Design and Research on Cultivating Students' Innovative Ability by Project-based Teaching

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Abstract

It is the requirement of education development in the new era to innovate education idea and talent training mode and develop innovative talents. The application of project-based teaching mode can effectively promote students' investment in learning and stimulate students' interest in creation. In order to promote the improvement of students' innovation ability, this paper designs a project-based teaching mode which is beneficial to the improvement of students' innovation ability on the basis of the research of project-based teaching.

Keywords

Project-Based Learning; Innovation ability; Teaching mode.

1. Introduction

With the rapid development of the global economy, the competition for scientific and technical talents in various countries is increasingly fierce. It is the requirement of education development in the new era to innovate educational concepts and talent training methods and develop innovative talents, and having innovative ability is regarded as an important goal of talent training in various countries. In 2015, Premier Li Keqiang proposed to promote innovation and entrepreneurship in the Government Work Report, and in September 2015, the Ministry of Education clearly pointed out to explore new education models such as maker education. In 2016, the State Council issued the Outline of the National Strategy for Innovation-Driven Development, which proposed to develop the mass maker space, encourage everyone to innovate, and promote maker culture in schools. In 2017, the report to the 19th CPC National Congress pointed out that "we will accelerate the building of an innovative country". Maker education aims to cultivate students' innovative and creative ability. In recent years, China has invested more in maker studios, and various colleges and universities have adopted various ways to improve students' innovative ability, which shows the important role of innovation ability in education and teaching. Research shows that the project type teaching to improve students' learning has significant effect, and the project type teaching according to different teaching environment, the characteristics of students and teaching objectives can be developed, and the flexible applicable types of teaching subjects, in training students' innovation ability, the project type teaching can inspire students' thinking, encourage students to learn to do, bold attempt, plays a positive role in promoting the students' innovation ability ascension.

Based on this, this paper studies the connotation, function, teaching method and practical application of project-based teaching. Guided by cultivating students' innovation ability, this paper constructs a project-based teaching model, in order to promote the important role of project-based teaching in improving students' innovation ability.
2. The Connotation and Function of Project-Based Learning

Project-based learning is a dynamic classroom approach in which students actively explore real-world problems and challenges and acquire a deeper knowledge. Project-based learning, first described in the article written by the American educator Kerber in 1918, is called project-based learning, or PBL for short. After it was introduced into China, it is also known as project-based learning and project-based learning. The earliest of the definition of the concept of the project learning is the buck institute of education (BIE) of the United States: "the project to study the problems from the real world, by organizing study groups, lets the student with the help of information technology in a certain time, and a variety of resources, to carry out the inquiry activity, solve a series of interrelated problems, and the research results in the form of a certain issue. [1] Professor Li Jiahou, a Chinese scholar, pointed out that project learning is centered on learning concepts and principles. By participating in project activities, students can investigate and study the problems to be solved, so as to build their own knowledge system and apply what they have learned to social practice. [2] In the research process, it can be found that project-based teaching is not only a teaching mode, but also can be used as a teaching idea to guide the teaching process.

Project-based learning is widely adopted in primary and secondary schools in the United States, which exercises the creativity, teamwork, leadership, hands-on ability, and ability to plan and execute projects of American primary and secondary school students. In addition, the choice of projects also enables primary and middle school students to face and solve problems in real life earlier and more deeply. These abilities are the ability that the exam-oriented education of Chinese children lacks to deal with the world and face the future challenges. Hossein Sadeghi et al. ‘s research on project-based learning has shown that when students use technological tools to communicate (display and publish their work), it can promote the development of students’ critical thinking skills. [3] Cao Yan, Wang Bing et al. ‘s research shows that project-based learning has a significant positive impact on students’ learning results.[4][5] Through the research, the following points are summarized as follows: (1) To be able to teach based on real situations and stimulate students’ interest in solving problems. (2) Give full play to the subjective role of students, teachers assist teaching, and promote personalized learning and collaborative learning. (3) Focus on the evaluation of students’ learning process, encourage students to try and make mistakes, and mobilize students’ learning enthusiasm. (4) Innovate the teaching method of the course, and pay attention to the cultivation of students’ innovation ability.

3. Project Teaching Mode of Cultivating Students' Innovative Ability

![Figure 1. Project teaching mode to cultivate students’ innovative ability](image)
Based on the research of project-based teaching, a project-based teaching mode is constructed to cultivate students' innovative ability with the goal of cultivating students' innovative ability as shown in Figure 1. The project environment is designed in the model, and teaching activities are carried out based on physical environment and virtual environment. In the project activities, students are the main body, teachers give guidance and peers cooperate. Finally cultivate the students from the innovation consciousness and form the innovation ability.

3.1. Project Environment

In the project environment, two kinds of learning environment are designed: physical environment and virtual fantasy environment. Physical environment refers to the physical environment in the learning process, the environment that students can actually touch. From the perspective of space, it mainly refers to the materialized classroom, the space for students to study and carry out activities. Ways from the use of equipment, in addition to the necessary multimedia in the classroom, white board, etc., as a learning environment to develop the innovative ability of students, need to use the round table convenient teaching team member interaction, with the use of innovative equipment, such as all kinds of good electronic product design, on the basis of the courses need to display, provide students with view of space, in order to mobilize students' learning enthusiasm. Provide a variety of equipment to encourage students to use their brains and hands in learning. Virtual environment mainly makes up for the deficiency of physical environment. Students can use the characteristics of Internet technology, such as virtual reality technology and 3D printing technology, to build models. At the same time, it can feel the real situation that cannot be walked into in reality. For example, in the course of "walking into outer space", virtual technology can be used to help students observe the environment of outer space. In this way, the authenticity of the project situation can be improved.

In this mode, the physical environment and the virtual environment are connected by a "multiplication sign", which means that the two environments are not simply combined and superimposed, but used in conjunction with each other, depending on different projects or course content. Focus on use, make full use of the convenience provided by the environment, improve students' learning efficiency, and improve students' innovative ability.

3.2. Project Activities

The project activities are carried out with students as the main body, teachers as assistants for guidance, and peers cooperate with each other to complete the project. The project is divided into four parts: design, implementation, evaluation and improvement.

3.2.1. Project Design

The first stage is the early stage of the project. This part of the teacher designs, students imagine, and peers share, as shown in Figure 2. The teacher is responsible for the design of the project, and organizes and arranges the content of the project according to the requirements of the teaching objectives and the characteristics of the students. When designing a project, it is necessary to select novel questions, suitable for students to "play" and learn while designing interesting content and authentic situations, so that students can immerse themselves in the completion of the project. The task of students at this time is mainly to make creative ideas, integrate into the project according to the project context provided by the teacher, boldly imagine, temporarily do not consider whether they can get the result or what kind of result will be obtained, and give full play to themselves. The creativity and the enjoyment of creative projects can be more conducive to improving the effect of learning. The task of peers is to share ideas and communicate with other members of their own ideas. The communication between peers is more conducive to breaking the original fixed thinking of individuals, constantly improving creativity, and jointly further combining creativity with project requirements.
3.2.2. Project Implementation

The second stage is the implementation of the project, which is mainly implemented with the assistance of teachers, and students conduct inquiring and cooperative collaboration, as shown in Figure 3. At this stage, the teacher should play a supporting role, hand over the classroom to the students, provide the equipment needed for the completion of the project, maintain the classroom discipline when the project is implemented, follow up and record the learning progress of the students, and pay attention to the performance of the students. Prepare for the follow-up evaluation. When students encounter unsolvable problems, teachers will give appropriate guidance to help students solve complex problems. Students are mainly responsible for exploring and practicing, implementing the ideas they have already thought of. They need to solve each task step by step, adopt appropriate solving tools, and actively consult materials to solve new problems. Combine the learned knowledge with creative ideas for use, so as to learn by doing and do while learning. The task of partners is to cooperate and help each other, assume different roles according to each person's strengths, reasonably divide the labor, and improve the efficiency of problem solving. In the face of complex and unsolvable problems, cross-group discussions can also be carried out, with intra-group cooperation as the main method and inter-group cooperation as the supplementary method for exploration.

3.2.3. Project Evaluation Stage

The third stage is the project evaluation stage, in which teachers make project summary evaluation, students make reflection evaluation, and peers answer questions and supplement questions, as shown in Figure 4. At this stage, teachers make evaluations based on the phenomena observed in class and the demonstration of students' achievements. Teachers from other disciplines can be invited to make evaluations together to achieve a more objective and comprehensive evaluation. At this time, the task of the students is to share and evaluate each other, show the achievements, comprehensively introduce the process of completing the task and the features of the product, highlight the innovation of the designed product, and show the
functions of the product. On the other hand, I evaluated each other, listened to the reports of
other groups carefully, raised questions in the face of doubts, evaluated the products of other
groups, and evaluated the report performance of other groups. To achieve the effect of mutual
evaluation between students. The task of the partner is to assist in answering questions. In the
face of other students' questions, he can give a timely reply, reflecting the responsibility of the
team.

![Figure 4. Project evaluation stage](image)

3.2.4. Summary of the Lifting Stage

In the fourth stage of summary and promotion, teachers summarize, students reflect, and
partners share innovation, as shown in Figure 5. After summarizing the completion of the
project, teachers should reflect on the whole project and further improve the project. At the
same time, teachers should reflect on their teaching behavior and improve their own ability.
Student’s task is to reflect on the innovation, reflect on yourself when to complete the project
problem solution, creative idea Angle, showing the performance, etc., from multiple angles to
give their own evaluation, found deficiencies and improvements, innovation in product design
and complete, improve their innovation ability. The task of the partners is to reflect and share,
and they will communicate and discuss with the members about their reflection in this
cooperation, so as to make progress together.

![Figure 5. Summary of the Lifting Stage](image)

3.3. Project Objectives

The main goal of carrying out project activities in the project environment is to cultivate
students' ability of innovation and creation. Starting from the innovation consciousness of
students, this study through the teachers' teaching, outdoor activities, such as a variety of ways,
to the student what is innovation, and make students in learning and life have a concept on
innovation consciousness, can exert a subtle influence in learning reflects their innovation
consciousness, to innovation to create products with innovative consciousness. In the
completion process of the project, the innovation consciousness will be used as guidance, and
the knowledge and experience will be combined to transform the innovation consciousness into the innovation ability. In the process of constantly improving the innovation ability, students will further realize the shortcomings of their innovation consciousness and innovative thinking, so as to continuously improve their innovation quality. Therefore, the goal of this study is the interaction between innovation consciousness and innovation ability, and the ultimate goal is to continuously improve students’ innovation ability.

4. Conclusion

According to the requirements of The Times for talent training, this research takes innovation ability as the fundamental goal, and meets the needs of talent competition in the future. By studying the meaning and function of project-based teaching, it combines the project-based teaching with the cultivation of students' innovation ability, and gives full play to the role of project-based teaching. The design of the model is completed through the construction of project environment, project activities and project objectives, highlighting the role of students’ subjectivity. However, there is no elaboration in the practical research and lack of practical data. Therefore, it is necessary to further implement the model research into practice and analyze the practical effect so as to continuously promote the optimization of the model. I hope that the practice can be put into practice in the future research, and the model can be concretized to reflect the characteristics of different learning periods. In order to promote the cultivation of students’ innovative ability in this mode of research.

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