attitude and responsibility.

2.4 Grasp The Timing Of Teaching And Use Teaching Tact

Teaching tact is a sensitive, rapid, and accurate judgment ability displayed by teachers in the face of complex teaching situations [7]. In physics teaching class, quickly seizing the teaching opportunity and the proper use of the generative resources that students sprout in the class are the keys to give a good physics class.

In contemporary era, students' knowledge reserves are difficult for teachers to predict. They may have strange problems and various emergencies in the class. Although it may be difficult for teachers to answer these questions right away in class, teachers should not miss such teaching opportunities. When learned about the movement of celestial bodies, students asked questions about the Big Bang, black holes, etc. The teacher couldn't answer them accurately and comprehensively for a while. At this time, the teacher should put themselves on an equal position with students and tell students honestly that physical knowledge is endless, so the teacher could not answer these questions accurately, and then they could assign homework about collecting the knowledge of the universe carried out by teachers and students, in order to encourage students to share in the next class, which could not only stimulate students' interest in physics learning, but also exercise students' abilities to study independently and collect more information, and it also avoided teachers' embarrassment. When learned about the production and dissemination of sound, the sound of firecrackers happened outside the classroom, and the class order became chaotic. After the sound of firecrackers, the teacher used the production and dissemination of firecrackers as an actual cases for students to analyze, and the students became quiet quickly, get involved in thinking about the problem, which not only conducted a simple examination of the students, but also rectified the discipline. The teacher seized the right time for teaching by using the teaching tact, captured the students' interest and attention from the emotional level, it was much better than corrective discipline ponderously.

3. CONCLUSION

The physics generative teaching strategy proposed in this paper based on the core literacy has injected fresh blood into the physics teaching class under the background of the new curriculum reform. We emphasize generation, but we do not deny the importance of presupposition, both are dialectical unified. Generating on the basis of presupposition is purposeful and directional. Only on the basis of presupposition before class, can the space be left for students to generate, so as to avoid the situation that excessive presupposition of teachers imprisons students' thinking and hinders students from expressing their own ideas and opinions in class. Only when teachers create an appropriate situation in class, can students' life experience be connected with the new knowledge that they want to learn, building a bridge of knowledge construction, and arousing students' interest in learning. When students have questions or mistakes, teachers should not rush to say the correct answer, but should guide them to follow the instructions, so as to find the crux of the problem in each generation, understand the knowledge from the level of physical thinking and concepts thoroughly. In order to meet the requirements of the new curriculum reform for the core literacy of students in physics, to help students become innovative talents with all-round development who are needed by the country and the age.

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