

Problems and Countermeasures of Project Learning Implementation in Primary and Secondary Schools

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Abstract: *Project learning is a teaching model that integrates learning into practice. Because its concept is consistent with the trend of China's curriculum reform and the concept of core competencies, it is highly respected in primary and secondary school teaching activities. At the same time, project learning also implements the concept of "learning-centered teaching" and promotes the practice of embodied learning and the achievement of in-depth learning. However, in teaching practice, under the influence of teachers' concepts, literacy, and implementation conditions, there are some problems such as empty and lengthy themes, far-fetched and one-sided situations, a mere inquiry into forms, incoherent cooperation, patchwork of blurred results, and single and alienated evaluations. The effectiveness of project learning implementation can be improved by narrowing the scope of topic selection to build real situations, encouraging real inquiry to promote effective cooperation, and enriching learning outcomes and implementing multiple evaluations.*

Keywords: *Project learning; Problem situation; Cooperation exploration; Multiple evaluation*

1. Introduction

As a new form of learning, project learning is prevalent in primary and secondary schools. Regardless of the academic period or subject, teachers are proud to participate in the research and practice of project learning. Influenced by the concept of situational teaching, teachers regard project learning as a way to closely connect subjects and life, and as a way to demonstrate that knowledge is useful to students and society. Therefore, some schools and some teachers are almost fanatical in developing project learning cases and carrying out project learning practices without understanding the connotation and implementation strategies of project learning, which to a certain extent has resulted in blind implementation of project learning and a waste of teaching resources. In this context, facing up to the existing problems in the design and implementation of current project-based learning and rationally examining the current implementation status of project-based learning will help improve the applicability of project-based learning in subject teaching.

2. The connotation and implementation significance of project learning

2.1. The connotation of project learning

Project learning, also called Project-Based Learning (PBL), is a task-centered teaching model that enables students to learn in the process of solving practical problems. Some scholars define it as a process in which students conduct in-depth and continuous exploration of driving issues and creatively solve problems over a period of time [1]. The general implementation process is to start from the learners' existing experience, guide learners to independently discover and explore problems, and solve problems in real natural and social situations. Finally, the individual learner's construction of the meaning of knowledge is demonstrated through the formation of works. Project learning has the characteristics of focusing on subject literacy, driving learning with real problems, pursuing continuous and appropriate inquiry and cooperation, paying attention to student outcomes, and insisting on evaluation of the entire learning process [2].

2.2. The significance of project learning implementation

2.2.1. Project learning can promote the implementation of learning-centered teaching concepts

"Learning-centered teaching" is a teaching concept that highlights the dominant position of students and the role of teachers, which is formed by taking into account the trend of curriculum reform and the cumulative effect of curriculum reform over the years. Its core is "learning as the center, teaching as a service for learning", which mainly reflects the characteristics of "learning more and teaching less", "teaching based on learning", "learning first and then teaching" and "teaching based on learning" in teaching activities [3]. Project learning requires students to participate in topic selection, exploration, testing and summary. The frequency and depth of participation in learning can ensure that students "learn more and teach less". The implementation of project learning must fully consider students' "pre-learning level", which is the main basis for determining the content and difficulty of project learning topics, and this is the embodiment of "teaching based on learning". The learning method of project learning can satisfy the "learn first, teach later" approach, while the evaluation method of evaluating students and teaching based on students' works can achieve "learning determines teaching". It can be seen that the concepts of project learning and learning center teaching are highly consistent. The implementation of project learning can highlight the teaching concept of learning center and can be used as a carrier for the implementation of learning center teaching concept.

2.2.2. Project-based learning can promote the practice of embodied learning

Embodied learning is a learning method that integrates embodied cognition and teaching interaction based on theories such as body phenomenology, perceptual symbols, conceptual metaphors, and dynamic systems [4]. It places the "body" at the center of cognitive practice and emphasizes that cognition is formed through physical experience and the way it moves. In traditional classroom teaching, the knowledge and problems students are exposed to are "processed" and often difficult to match students' experience. This makes it difficult for students to invest more energy in paying full attention and thinking to the content they learn and engage in less physical experience. Therefore, traditional classroom teaching is difficult to achieve embodied learning. In project learning, the core issues around project learning are mainly based on issues that students are familiar with and interested in. Whether based on individual experience or emotional identification, students can learn from both cognition and emotion during project learning. All aspects are deeply involved in inquiry activities. In the process of solving problems, students can experience the process of knowledge discovery, exploration and abstraction. In this way, the knowledge students learn is no longer cold and detached, but closely related to themselves and embodied. It can be seen that the practice of embodied learning can be promoted through the implementation of project learning to promote the occurrence of meaningful learning.

2.2.3. Project learning can promote the achievement of deep learning

Project learning creates good conditions for students' in-depth learning and is an effective way for students to conduct in-depth learning [5]. Deep learning is reflected in two aspects. On the one hand, it is reflected in the "depth" of students' learning results, and on the other hand, it is reflected in the "depth" of students' participation in learning activities. The process of project learning is a process for students to explore and discover around an issue. It is an important opportunity for students to think deeply about issues. This can ensure that students have a deeper knowledge and understanding of knowledge during project learning. In the process of solving problems, students may also have stronger abilities to apply and transfer knowledge, achieving "deeper" learning results. Project learning is centered on issues that students are interested in and have a certain basis for understanding. This is chosen by students independently or determined through consultation with teachers. This process is conducive to making students realize their dominant position in learning activities and their consciousness to their own responsibilities in learning. At the same time, familiar and embodied topic selection is conducive to increasing students' interest in learning, and can encourage them to exert their enthusiasm for participating in learning to a greater extent, thereby increasing the depth of their participation in learning activities.

3. Analysis of problems and causes existing in project learning implementation

3.1. Empty and lengthy topic

The topics studied in the current project are generally relatively large. This is mainly because designers are influenced by traditional "projects" and believe that since it is a "project" it should have a

certain degree of complexity, so the topic should be larger. Secondly, influenced by the STEM (Science, Technology, Engineering, Mathematics) teaching model, designers often believe that projects should break through knowledge modules and even discipline limitations, which to a certain extent expands the theme of the project and increases the difficulty of the project. In addition, due to limitations of the designer's level and physical conditions, project design is often easily separated from school and family life, and far away from students' life experience, thus making the subject of inquiry "empty". The large topic of the project made it difficult for students to research, so the research process had to be extended and divided into many smaller stages. This makes it difficult for students to effectively connect the various stages, and the topic is divorced from students' experience, making some students gradually lose interest in inquiry during the research process. The limitations of project designers' understanding of project learning make them pay more attention to the "form" of project learning without recognizing the "spirit" of project learning. They pay too much attention to the project itself and ignore the students' abilities, experience and needs. This is the main reason why the theme is large and empty. On the other hand, under the current educational evaluation system, project learning can only exist as an auxiliary to traditional teaching. In order to avoid conflicts with traditional teaching, project learning time is often arranged during activity times, usually one or two sessions a week, which extends the project learning time and often spans several weeks. This often results in the project's exploration cycle being too long, and the continuity of project learning cannot be guaranteed.

3.2. A far-fetched situation

Project learning requires setting up real inquiry situations. Therefore, in some project-based learning activities, teachers abruptly incorporate some life examples into inquiry activities. Students' cognitive level and social experience are limited. Although the situation is real and familiar to students, they do not know its details and principles. For these "real situations" that are both familiar and unfamiliar to students, students can only understand the situations and collect data through the Internet. This may improve students' information literacy, but its effect on the subject knowledge itself and the development of subject core competencies is quite limited. Many teachers break away from or weaken the essential attributes of subject content when introducing situations. This excessive emphasis on the external form and non-cognitive factor functions of introduction seems to stimulate needs, concentrate attention, and strengthen motivation, but in fact it often weakens the introduced cognitive factors and is not conducive to the meaning construction of knowledge [6]. The reason is that teachers have certain misunderstandings about situation design. On the one hand, teachers do not realize the role of situation design in project learning, and often stay on the superficial understanding that "the role of situation is to find a topic to introduce". They fail to realize that context always accompanies project learning, and all inquiry activities revolve around context which is both the starting point and the destination of activities. On the other hand, teachers generally tend to choose life situations when designing situations. This is due to teachers' one-sided understanding of situations. Most teachers will narrowly equate situations with life situations. In fact, in addition to life situations, subject culture, analogies within the subject, and subject background can all be used to create inquiry situations for project learning.

3.3. A mere inquiry into forms

At present, in some project-based learning, teachers interfere too much and students' thinking remains on the surface. Teachers act as designers and supervisors in project learning, designing the direction and solution steps for students. Students can achieve the goals expected by the teacher as long as they follow the "blueprint" designed by the teacher. This kind of independent design and trial-and-error inquiry without integrating into students results in the phenomenon that students attach more importance to participation and activity than thinking, which leads to the identity, formalization and surface of students' inquiry. Therefore, although on the surface, inquiry activities may be rich, in essence, students' thinking lacks rigidity. Inquiry is a desire to find answers to a problem of interest and a series of accompanying ways of thinking and behavior. Its essence is that at the thinking level, when an individual faces a problem or confusion, he or she can actively and proactively think about and explore issues repeatedly. Inquiry learning is not mainly an external activity or procedure, but an internal spiritual quality. Influenced by utilitarianism, teachers are more willing to build "scaffolding" for students to reduce students' blind trial and error and improve the efficiency of inquiry. As everyone knows, students' problem awareness and interest are the driving force for inquiry activities, and inquiry following the teacher's instructions is a programmed and formal inquiry. In addition, inquiry activities are more reflected in mental activities rather than external activities. Students who think quietly may be engaged in deep thinking and inquiry. Trial and error is also an important form of inquiry learning. Trial and error is also an important form of

inquiry learning, which "wastes" time and energy in exchange for the development of students' thinking and the accumulation of experience.

3.4. Incoherent cooperation

Project learning generally takes the form of group cooperative learning. During this process, group members form a miniature think tank. They need to share opinions and exchange information with their peers in a timely manner [7]. However, influenced by the traditional concept of cooperation, cooperation often appears superficial and formal. The students in the group seem to cooperate, but in the learning process they work independently and do their own things. Even if there are tasks assigned in the group, the tasks are relatively fragmented. After students complete their own tasks individually, they submit them to the group and simply put them together, which is considered "cooperation". There are many reasons for this seemingly inconsistent cooperation. First, due to time and condition constraints, students often use the limited time in school to focus on collaborative exploration, which makes cooperation stay on the surface, usually just simple division of tasks and information collection. Secondly, in teacher-student cooperation, teachers cannot provide students with personalized learning strategies, but often set relevant questions for students as thinking clues to guide them in a "uniform" manner. Moreover, it is impossible to provide students with personalized attention and consultation in a large class environment. Cooperation in students' understanding generally stays at the level of division of tasks. In fact, the purpose of cooperation should be to complement each other's strengths and promote all-round personal development. In cooperation, in addition to complementing each other, we should also learn from each other. In particular, we should establish a comprehensive personal understanding of project ideas and the concept of guiding the overall situation.

3.5. Piecing together blurred results

In addition to implicit results such as the improvement of knowledge and abilities, the visual results of project learning are generally a specific object, a plan or a design. Currently, some projects do not have requirements for students' achievements and believe that project learning is mainly for students to participate in inquiry, while others ask students to fill in a one-page project report similar to a physics experiment report sheet. In order to cope with the situation, students pieced together the activity steps and data in the project learning. The results are often shelved by teachers and archived as the "results" of project learning. There are two main reasons. Firstly, the project design is too large, which makes the students' learning in the project too long. Project learning is generally carried out outside the school curriculum, so the project has to be divided into several segments, and time is spent every week to solve the problems. As a result, it is difficult for students to form an overall understanding of the project. Secondly, some students' inquiry activities are only "formal participation", and the lack of understanding of cooperation makes students limitedly focus on their own division of labor and lack the understanding of the overall project. This makes students often have no way to start when forming results and can only search for bits and pieces of materials to list. Thirdly, teachers have insufficient understanding of the role of the results of project learning and are unwilling to spend time displaying and communicating the results of project learning. They ignore that they can train students' subject writing and expression skills, cultivate students' awareness of results, stimulate students' enthusiasm, and help students feel the application value of subject knowledge.

3.6. Evaluation of single alienation

The complexity and comprehensiveness of the projects lead teachers to place too many expectations on project learning. They not only want to develop students' core subject competencies, but also want to improve students' ability to cooperate and communicate through inquiry activities and improve students' subject communication abilities through achievement display. Restricted by teachers' design level and concepts, it is difficult for teachers to extract the meaning of project design from complicated projects and refine the goals that students need to achieve through activities. Instead, they can only give a general overview of the project goals, which makes it difficult to evaluate the results of the project. Since project learning is slow to produce results and is not a mainstream learning activity, the evaluation of project learning has been severely weakened. Although this is related to the status of project learning and teachers' understanding of evaluation to a certain extent, the main reason is that project learning requires comprehensive evaluation of students, which requires both process evaluation and result evaluation, and requires the combination of multiple evaluation subjects. This poses a higher challenge to teachers' evaluation abilities. The complexity of comprehensive evaluation daunts most teachers. Moreover,

restricted by their own concepts and abilities, project learning outcomes are limited to the dilemma of simplification and representation.

4. Strategies for project learning implementation

4.1. Narrow the scope of topic selection and construct a real situation

In order to reduce the difficulty of inquiry and shorten the time of inquiry, the teacher can consider narrowing the scope of project topics, that is, setting up "micro-project" learning methods to break through the difficulties faced by current project learning. "Micro-project" is a streamlined version of project-based learning. It has almost all the characteristics of project-based learning. The biggest difference is that the topic selection is smaller. The purpose is to limit the scope of inquiry, shorten the inquiry time and reduce the difficulty of inquiry, thereby improving the integration of project learning and traditional classroom teaching. From the perspective of efficiency, rationality and subject characteristics, traditional classroom teaching has advantages that other teaching forms cannot match, and it caters to the current evaluation system, so it will not disappear within a certain historical stage. Therefore, project learning cannot replace traditional classroom teaching. If project learning is to be widely used to improve students' inquiry abilities, project learning must be integrated into traditional teaching. Teachers can combine the actual teaching and use the teaching content of this lesson as the basis for material development, set up micro-projects, and transform the traditional classroom into a classroom with a project learning module. This means that in the traditional classroom, project learning will mainly focus on a certain theme. Or at least have small links to project learning. This can strengthen teachers' project learning design capabilities, improve students' inquiry levels, and make it easier to develop students' core competencies.

The theme is embedded in the situation, and a good theme must be integrated into the appropriate situation. Situations must be realistic and relevant to the student's personal experience. Such a situation can promote students' enthusiasm to participate in learning to a greater extent and stimulate students' embodied cognition. On the one hand, teachers can understand the academic situation through extensive communication with students and create situations based on the academic situation. Or the situation can be created independently by students or through consultation between teachers and students. This situation is independently proposed or chosen by students and is, to a large extent, in line with students' interests and experiences. On the other hand, teachers can break through subject boundaries and select relevant situations from other subjects. Selecting content that students have studied or are familiar with in other subjects as contexts can not only focus on the subject and cultivate students' subject logic, but also break through subject boundaries and help students gradually move towards comprehensive problem solving. For example, there is a lot of common knowledge in high school mathematics and physics, such as force decomposition and vectors, electromagnetic conversion and trigonometric functions, etc. In addition, molecular structure and solid geometry in chemistry, gene sequences and arrangements in biology, algorithms and functions in information technology, etc., can also be used as interdisciplinary project learning topics.

4.2. Encourage authentic inquiry and promote effective collaboration

During the implementation of project learning, creating a good inquiry environment for students is conducive to encouraging students to use different inquiry ideas to solve problems, and is conducive to the occurrence of in-depth learning. The time for students to explore should be guaranteed, and the new ideas generated by students should be supported. Teachers can provide appropriate assistance during this process. For the students' research results, the teacher first makes a preliminary judgment, and if the feasibility is strong, the teacher should assist the students to conduct in-depth research until the end of the activity. During this process, students can enjoy the joyful experience of having their "unique" ideas respected. If the feasibility is not strong or goes against common sense, the teacher will allow the students to make preliminary trials and errors. If students can find the problem, they will be encouraged to continue to seek other paths. If students continue to get into a "trouble", the teacher should appropriately guide students to discover misunderstandings and "stop losses" in time. In the summary stage, students should be asked to reflect on the process of trial and error, correct misunderstandings in understanding and methods, cultivate students' critical and reflective abilities while cultivating divergent thinking skills, and provide reference for future activities.

Cooperation is the current development trend of learning activities and an inherent requirement for

the effective implementation of project learning. Compared with traditional learning, project learning faces more complex problem situations and faces greater challenges in the process of solving problems. This is difficult for individual students, both in information collection and problem solving. Therefore, teachers can reduce the difficulty of project learning, develop students' cooperation abilities, and improve the implementation effect of project learning by promoting effective cooperation among students. At the beginning of the project learning design, teachers can set the work route and direction for the project team based on the project goals, so that the team has "laws to follow" [8]. In the grouping process of project learning, teachers can implement homogeneous or heterogeneous grouping according to the characteristics of the problem and the personality of the students, or they can group according to the interests of the students, which can promote the occurrence of cooperative learning from the perspective of personnel characteristics. In the process of task decomposition, teachers can highlight the logical connections between tasks from a higher perspective, which can promote more cohesive and integrated cooperation among students.

4.3. Enrich learning outcomes and implement multiple evaluations

The results of project learning are a summary of students' ideas and innovations in participating in inquiry activities, and a demonstration of students' comprehensive abilities. The results of project learning should be diverse and can be physical objects, but more often in the form of learning reports and short papers. In the process of writing reports and papers, students will reflect on their own thoughts and behaviors and compare their results with those of their classmates. This is a good opportunity to promote student reflection. Taking the subject of mathematics as an example, in the process of converting ideas and behaviors into words, students need to master the flexible application of the three expression methods of mathematics, namely words, graphics and symbols. In the process of comparing the results of other students, students can transform and understand mathematical language from different forms of expression, which can improve students' mathematical expression and understanding abilities. To enhance the authenticity of learning outcomes, teachers can encourage students to retain procedural materials. This is not to test the authenticity of the results, but the materials generated during the learning process can carry the staged results of students' learning, have higher authenticity, and can also be used as a learning outcome in itself.

In the evaluation process of project learning, teachers should adopt a multi-evaluation method, which should not only focus on the combination of process evaluation and result evaluation, but also pay attention to the diversification of evaluation subjects and the diversification of evaluation forms. Paying attention to process evaluation is to avoid the "labeling effect" of summative evaluation, pay more attention to the changes in students' learning psychology and learning attitude during the learning process, and provide timely encouragement and guidance to students. The diversification of evaluation subjects means that relevant experts, parents and classmates can all participate in the evaluation, so as to form a multi-faceted "perspective" on student achievements and student ability levels, thereby forming a more comprehensive understanding of students. The diversification of evaluation forms means that in addition to the traditional paper-and-pencil test, it can also take the above-mentioned physical display, study reports and essays, and can even be combined with activity observation, oral tests, etc. The evaluation formed in this way is more scientific, objective and comprehensive. The results of the evaluation should include original materials, relevant supporting materials, comments, etc., and be archived in paper or electronic form as the students' phased learning outcomes.

5. Conclusions

Project learning is not a new form of learning, but it is an opportunity for current subject teaching reforms. The use of project learning can attract more teachers to participate in the new round of curriculum reform, participate in resource development, and participate in teaching research, enhance teachers' enthusiasm for participating in teaching reform, and enable more teachers to deeply understand the meaning of teaching reform and creatively carry out teaching activities. At the same time, it can also enhance students' interest in learning and cultivate their inquiry, reflection and subject expression abilities. In this process, teachers should combine the actual conditions of teaching and environment to provide students with as many project learning opportunities as possible and ensure students' autonomy to the greatest extent, so as to ensure the continuity and consciousness of students' project learning, and maximize the role of project learning in improving students' learning abilities and developing students' core competencies in disciplines.

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