

A Study of Problem-solving Skills Development Model for Junior High School Students under C-STEAM Concept

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Abstract. C-STEAM education is a traditional culture-led STEAM education, which is a much-needed task for the talent cultivation mechanism in the current information-based society and is of great significance for cultivating cultural confidence and increasing national identity. This paper integrates C-STEAM education with problem solving for junior high school students based on the IT curriculum, changing the existing talent training model, realizing students' problem identification, experiencing the problem-solving process through collaboration and then completing the construction of knowledge, and providing support for complex learning, as well as providing experience that can be applied to the implementation of C-STEAM education in the classroom.

Keywords: C-STEAM concept, problem solving for junior high school students, classroom teaching, training model

1 INTRODUCTION

In the 21st century, science and technology are constantly changing and social problems are becoming more and more integrated, and single subject knowledge is no longer able to solve complex real-world problems, which forces school education to reform from test-based education, which simply transmits subject knowledge, to quality education, which cultivates students' core literacy [[1]]. Collaborative problem-solving skills as one of the new teaching methods to enhance the overall quality of individuals, combined with STEAM education's emphasis on interdisciplinary culture, cultivating students' creative thinking and innovative practical skills, and exploring the elements and background of China's local culture, can study a composite talent training model suitable for China's future development.

However, teaching collaborative group problem solving is currently lagging in the IT classroom-assessment of task outcomes makes it difficult to effectively assess students' cooperative behavior in a collaborative setting. Therefore, the purpose of this paper is to combine the current situation of Chinese IT education with the actual background of local traditional culture. Based on the model of developing secondary school students' problem-solving ability, teachers can provide effective guidance and fully demonstrate their "scaffolding" ability so that students can complete the construction of knowledge in the process of discovering and solving problems; by fully integrating the C-STEAM educational concept and problem-solving ability

in the context of cultural heritage, an applied educational model can be created to improve secondary school students' problem-solving ability.

2 ANALYSIS OF THE FIT BETWEEN C-STEAM EDUCATION AND PROBLEM-SOLVING SKILLS DEVELOPMENT OF JUNIOR HIGH SCHOOL STUDENTS

2.1 Integration of academic disciplines enhances the value of education

C-STEAM emphasizes the intrinsic integration of multidisciplinary knowledge and ways of thinking under the orientation of cultural heritage, as well as the experience of activities and systematic modeling rich in cultural contexts, and is an active attempt to develop the localization of STEAM education [[2]]. On the one hand, according to cognitive development theory, useful and authentic middle school IT projects can be created based on collaboration, which is applicable to students at the middle school level [[3]]. On the other hand, C-STEAM, as an interdisciplinary learning approach that adds cultural values to the concept, fits with the concept of future social development, and the integration of the two has unique advantages for developing problem solving skills of middle school students, which can be considered as an important way to pass on culture and cultivate talents.

2.2 Various teaching methods to strengthen the cultivation of literacy

In Liu X.Q.'s analysis on the development trend and research hotspots of domestic C-STEAM education in the context of cultural inheritance [[4]], C-STEAM education research hotspots are divided into five types. Relying on the development trend of C-STEAM education combined with project-based teaching, this paper proposes the design of an IT course teaching model for problem-solving ability development of junior high school students.

The acquisition of problem-solving skills depends on problem-solving scenarios, which require students to apply interdisciplinary knowledge and skills in concrete real-life situations and complete tasks through division of labor and cooperation. This teamwork is also conducive to fostering trust and tolerance among members, mutual promotion and respect, in line with the current requirements for talent quality in the new era [[5]]. At the same time, C-STEAM teaching meets the environmental needs, activity design, and evaluation support for problem-solving skills development.

2.3 Educational practices promote cultural dissemination

Traditional culture, as the root of the nation, contains immeasurable emotional values, aesthetic customs, and unique ways of thinking [[6]]. In the education process of traditional culture, teachers need to recognize the importance of a multifaceted social call to action, and a good social atmosphere to promote its dissemination in a new way [[7]]. Teachers should pay attention to the infiltration of traditional culture in relevant themes and contents, give new connotations to traditional culture, create richer forms of cultural expression, and let students be practicing transmitters of traditional culture in their exploration.

3 DESIGN AND TEACHING CASE OF PROBLEM-SOLVING TEACHING MODEL UNDER C-STEAM CONCEPT

3.1 C-STEAM concept in the design of the teaching model of information technology courses

Under the C-STEAM education concept, the teaching process designed based on constructivist learning theory, contextual learning theory and multiple intelligences theory has the following five components. Each segment will exercise students' problem-solving skills to some extent. The details are shown in Figure 1:

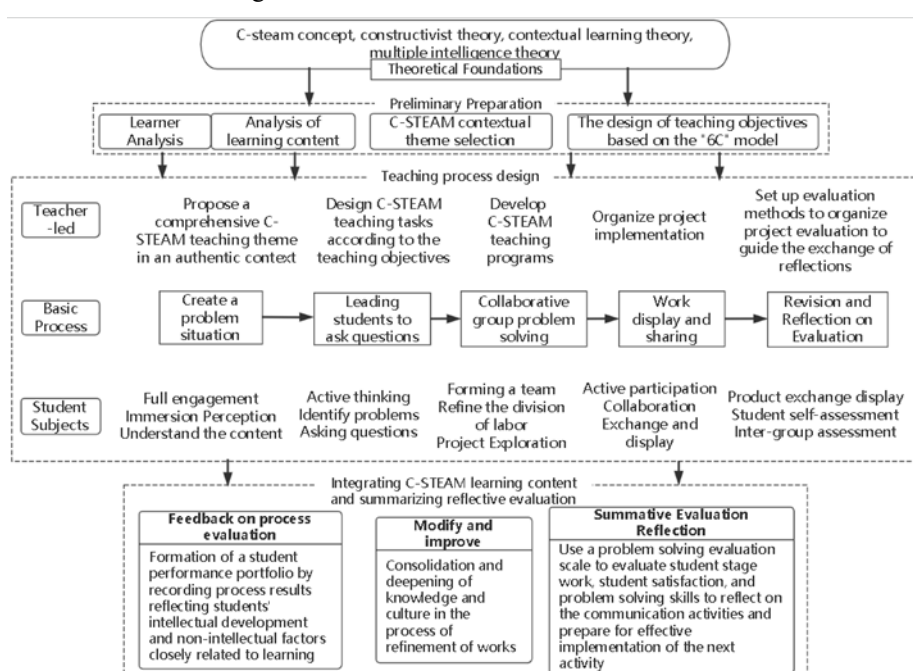


Fig. 1. Problem solving training model under C-STEAM concept

- (1) Create authentic problem situations. The teacher presents a comprehensive C-STEAM teaching theme in an authentic context as the beginning of problem identification, corresponding to the perception stage of problem solving.
- (2) Guiding students to ask questions. Problem design based on the C-STEAM concept is the core part. As a "scaffold", the teacher should propose quality problems at the beginning of problem design that can give students clear direction in their thinking, and guide them to take the initiative to identify problems, which corresponding to the representation and modeling stage of problem solving.
- (3) Group work to solve problems. In this process, teachers need to guide students to refine the division of tasks, work specifically to individuals, and to use "light-weight" "groups" for different types of tasks, negotiated in groups of 2-3 people. The use of "lightweight" "teams"

minimizes the risk that each individual will not be able to perform to the best of his or her ability due to the large number of team members [[8]]. This corresponds to the planning and execution phases of problem-solving.

(4) Work presentation sharing and exchange. Students complete the implementation of the project under the guidance of the teacher and share and present their works, corresponding to the experience stage of problem solving.

(5) Revise and improve the evaluation reflections. Adopt a combination of student self-assessment, intergroup assessment, and teacher assessment, corresponding to the critical phase of problem solving.

Among them, the process evaluation feedback is done by recording the process results reflecting students' intellectual development, and by paying attention to the non-intellectual factors closely related to learning, completing the modification and improvement of the work, thus integrating the knowledge system and forming a schematization of knowledge. Students discover new problems in this reflection process, continue to revise and improve on the basis of their practice, and enter a new round of learning activities.

3.2 Teaching examples of developing problem-solving skills under the C-STEAM concept

Based on the above analysis, this paper chooses Shenyang Station, a landmark with regional characteristics in Shenyang, as the contextual theme of C-STEAM for design. Since making a promotional video of Shenyang Station is an open task, the design idea of this learning activity is not unique, and Students can take a different perspective, either from historical changes, or from the scale of the building, or from the geographical location, or from the construction achievements, or from the value and significance, etc., to find the best solution to the problem. By taking a collaborative approach with group team members, not only can we target and develop students' problem-solving skills, the content design of this lesson example also incorporates the knowledge of culture, science, technology, engineering, art, and mathematics in C-STEAM elements. The five major components of the teaching process are as follows:

(1) In the “Creating a Problem Situation” session, the teacher proposes a comprehensive C-STEAM teaching theme in a real situation, and introduces the content of this lesson by showing students a micro-video and taking them through the historical and cultural background of Shenyang Station. At this point, students are fully engaged, immersed in perception and understanding.

(2) In the session of “Guiding students to ask questions”, the teacher provides students with an open perspective at the starting point of the question design, through “What are the architectural features and principles of Shenyang Station as a modern work of architectural art? What are the cultural concepts in it? What are the historical factors that led to its several expansions and changes? Why does Shenyang Station have such a great value?” and other questions, the students are guided to think actively and find a certain question as the entry point for the design of the work through analysis, and determine the steps and methods of making the promotional video.

(3) In the “group problem solving” session, the teacher presents the task: work in groups to produce a promotional video for Shenyang Station, requiring the work to reflect the concept of

local culture, collecting materials first and then producing the work. The focus of this session falls on the detailed division of labor in the group. Each group in turn determines the person who collects the materials, makes the video, describes the work, and records the process. This session is an important means to realize students' hands-on, innovative practice.

(4) In the session of “Work Presentation, Sharing and Communication”, In the "Work Presentation, Sharing and Communication" session, each group presents their results according to their design ideas, describes the process of collaborating and helping each other to complete the task design, and discusses and shares with other groups to gain experience in problem solving. This process can exercise students' expression and communication skills.

(5) In the “Revision and Refinement Evaluation and Reflection” session, each group reflected on the problems they encountered in the production of the promotional video, provided ideas for solving them, and consolidated and deepened their knowledge and culture in the process of improving their work. This session helps students develop the ability to monitor and reflect on their work.

4 EVALUTATION SYSTEM OF PROBLEM-SOLVING ABILITY UNDER THE CONCEPT OF C-STEAM EDUCATION

4.1 Focus on the invisible learning outcomes of process evaluation

The assessment component is an effective means of testing the effectiveness of learning and is essential for measuring the effectiveness of learning activities. Traditional IT teachers use summative assessments that focus only on knowledge to test students' knowledge mastery and achievement of standards, which cannot reflect students' learning in a comprehensive way [[9]]. Evaluation based on the C-STEAM education concept should focus on the implicit learning outcomes such as students' learning attitudes, participation, motivation, and task completion in the process of problem solving, while paying attention to the explicit outcomes such as final works.

4.2 Diversification of evaluation methods and subjects

A single instructional assessment may lead to a lack of student motivation, and adopting a variety of assessment methods can help motivate and sustain students' interest in the IT classroom. Therefore, this paper refers to the STEAM collaborative problem-solving assessment framework developed by Danielle's team in analyzing seven schools with STEAM courses [[10]] for process evaluation. A variety of evaluation methods and multiple evaluation subjects are adopted to consolidate and deepen the knowledge and culture in the improvement of the work.

5 CONCLUSION

As a practical course, the junior high school IT classroom should pay attention to the application and transfer of theoretical knowledge, and ultimately improve students' problem-solving

ability so that they can become complex talents for future social development. the cultivation of collaborative problem-solving ability under the C-STEAM concept is an important part of the IT classroom, and traditional culture must permeate the teaching of the subject and become an important vehicle for cultural inheritance. Therefore, the teaching model proposed in this paper has positive significance for the promotion of China's traditional culture, which allows students as a group to become practicing transmitters of traditional culture in their exploration, while cultivating new talents that conform to the development of the times and promote cultural confidence and national identity.

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