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Research on STEM Teaching Mode in Nanchong from the Perspective of Deep Learning

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Abstract

STEM education solves real problems with interdisciplinary thinking and focuses on reflective transfer, making deep learning possible. This paper summarizes the characteristics of STEM education and analyzes the relationship between STEM education and deep learning. According to the difficulties of STEM education in Nanchong city, this paper combines the characteristics of STEM education and its internal relationship with deep learning from the perspective of deep learning. Taking the implementation process of STEM education as the abscissa and the occurrence route of deep learning as the ordinate, this paper constructs the framework of STEM teaching model from the perspective of deep learning, and explains the constituent elements and implementation process of STEM teaching, which provides a useful reference for the integration and development of deep learning and STEM education in Nanchong city.

Keywords

STEM education, deep learning, STEM teaching mode.

1. Introduction

STEM education is an interdisciplinary education that breaks the traditional single subject learning, emphasizes the comprehensive application of science, technology, engineering, mathematics and other disciplines, and pays attention to the common development of knowledge and ability. It is a new path of talent training. In 2018, the "China STEM Education 2029 Innovative Action Plan" issued by the China Academy of Educational Sciences pointed out that STEM education is of great significance to a country's international competitiveness, economic development level and national quality. The scientific STEM education model helps to cultivate students' innovative thinking and scientific inquiry ability.

In the process of STEM teaching, if students only memorize knowledge mechanically and carry out operation training step by step, they are easy to fall into the dilemma of doing nothing and ignoring the process of students' learning and acquisition. STEM education can't really play its advantages and roles in cultivating talents in the new era. STEM education should be aimed at deep learning. Deep learning focuses on students 'learning to learn' and 'effective learning', emphasizing that students integrate knowledge on the basis of understanding and improve the application and transfer ability of knowledge. Using deep learning theory to guide the design and implementation of STEM teaching mode is conducive to giving full play to the value of STEM education and promoting the sustainable development of STEM education. Based on the actual situation of education in Nanchong city, this study constructs a STEM teaching model from the perspective of deep learning to help students develop good deep learning habits and cultivate high-order thinking ability and innovation ability.

2. The characteristics of STEM education and its relationship with deep learning

(1) Characteristics of STEM education

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STEM education is to cultivate students' practical ability and problem-solving ability through the design of learning activities in complex learning situations. STEM education is based on constructivism learning theory, Dewey's pragmatism and Bruner's discovery learning theory. It consists of situation, content, activity and result. STEM education has the core characteristics of real situation, interdisciplinary integration, project-based learning and evaluation transfer, which provides support for students to carry out deep cognitive learning.

Real situation: the real situation with non-predictive and non-fragmented knowledge fragments, can stimulate students' interest in learning, three-dimensional display of knowledge background, so that students have a sense of immersion and immersion.

Interdisciplinary integration: STEM education breaks through the barriers between disciplines and solves problems with the concept of integration. When constructing an interdisciplinary knowledge system, different cognitive regions of the student's brain are activated, and subject knowledge is continuously understood, applied, and transferred.

Project-based learning: In the process of project-based learning, students use interdisciplinary knowledge in combination with their original cognition, and truly link textbook knowledge with real-life problems.

Evaluation transfer: using formative evaluation and process evaluation, students evaluate the project-based learning process and learning effect, and teachers adjust according to the evaluation results to provide reference for the design of subsequent project-based activities.

(2) The relationship between STEM education and deep learning

Deep learning is a high-input learning process that pursues knowledge application and transfer, focusing on cultivating students ' innovative thinking and inquiry ability. STEM education and deep learning have the following internal relations:

The immersion of real situation is easier to stimulate students' interest and deep learning motivation. With experiential learning and immersive learning, students can focus on the internal relationship between broader background information and materials, thus stimulating deep learning.

The integration of interdisciplinary knowledge helps students use different subject knowledge, interact with teachers and learning peers, brainstorm and reflect on themselves, and it is easier to understand the knowledge points thoroughly.

Project-based learning broadens students' thinking, promotes the collision of different students' thinking in communication, and provides support for the construction and development of knowledge system.

Evaluate migration and achieve deep learning. Rethinking through evaluation, promote students to question the original cognition, adjust the perspective of thinking problems, and optimize the strategy of solving problems.

3. Difficulties of STEM education in Nanchong from the perspective of deep learning

(1) Lack of multidisciplinary integration, planarization of STEM education

First, the integration of disciplines lack of substantive. At present, there is a misunderstanding of the integration of STEM disciplines. At present, it is only a superficial "patchwork" integration, rather than a substantive "seamless" integration. Because students do not grasp the specific subject knowledge structure, it is difficult to establish a substantive connection between multiple disciplines. It is difficult for students to sort out the knowledge framework of the internal logical relationship of multiple disciplines, and it is impossible to truly form an organic whole. Secondly, the integration of disciplines lacks extensibility. At present, in the process of carrying out multidisciplinary integration of STEM education in Nanchong city, students lack

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attention to the internal relationship between knowledge, and it is difficult to transfer the knowledge they have learned to new situations. The knowledge they have learned cannot be transformed into their own skills, and their thinking of solving problems will be limited, so they cannot analyze and explore problems from a larger perspective.

(2) Lack of scientific problem, formalization of STEM education

First, the design of the problem is not realistic enough. Due to the lack of intuitive perception of real needs in life, it is difficult for students to associate the process of inquiry with their own experience, interest in learning and knowledge reserves, which makes it difficult to guide students to establish a link between what they have learned and the real environment, nor to achieve the principles of STEM education that are practical and close to life. Second, the design of the problem is not comprehensive enough. The development of deep learning originates from the exploration of unknown things. It is guided by solving complex problems and emphasizes the integration of students' understanding learning and multi-dimensional knowledge content. However, most of the problems in the current teaching process are characterized by simplification and do not reflect comprehensiveness.

(3) Lack of inquiry in learning process, superficial STEM education

Deep learning emphasizes the continuous exploration of complex phenomena contained in social dynamic situations, pursues the personal experience of the learning process, and attaches importance to the cultivation of subject thinking ability. It is very important for students to master learning methods and learn to think. They not only need to have the learning quality of daring to practice and innovate and the critical inquiry consciousness, but also need to have the ability to use advanced thinking skills to carry out deep learning. However, in the current STEM teaching process, teachers do not further guide students to transform the knowledge into their own skills, which leads to the superficiality of STEM education.

4. Constructing STEM education teaching mode in Nanchong from the perspective of deep learning

(1) Nanchong STEM teaching model framework from the perspective of deep learning

In order to promote the occurrence of students' deep learning in the process of problem solving, this study is guided by situational cognition, constructivism and other theories. Starting from the reality of STEM education in Nanchong city, through teacher guidance, student experience, group inquiry, etc., combined with the implementation process of STEM education and the occurrence route of deep learning, the STEM teaching model in Nanchong city from the perspective of deep learning is constructed, as shown in Figure 1.

The STEM teaching model in Nanchong from the perspective of deep learning takes the implementation process of STEM education as the abscissa and the occurrence route of deep learning as the ordinate, aiming to realize deep learning with the support of STEM education. The implementation of the STEM teaching model from the perspective of deep learning is divided into four stages: preheating, brewing, occurrence and maturity. The development of each stage conforms to the implementation process of STEM teaching and the occurrence route of deep learning, from shallow to deep until the completion of evaluation, and finally promotes the occurrence of deep learning.

(2) Elements design of STEM teaching mode in Nanchong from the perspective of deep learning

Learning objectives: STEM teaching from the perspective of deep learning not only pays attention to the construction and transfer of knowledge, but also pays attention to the cultivation of students' deep learning ability. On the one hand, it supports students to construct STEM knowledge system under the guidance of promoting the effectiveness of learning. Students pay attention to the developmental construction of knowledge in the learning process,

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realize the effect of deep learning, construct STEM basic knowledge on the basis of understanding, and effectively use basic knowledge to solve practical problems in life. On the other hand, guided by the cultivation of students' thinking ability, it promotes the development of students' deep learning ability. Deep learning ability is a kind of higher-order thinking, which occurs in higher cognitive level of mental activity or higher level of cognitive ability. Deep learning ability is the key to realize the application of students' knowledge transfer, and it is also an important standard to judge whether the STEM education goal is achieved or not from the perspective of deep learning.

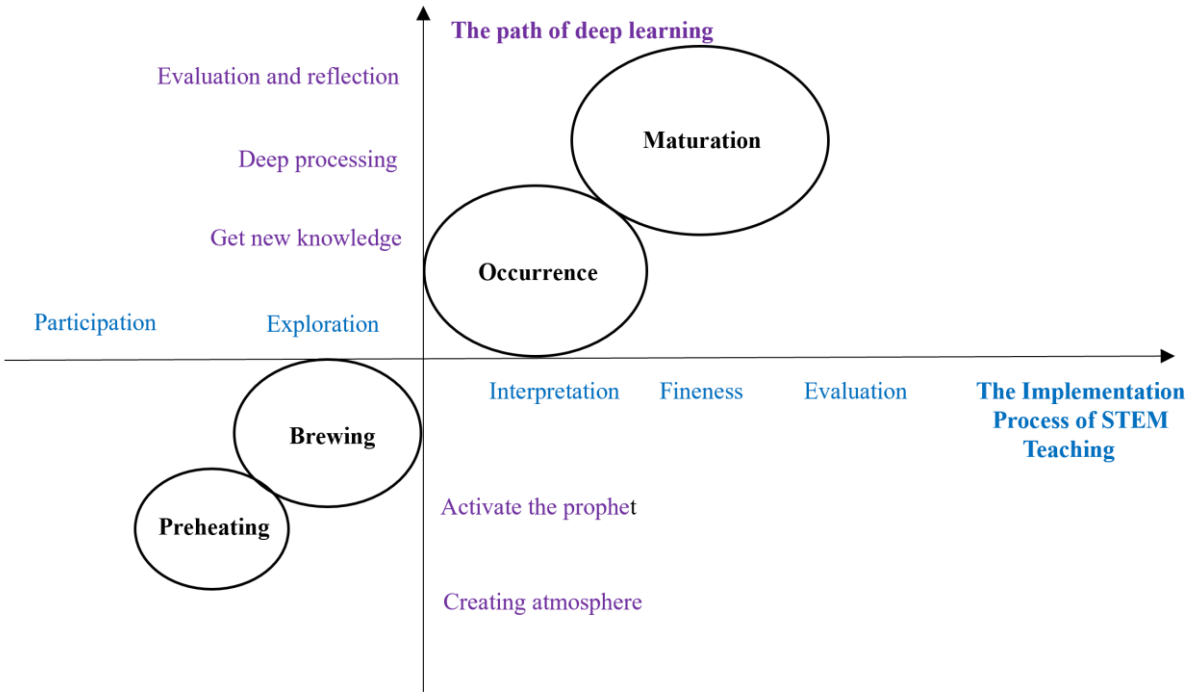

Figure 1: Nanchong STEM teaching model framework from the perspective of deep learning

Learning environment: Learning environment is a dynamic combination of learning resources and interpersonal relationships, which has both rich learning resources and interpersonal interaction factors. The school should create a suitable learning space for students, create a good interactive interpersonal atmosphere, provide sufficient learning resources, and support them with technical tools to build a learning community for STEM learning. With a good learning environment to stimulate students' motivation to learn, to help students diverge thinking, linking the original knowledge points to support students for data analysis, knowledge construction, reflection and criticism, critical evaluation of the learning process, to further consolidate the learning content.

Learning content: the design of school STEM curriculum content should meet the needs of students' deep learning. First, it should combine students' knowledge and ability foundation, second, it should consider students' interest in learning, and third, it should consider the feasibility of the implementation of the curriculum content. On this basis, design projects that meet the development of students' personality. STEM education is a comprehensive education with multidisciplinary integration. The design of curriculum content can link previously independent knowledge, lay a foundation for students to better learn new knowledge, master and understand the core content of STEM, promote students' deeper understanding of learning content, carry out meaningful knowledge construction, and cultivate students ' higher-order thinking ability.

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Learning evaluation: STEM teaching focuses on evaluating students' performance in learning activities. Deep learning emphasizes students' autonomy, high input, high participation and high quality in the learning process. Therefore, the evaluation of STEM education and teaching under the guidance of deep learning theory should evaluate students' learning process and learning results, and evaluate students' learning motivation, participation, input and learning quality. Deep learning results include the mastery of knowledge, problem solving, thinking complexity, and evaluation of project works.

(3) The implementation process of STEM teaching mode in Nanchong from the perspective of deep learning

Preheating stage: Creating a positive cultural atmosphere is the main task of the deep learning preheating stage, including: First, clarify the theme. The selected research topic cannot be a single fixed textbook knowledge, nor can it be a fictitious problem, but should come from the real problems around the students, so that the theme is more 'authentic' and 'practical'. Merrill pointed out that only when students solve real problems can they effectively promote learning. Second, presenting knowledge. The project theme is disassembled into sub-projects with different difficulties, and then the sub-project content is transformed into operable learning activities, so that students can understand and master the basic knowledge and basic principles of STEM education presented in learning activities. Third, create situations. Teachers will be situational and vivid teaching content in front of students, learning in a relaxed and pleasant atmosphere. The real situation and relaxed atmosphere can make students interested in exploring, students can also maintain a lasting state of deep learning.

Brewing stage: Preparing to activate the original knowledge is the main task of the brewing stage of deep learning, including data collection, autonomous learning, and analytical tasks. Students are divided into groups, and each group has students with different cognitive levels and different cognitive characteristics, which is convenient for mutual learning, learning from each other, finding and analyzing problems from different angles. Each group first collects data related to the project theme, then conducts multidisciplinary independent inquiry, and seeks the help of teachers to decompose the complex project theme into sub-tasks with a single goal, and then analyzes the sub-tasks. At this stage, students first master the principles of knowledge based on the collected data, and then explore autonomous learning through observation and practice. As a result, the original knowledge is activated and connected with the project task, and the students' thinking is opened to form a deep analysis of the task.

The occurrence stage: the occurrence stage is the key stage for the formation of students' deep learning ability. Obtaining new knowledge and deep processing are the main tasks at this stage, including teamwork, displaying products, teacher guidance, and improving products. The members of the group are responsible for different sub-tasks according to their own cognition and expertise. They strengthen communication, sharing and cooperation among members, gradually generate a sense of belonging, stimulate learning potential, and continuously deepen students' understanding of knowledge and tasks until they master the methods and skills to solve problems. Subsequently, the groups work together to complete the learning products and display them, and explain the plan to complete the task and the strategy to solve the problem in the form of a report. In the process of product display, teachers put forward optimization suggestions for products and consciously guide students to think and discuss. In the process of post-improvement of products, students further process knowledge and understand complex problems in depth, and achieve a qualitative leap from 'learning' to 'learning'.

Mature stage: the main task of this stage is to evaluate reflection, including multiple evaluation, self-reflection, expand migration. Multi-evaluation refers to diversified and multi-subject evaluation, including process evaluation, work evaluation, self-evaluation, student mutual evaluation, teacher evaluation, etc. On the one hand, through the diversified evaluation results, students reflect on the problems in the learning process and improve the level of metacognition;

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on the other hand, through reflection, empirical knowledge is formed to promote knowledge transfer. Teachers provide similar problem situations, and students practice repeatedly to further internalize knowledge and expand knowledge system. Students complete a round of learning through 'evaluation-reflection-migration', and their thinking can be iterated layer by layer, and finally achieve deep learning and experience the fun of STEM education.

5. Conclusion

This study constructs a STEM education model from the perspective of deep learning, and on this basis, designs the implementation process of STEM teaching from the perspective of deep learning, aiming to open up a new perspective for the research of STEM education in Nanchong and find a new path for the realization of deep learning. Of course, this model still needs to be combined with specific teaching practice experience to solve the problems of how to grasp the balance between independent thinking and group wisdom in the process of deepening cognition in group cooperation, how to effectively play the leverage role of emotion, and how to cultivate students' objective and realistic, critical and innovative scientific spirit, so as to make STEM education from the perspective of deep learning achieve better results.

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