

Research on PCK Theory Based on Core Literacy – A Case Study of High School Physics Teaching

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Abstract: *The core quality of physics in senior high school aims to train students to understand nature from the perspective of physics, understand nature, learn to explore, experience scientific research methods and develop scientific thinking habits. Teachers should have certain means in the leading process. Therefore, under the premise of taking the core literacy of physics as the guidance, this paper, through the content of the basic core literacy of physics, once again studies the teacher's PCK theory of Schulmantift, analyzes the content of the PCK theory and its specific guiding role in teaching, summarizes the basic methods to achieve the core literacy of physics, and summarizes the construction process of the teacher's PCK theory. Eileen Chang was educated in Hong Kong from 1939 to 1941, and her writing mainly started after she dropped out of school. Therefore, Hong Kong can be regarded as the starting point of Eileen Chang's literary creation. She mentioned Hong Kong many times in her works. It's worth examining what characteristics Hong Kong has in Eileen Chang's writing, and what significance the Hong Kong experience had for her life and writing. Sensory experiences were often paid attention to in the urban experience in Chang's works, and the text was full of sound narration. However, relative to the content about vision, hearing has not been systematically valued. Therefore, from the perspective of sound, this article attempts to explore how Eileen Chang used hearing to rebuild her memory and explore the image of Hong Kong in her works.*

Keywords: Core quality of physics discipline; High school physics; PCK theory.

1. INTRODUCTION

High school is the re-education and advancement of students after the completion of nine-year compulsory education. In high school learning, students gradually form their own values. The core quality of discipline is the embodiment of the values of discipline education, and is the process of students forming their own correct values and abilities through discipline learning. The core literacy of physics discipline mainly includes four aspects, namely "physics concept", "scientific thinking", "scientific inquiry" and "scientific attitude and responsibility". The core quality of physics can be regarded as some basic physical qualities that students need to acquire through high school physics learning. In order to make students form such physical quality and have such physical core quality, the key is reflected in the teaching process of teachers. There is a Chinese saying that "to give students a bowl of water, teachers must have a bucket of water first." But if teachers have a bucket of water for a long time, can they really give students a bowl of water? I'm afraid not. We need to consider how to give this cup of water in what form, and what kind of state we can give them. This article discusses how Eileen Chang's works express the soundscape of Hong Kong and the significance of Hong Kong to her creation from the perspective of hearing. Chang's construction of Hong Kong's image took sound and acoustic senses as important media, linking "sound" with "memory". Significant soundscapes can be divided into three categories, including the 'city sounds' of Hong Kong, the sounds of bombing in war, and the incomplete silence. The construction of soundscape implied the author's psychological trauma and historical memory, and the aural experience ultimately fitted the "bleakness" theme of Eileen Chang's creation, reflecting her personal view and understanding of the troubled world and life when she started writing in Hong Kong, a threshold space between civilization and barbarism, where cultures mingle.

As early as the 19th century, Schulman of the United States put forward the PCK theory in response to the requirements of the teacher assessment system at that time. He proposed PCK theory includes "using the integration of professional subject knowledge and pedagogical knowledge to understand how the teaching of a specific unit is organized and presented to adapt to the different interests and abilities of different students". In the later development, Grossman defines PCK as four parts: "Knowledge about the teaching purpose of the subject, students' understanding and misunderstanding of a certain knowledge, curriculum and textbook knowledge, teaching side ratio and presentation knowledge of specific topics [1].

Characteristics of PCK theory: PCK theory is related to subject content. Teacher's PCK theory is the knowledge that teachers process, transform, express and impart their subject knowledge to students in a way that is easy for students to understand. Before imparting knowledge, it is necessary to consider the form of imparting such subject knowledge, processing method and transformation effect; The PCK theory is based on the reflection of experience, which is connected with the practice of teachers and reflects the negative thought of philosophy. It is a gradual rising process of reflection, re-summarization, re-practice, re-reflection and re-summarization in the teaching practice of teachers; PCK theory is personalized. In the teaching process, facing different students, due to their different pre-knowledge ability, understanding ability and thinking ability, teachers should also have different ways in the teaching process to receive better results; PCK theory is objective. In the process of imparting knowledge, students' learning environments and cognitive abilities are different, so the corresponding forms of imparting knowledge should also be different; Overall, it reflects its comprehensiveness, that is, it is connected with and integrated with various factors, and teachers can form a stable teacher PCK structure only by adopting varied teaching methods. Combined with

the core accomplishment of physics in senior high school, this paper expounds the position of PCK theory in teaching from the following aspects.

2. PHYSICAL CONCEPT

The physical concept is the basic understanding of matter, movement, interaction and energy formed from the perspective of physics. It is not a physical concept, but is formed after refining and sublimating the physical concepts and laws in the mind through high school physics learning. In the process of building physical concepts, PCK theory should be used to reflect the step-by-step approach in physics teaching. First, some physical concepts should be explained and analyzed, then promoted to understanding and application in life, and then gradually strengthened, sublimated to students' physical concepts. For example, in the teaching of the concept of energy conservation, the teacher first expounds the law of energy conservation in mechanics, obtains the facts of the law of conservation through experiments, and then extends to electricity, heat, optics, atomic physics, etc. If we can always hold on to conservation in the process of energy research in the teaching process, students will gradually internalize the concept of energy conservation from the original law of energy conservation.

2.1 Sound Memory in Hong Kong: An Unforgettable Distance

The Hong Kong experience was a turning point in the life of Eileen Chang. Hong Kong was a diverse colonial city that gave this schoolgirl from a legacy family an extraordinary sense. On 8 December 1941, the Japanese attacked Hong Kong. During the 18 days of the battle, she joined the air defense regiment and later worked as a nurse in a hospital. She returned to Shanghai in 1943 and began to write, referring to Hong Kong in many of her works as having an influence of "cut too close to the bone, affecting me in an altogether drastic fashion" [1] on her.

Chang used sound and hearing as important media in the construction of Hong Kong. In the article *From the Ashes*, she used the metaphors of sound to express her feelings about Hong Kong during the war. "This thing we call reality is unsystematic, like seven or eight talking machines playing all at once in a chaos of sound, each singing its own song.[1]" In fact, she often used a variety of sounds to create dynamic urban soundscapes - urban sound forms that were happening and shifting every moment and entering the human ear. Eileen Chang loved the sound of the city, and she mentioned her memories of Hong Kong in relevant texts. In *Notes on Apartment Life*, she wrote: "...while I can't fall asleep until I hear the sound of streetcars. On the hills in Hong Kong, it was only in the winter when the north wind blew all night long through the evergreens that I was reminded of the charming cadence of a streetcar." [2] She preferred artificial mechanical sounds to natural sounds, but found the charm of a streetcar in the natural sounds of Hong Kong. As a writer with strong sense of urban identity, she thought that Hong Kong had only trees but no trams, and understood Hong Kong as the other side of the city. Also in this article, Chang established an analogy between sound and memory: The further the distance, the clearer the sound, the longer the time, the clearer the memory. Combined with this relationship, it can be linked to the beginning of *From the Ashes*: "There's already a considerable distance between myself and Hong Kong" [1], This leads to a conjecture about the relationship between Hong Kong and sound: some of the sounds of Hong Kong have survived in Eileen Chang's memory.

This can be verified in the words of Eileen Chang. In June, 1977, she wrote to Song Qi and his wife: "I was walking in the nearby street the other days ... Every summer I think of when I first arrived in Hong Kong Mountain in 1939. It was a sunny downhill day, and nothing happened in between, it was blank and light." [3] The daily moments overlapped with the memories of Hong Kong, and the silence in the scene became a special sound. This was what Eileen Chang expected of Hong Kong when she first came to the city. However, after many years in a foreign country, she remembered this experience every year. Is it possible, then, to find some representative Hong Kong soundscapes in her texts to explore what Hong Kong meant to Eileen Chang's writing?

2.2 Wartime Bomb Sound: A Realistic Alienation

The Battle of Hong Kong was another important experience in the life of Eileen Chang. Her works were also full of depictions of wartime soundscapes, notably the sound of bombing and air alarms. As the representative voices in the war, their penetrating power can stimulate people's emotional experience and make Hong Kong appear as a carrier of war and fear. During the 18 days of the war, Hong Kong was frequently bombed by the Japanese, which caused severe destruction to facilities and civilian life. Although the bombers were generally aimed at specific areas, the air alarms and bombing sounds pierced the eardrums of the public and had a considerable psychological impact on them. In *Notes on Apartment Life*, Chang heard the buzz and two blasting sounds of a water pipe and immediately thought of bombs in Hong Kong, which was also a reflection of this mentality. We can also find relevant descriptions in Chang's novels about Hong Kong. The war of *Love in a Fallen City* was extremely faithful in reconstructing the auditory experience. The novel used a large number of onomatopoeia words to describe all kinds of horrible sounds on the first day of the Japanese occupation of Hong Kong, and distinguished the length, height and types of sounds. At the same time, the text's perception of wartime sound began indoors, in order to highlight wartime experiences from the perspective of women. Unable to escape because of her status and situation, Liusu could only hear the desperate sound of stray bullets from her home. It shows that Eileen Chang's auditory reconstruction of wartime soundscape was not groundless, but a reflection of the characters' detailed experience.

Chang's later works also mentioned bombing many times. In the face of the war, she or the characters in the text showed unusual calmness. In the novel *Little Reunions*, Bebe went to the movies: "And halfway through the movie, the air-raid siren went off but the show continued regardless. It was like something extra added to spice up the movie." [4] In the essay *Remembering Hu Shizhi*, she found a book to read when she was an air defense officer: "Bombs came crashing down, getting closer and closer. I just thought: at least wait until I finish reading it.[5]" When her life was threatened, all she could think was that it was too late to read, which reflected her helplessness during the war. Life and death are unpredictable, and the next second she may lose her life, so she shouted "it will be too late"[6] and wanted to finish it as soon as possible. With the continuation of the war, the abnormal state has become a daily life, and people's fears have gradually turned into habits and fatigue, accompanied by strangeness and detachment in troubled times. This mentality seemed to be in contradiction with nervousness, which may be regarded as the concrete embodiment of "time anxiety" in Eileen Chang's works. [7] When real events seriously disturbed people's lives, the anxiety of life and time suffered by the mind would be strong and specific. In above texts, the wartime scene and the character's calmness appeared at the same time, and the characters always kept a distance from the scene and other characters. And Chang herself was "nowhere to go" during the war. She just joined the air defense regiment and served as a nurse, but she did not take the initiative to face the war with others, which was contrary to general war experience. This also reflects the characteristics of alienation in Chang's works.

Eileen Chang's memories of the Battle of Hong Kong, in the form of listening to soundscapes, formed the writing style. Then, apart from the sounds of a specific environment, what other features of the Hong Kong soundscape have inadvertently influenced Eileen Chang's creation?

2.3 Incomplete Silence: Desolation in Time Gaps

The exploration can be made from a kind of sound landscape. "Silence" is a special sound landscape, and there will be silence in war or daily life. Eileen Chang's description of Hong Kong's quiet environment also presents an objective feature, and promotes this silence into a vague voice. An example is the description of the "silence" in the city in *Love in a Fallen City*:

".....only the strong winter wind, wailing on and on in three long tones-oooh, aaah ,eeei. When it stopped here, it started up there, like bodies trailing on and on, tails never coming into sight. Here, everything had ended. There were only some broken bits of leveled wall and, stumbling and fumbling about, a civilized man who had lost his memory; he seemed to be searching for something, but there was nothing left." [8].

In quiet Hong Kong, even the wind had three different tunes. The sudden disappearance of the sounds of the city and the fall of civilization into the void, while the sounds of nature reappeared, was a concrete expression of the 'bleakness' style of Eileen Chang's work in the post-war scene. Eileen Chang once said that she had felt staggering threat in the back of mind. As a woman who has gone through decline, facing the strangeness of the colony, she felt the pressure of time. The voices of civilization faded away abruptly, and the cold wind restored the helplessness of man in the face of history.

Leo Oufan Lee once suggested that there are three kinds of time in Eileen Chang's works, corresponding to the three sounds in the text ("civilized time", "wild time" and "forced, interrupted, static and dynamic time" in between) [9]. The sound of civilization masked the sound of nature in modern cities, but in war civilization was destroyed and the sound of nature reappeared. Two kinds of times reinforced each other, resulting in multiple time cracks. In such a transitional space-time, civilization had been destroyed and not completely returned to the wild world, forming a kind of incomplete silence. Eileen Chang had a personal insight into life and humanity in the incomplete silence of Hong Kong. Depictions of the blue sky of Hong Kong

- where all was silent but a little savage sound was faintly heard – are often found in the works. At this time, Chang or her characters began to think about life. As in *From the Ashes*:

"Looking above their heads, I saw a brilliantly clear pale blue sky. The emptied tram ast in the middle of the street. The space outside the tram was full of pale sunlight; the tram, too, was filled with sunlight, and that lone tram possessed at that moment a sort of primitive desolation all its own.

I felt terribly uncomfortable-would I die amid a crowd of strangers? Yet what would be the good of being blown to bits and scraps alongside my own flesh and blood?" [10].

Eileen Chang couldn't choose who to die with, which echoed melancholy and desolate loneliness. Such loneliness or reflection on human nature is also strongly reflected in the back of the article. She recorded the soundscape of a Hong Kong hospital in which a patient screamed in pain the silent night. She, the caretaker, was annoyed and told him that his needs cannot be met as if nothing had happened. The hospital was a space of experience between life and death. The patient's howling with brutal struggle was in uneven contrast with the dead silence at night. This incomplete silence reflected the desolation of life between the

destruction of civilization and the return of wildness. Furthermore, Eileen Chang realized that although the war is unforgettable for people born in troubled times when history goes by or struggles, the desolation in troubled times was actually negligible.

Such a “sound of silence” was mentioned in Chang's letters to Song Qi and his wife during her stay in the US. She wrote on June 24, 1969 “The shadows of the trees in the small square formatted all over the ground and I thought about Hong Kong and wondering what time it is...A day and a half apart in between was like a lifetime ago, and never before had I felt so acutely connected to time and space, so chilling that even I could never forget it.[11]” This scene was mentioned again in another letter of hers in 1985, which left a deep imprint on her memory. At the end of 1960, Eileen Chang came to Hong Kong for the last time. Years later, she described her farewell to Hong Kong in her essay *A Return to The Frontier*. She wrote about the depression of returning to school in the 1950s only to turn around and walk away. She wrote about her parting with the memory of Hong Kong when she smells a foul odour in the market, using sharp senses instead of words. Hong Kong implied a campus under war, an isolated island in the colonial era, always a space where civilization and barbarism are juxtaposed, where the whole soundscape is built on a silence that has nowhere to be placed. The positioning of Hong Kong is reflected in the “incomplete silence”.

3. SCIENTIFIC THINKING

"Scientific thinking is a way of understanding the essential attributes, internal laws and interrelationships of objective things from the perspective of physics; it is an abstract generalization process of building physical models based on empirical facts; it is the specific application of methods such as analysis, comprehensive reasoning and demonstration in the scientific field; it is the ability and character of scientific reasoning based on factual evidence to challenge and criticize different views and conclusions, test and revise them, and then put forward creative ideas" [2]. This coincides with the requirements of PCK theory that teachers should teach students to understand a certain topic and misunderstand the form of knowledge transfer. In the process of knowledge transfer, teachers should reflect the content of knowledge and be able to understand and apply it. At the same time, teachers can intentionally introduce students into the wrong areas in the process of teaching. Through the questioning of some top students, most students will reflect and explore again, and then reflect on the wrong areas of understanding again with the joint research of teachers. So in the teaching process, such affirmation, questioning, reflection, negation and reconstruction of the teaching form [3], on the one hand, reflects the leading role of teachers in the teaching process, on the other hand, reflects the main role of students in the teaching process, and achieves the goal of gradually improving students' thinking ability and scientific judgment thinking mode.

The formation of scientific thinking, in the process of teacher teaching, is not simply the accumulation of subject knowledge, but the presentation of knowledge to students through the construction process of questioning and criticizing opinions and conclusions. What is required is the way and skills of teachers in the process of knowledge presentation, which is the requirements of teachers in the "teaching form of understanding and misunderstood knowledge to students on a certain topic" of teacher PCK theory. Through this form, students can gradually internalize scientific research methods into their own set of physical scientific thinking. Physical scientific thinking mainly includes model construction, scientific reasoning, scientific argumentation, questioning and innovation, etc. According to the objectivity and comprehensiveness of teachers' PCK theory, teachers should constantly adjust their teaching forms for the formation of different scientific thinking forms.

Eileen Chang reconstructed her experience in Hong Kong in her writing, in which her auditory experience is outstanding, including faithfully recording the sounds she heard, imaginary sounds and highly abstract sounds, showing a three-dimensional and emotional world. The soundscape she expressed in Hong Kong is a kind of “everyday life in an unusual state”, and under the destruction of civilization, she explained her lonely and desolate personal life experience and pessimistic feelings about life with soundscape. When she first came to school in Hong Kong, the city left room for her imagination, and the modern history expressed in wartime soundscapes, struck her strongly. The experience of facing war and vagrancy deeply influenced her later writing, not only about Hong Kong, but also reflected in her writing style. Combined with Hong Kong's cultural orientation, an abstract “incomplete silence” can best correspond to it and best reflect the meaning of Hong Kong. Eileen Chang started her writing career with the memory of Hong Kong. After a series of imaginations, she returned to Hong Kong to say goodbye and returned to the state of “silence all around, as if nothing had happened”, but the silence was full of sounds.

4. SCIENTIFIC INQUIRY

Scientific inquiry refers to the ability to raise physical questions based on observation and experiment, form conjectures and assumptions, design experimental schemes, obtain and process experimental information, draw conclusions and explain based on evidence, and communicate, evaluate and reflect on the process and results of scientific inquiry. Physics is a science that should be based on experiments. Experimental ability is the basic ability that students should master, but scientific inquiry focuses on the process of inquiry rather than simple experiments. The individualization of teacher's PCK theory shows the process of constantly summarizing and innovating knowledge within the specific scope of their own class in the teaching process [4]. Teachers need to combine the requirements of the core quality of physics with their own understanding, generalization and systematization to gradually achieve teaching objectives through interaction with educational practice.

For example, in the training process of scientific inquiry, taking Galileo's Ideal Oblique Experiment as an example, the initial contact is in the process of exploring the free falling motion. First, Aristotle believed that the heavy object fell faster than the light object, then Galileo questioned and raised questions, then the experimental verification proved that two iron balls fell at the same time, and then the simple slope experiment verification was used to carry out reasonable extrapolation, and finally it was proved that the nature of the free falling motion was a uniformly accelerated linear motion with zero initial velocity [5]. This process shows that the conclusion of science needs to be verified by experiments, and the premise of inquiry is to put forward assumptions and questions. In combination with the teaching situation, the teacher should guide students to think about the method and verification scheme of the law before each physical experiment law is drawn. After the scheme is drawn, the teacher should also encourage students to go to the laboratory to verify their conjectures and process data reasonably. When the data is different from their conjectures, the teacher should guide students to analyze and explain [6]. Then students will gradually form their own scientific research ability in the process of such questioning and inquiry.

5. SCIENTIFIC ATTITUDE AND RESPONSIBILITY

Scientific attitude and responsibility are the internal power of exploring nature gradually formed on the basis of understanding the nature of science and the relationship between science, technology, society and environment. They have curiosity and thirst for knowledge in scientific research, and can take the initiative to study. They always adhere to scientific and rigorous attitude, respect facts and respect others in the process of exploration. The opinions or experimental conclusions are based on experiments. They do not tamper with data, do not cater to the attitude of not superstitious authority, and are responsible for their own opinions.

It seems that the saying "to give students a bowl of water, you have to have a bucket of water" is certainly good. However, this "bucket of water" does not mean a simple amount of knowledge, but requires teachers to have both quantity and quality, and higher requirements for quality. This requires teachers to constantly improve themselves and pay attention to the analysis and adaptation of teaching knowledge and students' quality. PCK theory is a hint and guidance to educators. Its theory points out that educators should have knowledge of teaching, learners' knowledge, teaching situation knowledge and teaching method knowledge. Although this theory is constantly changing and developing, scholars have a unified understanding of the essence of PCK theory; It is necessary to explain the learned knowledge in an effective way to guide students to understand new knowledge; Is the knowledge associated with specific knowledge; It is knowledge about a certain topic, and it is a process of continuous improvement and construction.

5.1 Adaptation to Natural Environment

In order to solve the problem of harsh natural environment, and the rational use of limited resources to the scientific plateau plateau climate, the construction of the rural city white Tibetan houses on the facade of the targeted changes. Thick rammed earth walls and sunrise windows can effectively block cold air and improve indoor lighting and heating. At the same time, Tibetan residents make full use of the structural characteristics of the external walls of buildings, and integrate local ethnic cultural characteristics into decorative details to form a sharp contrast. Through the study of the construction technology of rammed earth wall in Han nationality area, the shortage of local building materials can be well solved. In order to protect the rammed earth wall and improve the rainproof performance, windproof performance and sun protection performance of the building, the white 'ga soil' unique to the rural city is smeared on the outer wall of the house, so that the white Tibetan house is shining under the background of blue sky and white cloud, shining under the bright sunshine, like a fairyland on earth.

5.2 Integration of Diverse Cultures

The rural white Tibetan houses reflect the basic characteristics of multicultural integration in architectural structure and decoration form. The white Tibetan house in the countryside is not only influenced by the southern national dry column building in the architectural structure, but also combines the original well dry structure of the Tibetan people, the shape of the blockhouse and the wall building technology of the Han people, forming a kind of civil blockhouse building with local characteristics. The method and form of decorating houses are also based on the integration of clay sculpture, wood carving and color painting art of Naxi, Han and Mongolian, which fully reflects its own characteristics.

5.3 Inheritance of Religious Belief

The layout, decoration and color application of white Tibetan house in Xiangcheng County reflect the extension of religious temple culture to the secular, which is similar to the local temples, forming a set of systematic architectural decoration and color application norms. The decorative elements mostly use the symbols, patterns and lines of Tibetan Buddhism with certain representativeness, forming a decorative cultural tradition that integrates 'home' and 'temple' with certain regional characteristics, reflecting the rural Tibetan residents' religious belief in Buddhism and the pursuit of a better life.

In addition, Tibetan is a nation that especially advocates white and regards white as a symbol of auspiciousness: on the one hand, it is related to the primitive beliefs and primitive worship of the early plateau people; on the other hand, some people think that

the Tibetan worship of white began from Buddhism into Tibet, because Buddhism was introduced into China from white India. The Tibetan people apply white to various objects in their daily life. They always believe that white is the purest color, which symbolizes peace and goodwill. In addition to doors and windows, the exterior walls of the white Tibetan houses are decorated in white, and the whole visual is simple and generous. The white houses are located in the sunny area of the valley. They are set against the bright sunshine and clear blue sky. They are like white pearls dotted in the mountains, giving a very shocking feeling.

6. CONCLUSION

In conclusion, people's communication anxiety often functions negatively in foreign language communication. The main reasons for foreign language beginners' communication anxiety are lacking of confidence and the insufficient language ability. To help foreign language beginners reduce communication anxiety, on one hand, beginners need to overcome their psychological obstacles and try to be more confident in communication. On the other hand, teachers have to help beginners develop communicative skills and strategies so that they can have a lower communication anxiety. This study has its own limitations, for example, the cause of beginners' communication anxiety is not comprehensive enough. It analyzes the reasons mainly from beginners' themselves, but in fact, teaching models or methods may lead to beginners' communication anxiety. Nowadays, communication anxiety has become a big barrier to hinder peoples' foreign language learning and oral expression. This paper is intended to help foreign language beginners relieve communication anxiety by exploring the cause of foreign language beginners' communication anxiety. The main body of this paper includes two parts. For one thing, it analyzes part of reasons for beginners' communication anxiety from psychology and language aspects. For another, it provides a few suggestions from beginners and teachers.

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