A Case Study of Integrated Practice Activities in Primary Schools for STEAM Education

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ABSTRACT: Through the comprehensive application of knowledge in various disciplines, STEAM education allows students to learn based projects via in a situation, which promotes stimulating students' interest in inquiry, improving application awareness and practical ability. Based on the concept of STEAM education, the project "Lantern Fish" was an example to explore the implementation and challenges of applying STEAM education to comprehensive practice activities in primary schools.

KEY WORDS:STEAM education; Comprehensive Practice; Practical ability

INTRODUCTION

In the times driven by innovation, the ability of active exploration and practice has become the key ability of students' life-long development. STEAM education, which originated in the United States in the second half of the 20th century, has gone through several development stages of STS-STEM-STEAM, and has become a fusion of Science, Technology, Engineering, Arts and Mathematics. STEAM education focus on real-world problems and teaches students to solve engineering problems as the main axis,which promotes cultivating innovative talents with all-round development. There are a few cases and researches on STEAM education worldwide, which is in its initial stages,mainly focusing on comprehensive practical activity courses and general technical courses. With the practice of H Primary School in Shenzhen of Guangdong province, this article aims to explore the steps of applying STEAM education to primary school classrooms, and to provide some references for the localization of STEAM education.

1. Design of comprehensive practice activities in primary schools for STEAM education

1.1 Student Analysis

STEAM education promotes coherent and progressive learning in the way that students explore real situational problems. Students in the first grade have a strong curiosity about the novel things in life. It is an important stage to establish abstract concepts initially, enhance the ability of logical thinking. Teachers should choose the dailylife phenomenon that students are interested in as a start, lead students to participate in the exploration of the internal relationship and laws of specific things, and exercise students' independent exploration ability and operation ability.

1.2 Content selection

Comprehensive practice is an interdisciplinary practical course that starts from students' real life and development needs, finds problems in life situations, and transforms them into activity themes. It cultivates students' comprehensive quality by means of inquiry, service, production and experience.Based on the characteristics of development of pupils□In this lesson, Hemigrammusocellifer, a beautiful fish which is also called “lantern fish” with various colors with the help of circular light emitters in the deep sea, is chosen to be a learning carrier for comprehensive practical activities to promote the ability of problem-solving and creative materialization .The Lantern fish is attractive to the first grade students, which can arouse students' curiosity about the "lantern" on the fish. Speaking of knowledge, the principle of lantern fish lighting and the structure of the "manipulator" for prey contain mathematical and scientific knowledge. The shape of lantern fish is relatively simple and suitable for students to make, and its bright colors are for students' artistic creation, and aesthetic expression provides a lot of space.

1.3 Target design

Considering about the integral idea of STEAM,the teaching objectives of this lesson are shown in Figure 1.

2 Teaching implementation

The instruction modes of STEAM education in China are concluded as 4 types, containing of inquiry teaching,verification teaching, manufacturing teaching and creative teaching□which this lesson belongs to. The whole class was organized by making "Lantern fish-Manipulator" as a clue,deviding as 5 parts: including activities, planning scheme, activity exploration, work making, communication and summary, etc. (Figure 2).

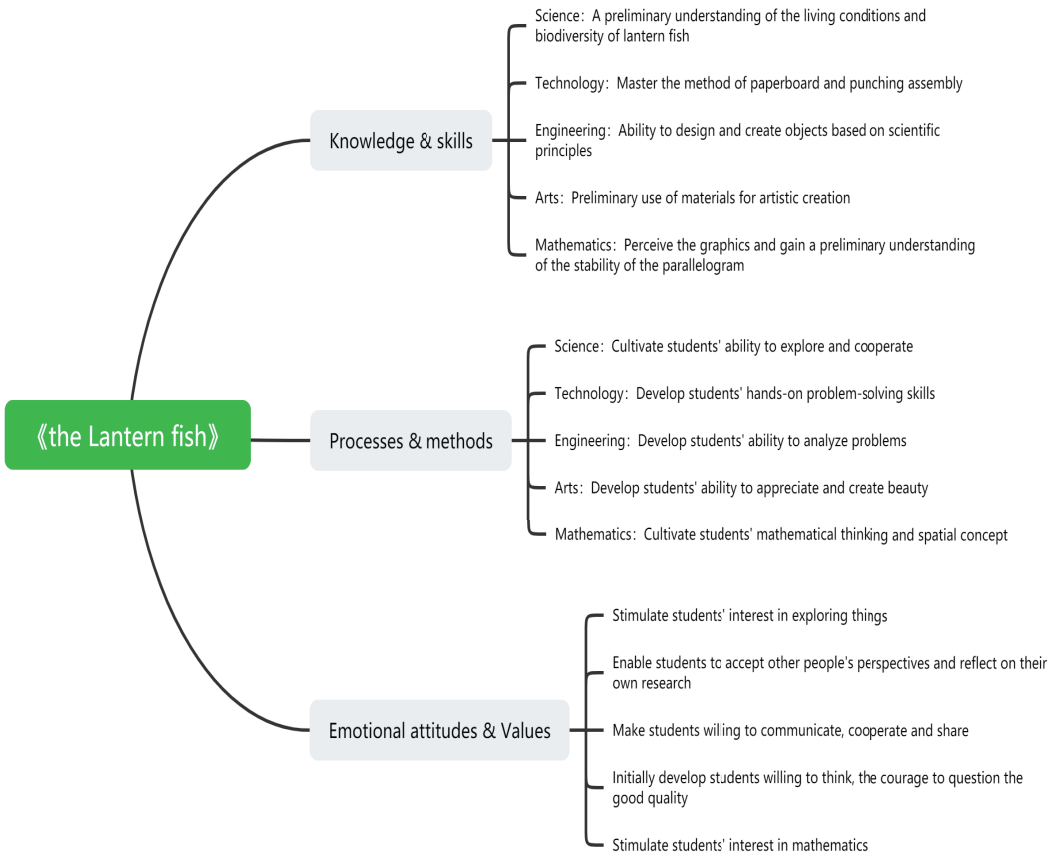

Figure 1 "Lantern fish" overall goal design

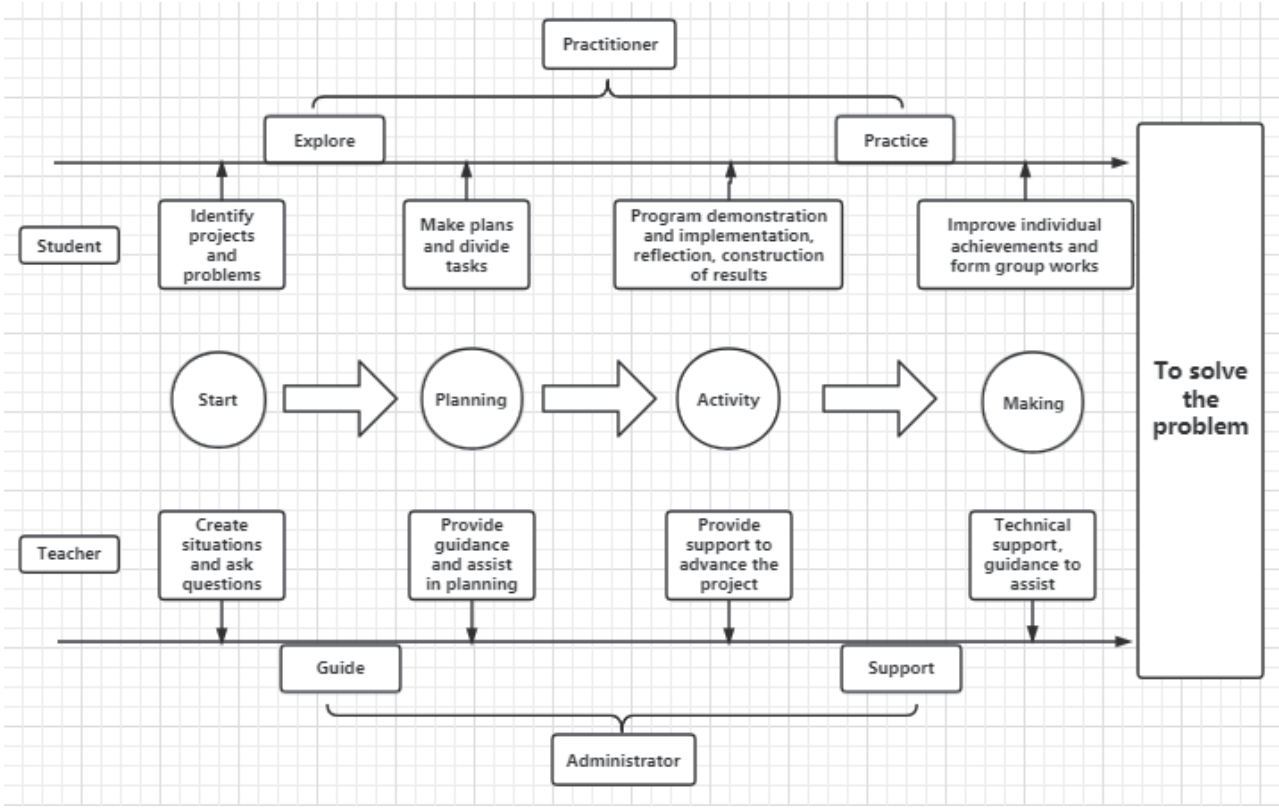

Figure 2 "Lantern fish" practice teaching process

2.1 Leading into the project

Creative transdisciplinary teaching in STEAM education relies on design, collaboration, and contextualized learning.At first, the teacher presented the living environment and habits of "lantern fish" with multimedia means, aroused students' interest in learning, and introduced the learning carrier of this lesson -- "lantern fish". The teacher then posed a question: Can we make a simulation of the lantern fish to take it home for parents to have a look?

2.2 Planning scheme

After the students had determined the main direction of the lesson, the teacher grouped the classmates according to the principle of "homogeneity between groups, heterogeneity within groups" and helped to confirm the goal and made detailed plans.Teachers are no longer the leader of courses, but the leader, organizer and cooperator of project learning. At the same time, students are no longer passive learners, but actively participating researchers, planners and experiencers.

2.3 Exploring

Firstly, students were required to look carefully at a video of lantern fishes' hunting to perceive the movement process of lantern fish predation through body contraction intuitively. Secondly, the teacher presented the simplified three dimensional structure and the structure of the "manipulator" from the image of the lantern fish. Students could see how the manipulator moved from which under the affect of the principle of lever. In the process of display, students knew about the "parallelogram instability" with the find that the shape of manipulator changed when the teacher force on its sides preliminary.

2.4 Making

With the step-by-step drawing guidance , students designed the specific image of the lantern fish using the materials provided by teachers (cardboard, tools, etc.), and determined the best plan through group discussion. The process was of knowledge transformation, and the stitching, combination and rotation of graphics. The design scheme in the group should not only practical but also beautiful. In the production process, considering the age, the weak ability on practice of the students and other reasons, the assistant teachers and parents volunteers joined to assist.

2.5 Summarizing

The integration of STEAM education allowed for exhibiting learners' understanding through various activities and in explanatory, persuasive, and imaginative manners. After the completion of the production of "lantern fish-Manipulator", each group displayed their works to the class. They explained the practicality and artistry of the works and exchanged and share their experiences with other teams.Evaluation was the last part of the activity. Students, teachers, teaching assistants and parents analyzed the activities from different perspectives. After the communication, students opened the class tickets and reviewed the learning process of the day by "painting stars", such as "Did you feel happy today? "Did you find it difficult?" And so on, improving students' summary ability. The teacher talked about the advantages and disadvantages of the design works of each group, which could lead and improve students' thinking.

3. Challenges and countermeasures of STEAM Education for primary school comprehensive practice activities

3.1 Challenges

3.1.1 The rationality of project design

In the process of designing a project, we should pay attention to rationality and science. In the project of"lantern fish", there was no systematic teaching material for reference. Instead, the teachers chose the content himself firstly, and then the group reviewed the content together. In the"lantern fish" case,it was hard to balance the difficulty of knowledge between "the instability of parallelogram" from perspective of mathematics discipline and the "lever principle" in mechanics from the perspective of science. In addition, in order to make stimulative lantern fish with manipulator, the students of first grades of primary school must understand the rules of mechanism,which is extremely difficult for the lower grade students in primary school.

3.1.2 Generative issues of activity development

Practical activities should be linked, point to the conversion of knowledge and experience, and promote interaction between knowledge and emotion on the basis of clear goals and clear clues. At present, due to the characteristics of students' age and the influence of traditional teaching inertia, students are still more accustomed to play the role of followers, waiting for teachers' instructions to complete the task even were told the corresponding knowledge points, which weaken the collision of thinking and independent expression.This problem has been confirmed by other studies. Studies have found that in the whole STEAM class, lower grade students lack of active exploration of the environment and projects they are in, and follow the ideas of teachers to learn.This suggests that we should pay more attention to the

guidance of students.

3.1.3 The appropriateness of teaching evaluation

In this class, students only answered superficial questions like "Were you happy? "Did you find it difficult?" . Evaluation conducted by teachers was through classroom observation, which lacks scientific standards, and the reliability and validity of evaluation results are not high were not tested before, so it was less befit to carry out further improvement and perfection.

3.2 Improvement strategies

3.2.1 Developing STEAM education systematically

Before we launch STEAM education, it is necessary to design and develop specific course content, determine the project theme, and then design the activity context and driving questions after comprehensive consideration.Besides,formative evaluation, grading evaluation and self-evaluation ba students themselves are emphasized by a empirical study abroad.

3.2.2 Strengthening the construction of curriculum environment and learning resources

STEAM education abroad provides supports through the virtual environment, such as the WISE scientific inquiry platform and the MUVE-based science project "River City" developed by the American scholar Chris Derby in middle school. The school can set up a resource library online, including teaching plans of various subjects, excellent lesson examples, textbook content, exercises and excellent STEAM education lessons in the domestic and overseas. The teachers of the school can carry out the transformation, and realize the socialization of course resources and the curriculum of social resources.

3.2.3 Focusing on teacher training and interdisciplinary research

Teacher training is a common problem for STEAM education at home and abroad.The survey of mathematics teachers in Brazil and Spain shows that, although teachers are already aware of the importance of STEAM education, the lack of relevant training makes it difficult to successfully organize STEAM teaching. The knowledge category of STEAM teachers is interdisciplinary, the source of knowledge is practical and the formation of knowledge is integrated. Schools should focus more on teacher training, promote problem-solving teacher learning community, so as to reduce the extra learning energy of teachers and promote the transformation of subject-based teachers to integrated teachers.

In a word, the reform of integrated practice activities in primary schools for STEAM education cannot simply be the adding of "science + technology + engineering + art + mathematics". The value of STEAM education lies in its exposure to the real world, exposing students to an open environment and developing critical skills that can adapt to changing times and lifelong development while solving problems and challenges.

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