



Design and Exploration of 5E Project-based Teaching Model for Core Literacy

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Abstract. Nowadays, imparting knowledge is only one of the purposes of teaching activities, but it is more important to cultivate well-rounded and innovative talents that meet the requirements of society through teaching activities. The traditional classroom is often a filler education, which has no obvious effect on the cultivation of students' core literacy, while 5E teaching and project-based teaching can precisely make up for the shortcomings of the traditional classroom and help cultivate students' good literacy and moral character. In order to achieve the teaching goal of cultivating students' core literacy, this study uses literature research method and CiteSpace research tool to analyze the current status of research on core literacy, and integrates 5E teaching and project-based teaching to build a 5E project-based teaching model, which provides new ideas for future teaching activities.

Keywords: core literacy; project-based teaching; 5E teaching; information technology

1 Introduction

Who to train and what kind of people to train is the primary issue of education. Whether it is the proposal of "China's core literacy for student development" in 2016 or the new requirements for teaching in primary and secondary schools under the compulsory education curriculum standards in 2022. [1] In the new curriculum standards, constructing a teaching model that points to core literacy has become a task that teachers need to accomplish. Compared with knowledge-based classroom teaching, the cultivation of core literacy internalizes the goal of teaching into the cultivation of competence, which requires the full play of students' subjective initiative.[2] Therefore, how to cultivate students' core literacy becomes the primary challenge that teachers need to solve. Both project-based teaching and 5E teaching are the opposite of traditional classrooms. They are student-led, with the teacher mainly playing a guiding role and teaching with projects that are close to students' lives. It can attract students' attention well and can develop students' problem-solving ability, creativity, team spirit, etc. To this end, this study will build a 5E project-based teaching model with student-centered, project-based, and teacher-led instruction to develop students' core literacies.

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G. Guan et al. (eds.), *Proceedings of the 2023 3rd International Conference on Education, Information Management and Service Science (EIMSS 2023)*, Atlantis Highlights in Computer Sciences 16, https://doi.org/10.2991/978-94-6463-264-4_44

2 Status of research on core literacy

This study will use the CiteSpace knowledge mapping tool to study core literacy and understand the current status of research, research hotspots and development trend of this topic. The research sample of this paper is mainly from CNKI database, and 2,067 relevant CSSCI journal papers were retrieved in the past five years with the theme of "core literacy". After manually excluding some of the journal papers with low relevance, 600 papers were selected and incorporated into the CiteSpace 6.2.R4 software for knowledge mapping analysis (Figure 1).

With the advancement of curriculum reform, more and more research related to core literacy has been conducted, and experts and scholars have more views and innovations on this field. From the figure, we can see that the high frequency terms of research on "core literacy" are mainly "curriculum standard", "instructional design", "subject teaching", "primary and secondary school", "core literacy" and "core literacy". The high frequency terms of research on "core literacy" are "curriculum standards," "instructional design," "subject teaching," "primary and secondary schools," "artificial intelligence," and "talent development. The research of core literacy is only related to the research of teaching design, and the cultivation of core literacy is also inseparable from the help of artificial intelligence, only in the environment of technology and intelligence to build a new teaching model can better cultivate students' core literacy and cultivate social talents.

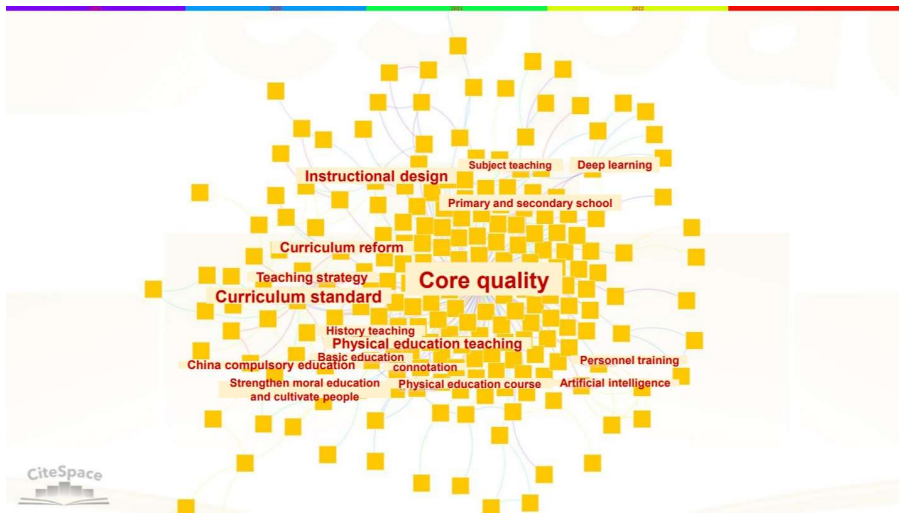


Fig. 1. Keyword Knowledge Graph

3 Comparing the traditional classroom and the 5E project-based teaching classroom

3.1 Characteristics of the traditional classroom in developing students' core literacy

A traditional classroom is a classroom where the teacher is the dominant force in teaching students in a fill-in-the-blank manner. One advantage of such a teaching method is that it can impart more knowledge points to students in a certain period of time, but there are limitations to fill-in-the-blank education in terms of developing students' core literacy. First, it is difficult to develop students' core literacy in a teacher-centered classroom. Students are in a passive position, and such teaching activities make students' learning state negative, blind and chaotic, and students have no passion for learning and no clear goal in the classroom. And the cultivation of core literacy needs to be built up by students through practical inquiry and teamwork. Second, there is a single method and mode of teaching implementation. The construction of core literacy cannot be separated from diverse teaching methods, and the traditional classroom is mainly based on the lecture method, which is relatively single.^[3] Specific teaching methods can only cultivate students' abilities from a certain aspect, such as the experimental method which is more about cultivating students' hands-on ability and observation ability. Therefore, the traditional classroom should incorporate diverse teaching methods to enhance students' core literacy from multiple dimensions. Third, teaching evaluation lacks developmental evaluation. An evaluation that focuses only on the final results can make teachers, parents, and students for the score theory. Therefore, enriching teaching activities is the primary task and establishing developmental assessment is the key. To judge students' achievement of core literacy, the traditional assessment model should be completely changed based on the four dimensions of core literacy, and diverse assessment methods such as daily learning assessment, classroom Q&A, self-assessment, and so on should be established.^[3]

3.2 Characteristics of 5E project-based teaching classroom to cultivate students' core literacy

Project-based instruction creates a classroom for students to actively participate, collaborate, and explore and innovate.^[4] 5E instruction is a common teaching method used in science classes in the United States, where each teaching session is conducted with students as the main focus, stimulating students' interest in learning and innovative thinking, emphasizing the learning process, and highlighting the innovation and application of knowledge.^[5] In "The BSCS 5E instructional model and 21st century skills", Bybee highlights the promise of the 5E instructional model in fostering 21st century core literacy for citizens.^[5] The integration of the two has the potential to foster 21st century skills. The BSCS 5E instructional model and 21st century skills" (The BSCS 5E instructional model and 21st century skills) emphasizes that the 5E instructional model is expected to foster 21st century core literacies in citizens.⁵ The integration of the two is very helpful in developing core literacies in students. The project-based instruction

allows students to focus their attention on learning; the practical inquiry guided by the teacher is conducive to the construction of a complete knowledge system; and the group-based instructional sessions are conducive to the development and enhancement of core literacy.

4 Building a 5E project-based teaching model for core literacy

Project-based teaching and learning is a project-based teaching and learning activity that integrates knowledge from multiple disciplines and is complex in order to develop students' ability to solve real-world problems. When carrying out teaching activities, some processes can be tedious, making it difficult to carry out in the primary and secondary school classrooms. 5E teaching is a teaching model with simple and clear teaching links, including five important teaching links, attraction, inquiry, explanation, transfer, and evaluation. The attraction stage generally attracts students to conduct inquiry through experiments, situations, and projects. Therefore, the integration of 5E teaching and project-based teaching can improve the implementation process of project-based teaching, which can develop students' core literacy and enhance their knowledge and skills through real and interesting projects in a limited time. Based on the requirements put forward by the new curriculum and the construction of a teaching model for cultivating students' core literacy, this paper combines two teaching methods and constructs a 5E project-based teaching model with the purpose of cultivating students' core literacy.

4.1 5E project-based teaching model

This paper combines the two teaching methods and constructs a 5E project-based teaching model with students as the center and projects as the main line (Figure 2).

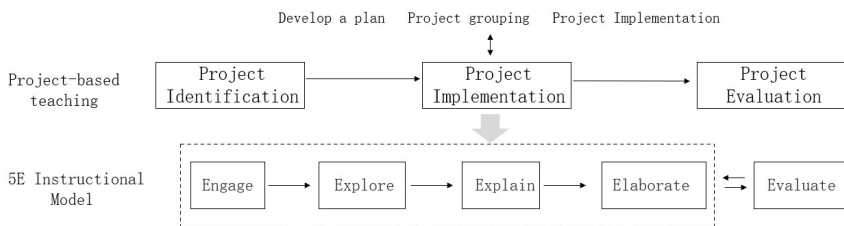


Fig. 2. 5E project-based teaching model

4.2 A 5E project-based teaching model that incorporates core literacy

The cultivation of core literacy has been the goal of education reform close to. Core literacy refers to the essential character and key abilities that students should possess to adapt to the needs of lifelong development and social development.^[6] It is synthesized into six major literacies: humanistic heritage, scientific spirit, learning to learn, healthy

living, responsibility, and practice and innovation.^[7] Since 5E project-based teaching is a dynamic and student-oriented teaching method, each of its teaching sessions is conducive to different aspects of students' core literacies (Figure 3).

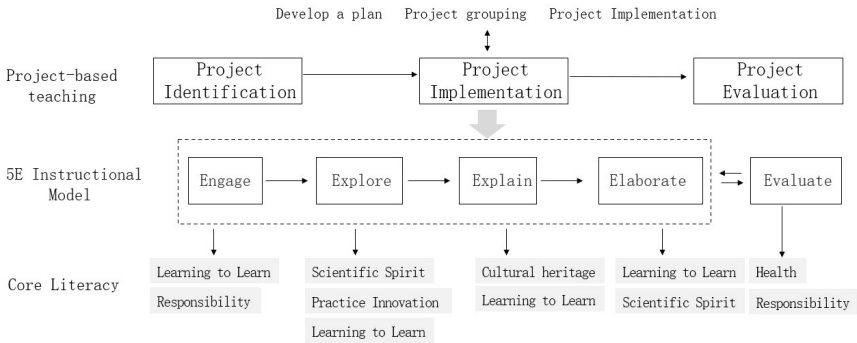


Fig. 3. 5E project-based instructional model incorporating core literacies

5 Implementation of 5E project-based teaching method in IT courses

5.1 Information technology core literacy in 5E project-based teaching and learning

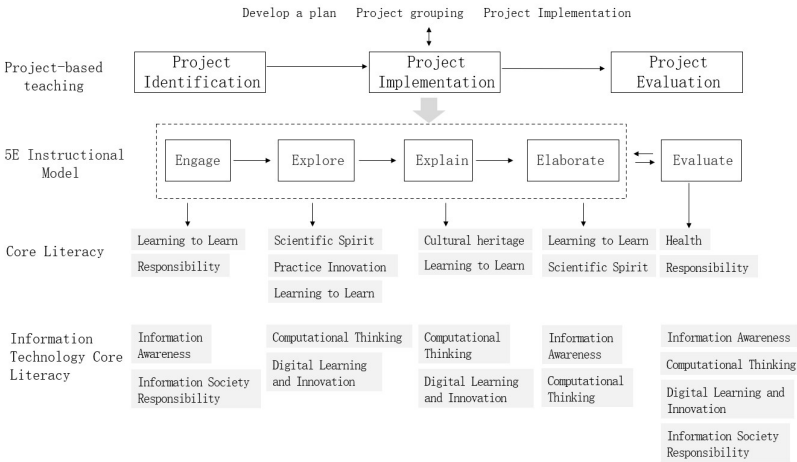


Fig. 4. IT core literacy in 5E project-based teaching

The 5E project teaching method not only develops students' core literacy in subject teaching and learning, but also develops students' subject core literacy in teaching activities. For example, in developing students' IT core literacy among IT courses, each teaching session is conducive to the development of some IT core literacy. In the actual

teaching activities, teachers can adjust the focus and way of core literacy development according to the project and students' situation (Figure 4).

5.2 Teaching process design of "Making a mind map (Table 1)

Table 1. Instructional design

Teaching Activities	Faculty Activities	Student Activities
Engage (Import)	<ul style="list-style-type: none"> ➤ Show several ways to introduce yourself, such as videos, photos, documents, and oral presentations, and ask: What are other ways to introduce yourself? ➤ Show several characteristics of the students in a group and ask: What are the ways to link the characteristics of the students together and show them in a beautiful way? 	<ul style="list-style-type: none"> ➤ Watch the self-presentation shown by the teacher and think about what other ways you can introduce yourself. ➤ Observe the features shown by the teacher and think about how to connect them together.
Explore (Learning New Knowledge)	<ul style="list-style-type: none"> ➤ Ask students to complete their group's overall self-presentation by hand-drawing a mind map. ➤ Observe students' completion status and provide guidance. ➤ Encourage students to show their hand-drawn mind maps and give them praise. 	<ul style="list-style-type: none"> ➤ Students begin to work in groups and complete a group self-presentation as a whole. ➤ Present their group's mind map on stage.
	<ul style="list-style-type: none"> ➤ Ask students to create an electronic version of their group self-presentation using XMind software and embellish it. ➤ Observe students' completion status and provide guidance. 	<ul style="list-style-type: none"> ➤ Students begin to work in groups to explore the use and functions of XMind software. ➤ Start to create an electronic version of the group self-presentation. ➤ Upload them to the learning software when they are finished.
Explain (Knowledge Exchange)	<ul style="list-style-type: none"> ➤ Ask students to come up to the stage to present their group self-presentation mind maps and to introduce themselves as a group. ➤ Ask the group to describe the general use of the software and its powerful features. ➤ After the students' presentations, the teacher makes a brief addition. 	<ul style="list-style-type: none"> ➤ Students present the results of their group work on stage. ➤ Present to the rest of the group the usage and functions that their group has explored. ➤ Listen to the teacher's explanation.

<p>Elaborate (Knowledge Sublimation)</p>	<ul style="list-style-type: none"> ➤ Ask the group to complete the following two tasks: What are the key points and principles of making a mind map? What are the software for making mind maps? ➤ Teacher explains the answers to these two tasks. 	<ul style="list-style-type: none"> ➤ Students complete two tasks with the help of the Internet and textbooks. ➤ Listen to the teacher's explanation.
<p>Evaluate</p>	<ul style="list-style-type: none"> ➤ Observe and evaluate students' performance and learning ability at each teaching session and record them. 	<ul style="list-style-type: none"> ➤ Students complete a self-assessment and group assessment after class.

6 Summary

From the existing theories, practical experiences and related researches, we can see that a student-centered teaching model like 5E project-based teaching is more conducive to the cultivation of students' core literacy. For example, logical thinking, scientific thinking, and innovative thinking are reflected in information technology, physics, and mathematics, and social responsibility is required in all disciplines.^[8] Therefore, although the content of teaching is important for developing students' core literacy, the teaching process also plays a crucial role. In order to effectively cultivate students' ability and accomplishment in class, the 5E project-based teaching model is constructed to promote students' understanding of concepts and construction of scientific knowledge, effectively improve students' information literacy, and improve students' scientific inquiry ability.^{[9][10]} Of course, this model has its limitations, and teachers need to improve and optimize it when teaching in the classroom.

Fund Projects

Chongqing Normal University Basic Education Research Special Educational Reform Project "Research and Development of K12 Artificial Intelligence and Programming Education Curriculum System with 'One Core, Three Steps and Two Platforms'"(Item No.202146)

Reference

1. Yan Hongde. Our educational mission based on "Chinese students' development core literacy"[J]. China New Communication,2020,22(11):187-188.
2. Wang Yan. Project-based teaching strategies of middle school information technology under the concept of core literacy[J]. Middle school curriculum guidance,2022(33):18-20.
3. He Jiahuan. Transforming traditional classroom teaching design and implementing core literacy in high school physics--Interactive classroom teaching design based on "Cosmic Voyage"[C]//Guangdong Education Society. Guangdong education society 2019-2020 academic results collection (III). [Publisher unknown], 2020:153-156. doi:10.26914/c.cnkihy.2020.054940.

4. by Hu Qingfang. *Optimizing classroom teaching: methods and practices*: People's University of China Press, 2014
5. Bybee R W. *The BSCS 5E instructional model and 21st century skills* (J) . Colorado Springs, CO: BSCS, 2009: 21.
6. Opinions of the Ministry of Education on comprehensively deepening curriculum reform to implement the fundamental task of establishing moral education. Ministry of Education of the People's Republic of China [cited 2017-01-09]
7. Lin Chongde. China's student development core literacy: an in-depth answer to the question of "what virtue and what kind of people" [J]. *People's Education*,2016(19):14-16.
8. Liu Xinyan, Mai Jiqing, Liu Enshan. Using the 5E teaching model to develop students' core literacy--a teaching orientation focusing on core literacy in biology [J]. *Journal of Education*,2017(06):48-53.DOI:10.16215/j.cnki.cn44-1371/g4.2017.06.010.
9. Wang Kesheng,Liu Lin.The application of 5E teaching model in high school information technology teaching[J]. *Educational Information Technology*,2019(10):61-64.
10. Zhu Aidong. Exploring project-based teaching strategies of high school information technology under core literacy[J]. *Examination Weekly*,2022(24):23-26.

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