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A Study of High School English Reading Teaching with Visual Thinking Incorporated into the 5E Teaching Model

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Abstract: Reading questions account for a large portion of the scores in China's college entrance English examination, therefore teachers and researchers have been studying how to teach high school English reading more effectively. In recent years, the 5E teaching model has been highly praised by teachers, which, as a constructivist's learning framework, provides students with a complete learning path from engagement to evaluation. However, English reading requires students to have reading comprehension skills. And visual thinking, as a powerful cognitive tool, can assist students in organizing and comprehending information in graphical and problematic ways. The article aims to investigate how to combine the two well in order to apply them to high school English reading teaching. It is found that the integration of visualization tools into the 5E teaching model can not only help students improve their reading comprehension, but also improve teachers' teaching efficiency.

Keywords: Visual thinking; 5E teaching model; High school english reading

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1. Introduction

"The English Curriculum Standard for General High Schools" (2017 Edition Revised in 2020) [1] emphasizes that English teaching in high schools should focus on students' core literacy, which includes the development of students' thinking quality. English reading, as an important part of language learning, has always been concerned by educators and researchers. However, traditional reading teaching is only one-sidedly explaining grammar and translating texts, neglecting the development of students' thinking quality; it is only teacher-centered which ignores students' needs. The 5E teaching model, however, is student-centered and helps to improve students' thinking quality by guiding them from inquiry to problem solving through five stages: engagement, exploration, explanation, elaboration and evaluation.

Currently, the 5E teaching model has been widely researched and applied in the field of science, but relatively little research has been done in language teaching, especially in high school English reading teaching.

Although some scholars have begun to try to apply the 5E teaching model to the English classroom, no systematic conclusions have been drawn as to how it should be operated. However, the 5E teaching mode can improve and enrich all the links before reading, during reading, and after reading, so that the teaching effect can be greatly improved. Moreover, English reading requires students to have the ability of discourse comprehension and discourse thinking. How to improve these two abilities in the English reading classroom, and how to stimulate students' motivation and interest in reading, is particularly important.

Based on the above research status, this paper proposes to adopt the method of integrating visual thinking into the 5E teaching mode to teach high school English reading. Visual thinking is a kind of thinking aid, and students applying it to English reading can help them sort out and process information so as to better understand and memorize the content in reading materials. By combining visualization strategies with the 5E teaching model, it is hoped that a new approach to teaching reading can be provided for teachers.

2. Related concepts

2.1. Visual thinking

"Visual thinking" is a concept introduced by Harvard scholars Shari and Palmer in their strategy research in the 1960s, who defined visual thinking as "Record the thinking, questioning, reasoning, or reflection process of individuals or groups in any observable form", and its core idea is: make thinking visible [2].

Foreign scholars have invented a lot of visual thinking tools; the most representative in teaching is the mind map. Mind mapping was invented by Tony Buzan, a British psychologist in the 1960s. He believes that mind mapping is to express human divergent thinking, so mind mapping is also a natural function of human thinking [3]. Common mind mapping tools include XMind, Zhixi, FreeMind, MindNode and so on.

In addition to mind maps, there are many forms of visual thinking, such as the concept map proposed by psychologist Novak. A concept map is a tool used to organize and represent knowledge, which uses nodes to represent concepts themselves, lines to show relationships between concepts, and emphasizes the hierarchy and interdependence between concepts [4]. Ralph Lengler and Martin J. Eppler, two scholars, also constructed a "visualization method periodic table". They combined many visual aids to create an organized chart similar to the periodic table of chemical elements. This table aims to help understand and distinguish different visualization techniques, to more effectively express and communicate information through graphics [5]. There is also the "Six Thinking Hats" developed by Dr. Edward de Bono of the University of Cambridge in the UK, which divides the thinking process into six different "hats", each representing a specific way of thinking, encouraging people to examine problems from different perspectives (such as facts, intuition, risks, etc.) [3]. In addition, Liu [6] proposed a five-level thinking visualization teaching system, including the concept transformation layer, method and technology layer, curriculum design layer, classroom environment layer, and effectiveness evaluation layer. This system aims to integrate visual thinking into various levels of teaching to promote the development of students' thinking abilities. In foreign countries, visual thinking has been widely applied. Harvard University and Cambridge University have also incorporated visualization of thinking into their courses. For example, Shatri et al. [7] believe that using visual thinking in teaching is beneficial for students' critical thinking growth. Since the 21st century, visual thinking has been increasingly applied in Chinese classrooms. For example, Jin et al. [8] use visual thinking tools to encourage students to read based on language input, which can develop their reading skills, and improve their ability to integrate reading knowledge.

2.2. 5E teaching model

The 5E teaching model was proposed by The Biological Sciences Curriculum Study (BSCS) in the United States. At first, in their research on improving the science curriculum in the United States, Bybee et al. [9] proposed the "learning cycle model," which was the prototype of the 5E teaching model and included "preliminary" "exploration," "invention," and "discovery." However, based on teaching experiments and implementation, they believed that emphasizing students' independent exploration and creativity in the early stages of learning posed certain challenges. Therefore, Bybee et al. [9] extended the learning cycle process to five stages: engagement, exploration, explanation, elaboration, and evaluation. This is the 5E teaching model, named after the English word "E" in all five steps. Wang et al. [10] believe that in the 5E teaching model, students are the main body and teachers only play a leading role. The 5E teaching model triggers students' cognitive conflicts by setting problem scenarios and includes a series of teaching activities focused on constructing new knowledge, such as explanation, extension, and application. These activities embody a student-centered approach and allow students to explore independently, with teachers only providing guidance and assistance on the side.

The 5E teaching model has been widely applied in scientific classrooms abroad. In terms of effectiveness, Bybee et al. [9] demonstrated through teaching experiments that the 5E teaching model is more effective in improving students' academic performance and learning interest compared to traditional models. Mcwright [11] simultaneously chose two modes for comparative teaching: one is the traditional method, and the other is the 5E method. The research results indicate that classes using the 5E teaching model have more innovative personal ideas in science reading and writing, and are more interested in chemistry classes and chemistry-related extracurricular activities. In terms of the English subject, Li [12] conducted experiments using the 5E teaching model in her graduate English reading class. The teaching effect shows that the 5E teaching model can improve and strengthen students' logical thinking ability in the educational process, while stimulating their research interest.

Overall, the 5E teaching model enables students to independently understand knowledge and construct knowledge frameworks through active student participation and effective teacher guidance. It is a successful classroom teaching strategy that emphasizes both the role of teachers and students.

3. The feasibility of visual thinking in various aspects of 5E reading teaching

3.1. Engagement

In the participation stage, teachers set up scenarios to stimulate students' interest, attract their attention, and improve their learning motivation. In this process, teachers can use a series of visual thinking forms to help students activate old knowledge and inspire new knowledge. Firstly, teachers can use multimedia tools such as images and videos to present content related to text, enabling students to have a more intuitive understanding of the knowledge they are learning and enhancing their interest in learning. Secondly, teachers can also use the KWL (Know, Want to Know, Learned) form to ask students to list the information they already know, the questions they want to know, and the new knowledge they have learned after reading. In this way, students can enter reading with questions and use known information to facilitate understanding. Secondly, students can also engage in brainstorming by writing down their thoughts, and then create a text cloud map based on the keywords they have written down, allowing them to guess the content of the discourse based on the cloud map. Students can also create mind maps based on the content of brainstorming sessions to organize their own ideas.

Through these forms of visual thinking, students can actively participate in English reading classes,

improving their reading comprehension abilities and learning interests. At the same time, these methods also help teachers to design and implement teaching more effectively, thus improving teaching effectiveness.

3.2. Exploration

In the exploration stage, students collaborate independently to explore, and teachers provide scaffolding to encourage students to actively learn and think. In this process, teachers can use visual thinking tools to help students actively think and explore new knowledge. Firstly, teachers can use fishbone diagrams to help students analyze the reasons and results of the text, which helps students understand causal relationships. Secondly, students can also construct a mind map to better clarify their ideas, grasp the structure and key points of the article, and thus have a deeper understanding and digestion of the knowledge they have learned. Tools such as reading logs can also be used to allow students to read with questions, search for answers, and summarize the knowledge they have learned in reading comprehension, thereby promoting the process of students from not knowing to knowing, and then from knowing less to knowing more. In addition, teachers can also have students create storyboards to present the main events and plot of the text in the form of comic strips, helping students grasp the story flow and main characters.

In addition to these, there are many forms in which teachers can design activities that are close to students' actual situations based on their own abilities and student situations, making teaching more vivid and effective. These visual thinking forms can not only help students better understand and memorize reading materials, but also stimulate their interest and autonomy, thereby improving their English reading proficiency.

3.3. Explanation

In the explanation stage, students collaborate to exchange and discuss the results, and teachers help students verify the conclusions of the exploration process, connecting new knowledge with existing knowledge. In this process, for texts involving historical events or developmental processes, teachers can create timelines to help students understand the sequence and temporal relationships of events. For texts involving related relationships, teachers can use Venn diagrams to compare and contrast characters, events, or concepts in the text, so that students can clearly see the similarities and differences between them. Teachers can also set up a problem chain that progresses layer by layer, allowing students to understand the text and explore its deeper meaning. By applying visual thinking in the explanation process, students can further understand the text, explore its details, and elevate their emotions.

3.4. Elaboration

In the elaboration process, students apply newly learned knowledge to solve problems or conduct deeper exploration, to deepen their understanding and memory of knowledge and cultivate problem-solving abilities. Teachers can create a new context similar to the text, allowing students to interpret or solve the situation through role-playing or debate. This interactive activity helps students deepen their understanding of the text content. Students can also engage in writing, combining reading and writing, to improve their writing skills and critical thinking when solving new situational problems. Before writing, students can create a brainstorming mind map to help them clarify their writing ideas. By integrating mind maps into transfer activities, the role of visual thinking in the 5E teaching mode will be fully realized. Secondly, teachers can provide students with a real-life case related to the text for research and discussion. Students can combine theoretical knowledge with practical situations to improve their problem-solving abilities.

3.5. Evaluation

Finally, in the evaluation stage, teachers conduct a comprehensive evaluation of students, using various methods such as process evaluation and summative evaluation, teacher evaluation, student self-evaluation, and student peer evaluation, to promote students' learning from each other's strengths and weaknesses, and to identify and fill in gaps. Teachers can design an evaluation form, which is a visual way of thinking that allows students to clearly see their shortcomings and make timely corrections and improvements. In addition, teachers can also incorporate process evaluations into reading instruction, such as using graphical progress bars to display students' progress in completing reading tasks, giving them a clear understanding of their learning. In addition, students can set reading goals together and use charts to track and evaluate the achievement of these goals, which helps students clarify their learning objectives and strive to achieve them.

4. Case study of integrating visual thinking into the 5E teaching model in high school English reading teaching

The study will briefly analyze and demonstrate the specific application of visual thinking integrated into the 5E teaching model in high school English reading teaching, using the reading section "From Problems to Solutions" from the People's Education Press (2019) Book 2 Unit 1 in this chapter.

4.1. Analysis of teaching materials

(1) What: The textbook is sourced from the Reading and Thinking section of Unit 1 in Volume 2 of the People's Education Press, with the theme of cultural heritage. The theme of the reading passage is people and society: it tells the story of history, society and culture, as well as the protection of cultural heritage. This article discusses the problems and solutions faced in the construction of the Aswan Dam.

(2) Why: This text enables students to understand the complexity and difficulty of issues in the process of cultural heritage protection, the possibility of balancing economic development and historical cultural heritage protection, and the importance of global cooperation in cultural heritage protection, thereby further reflecting on how they can effectively participate in cultural heritage protection activities in their daily lives. This chapter aims to raise students' awareness of protecting cultural heritage and establish the concept of a community with a shared future for mankind.

(3) How: This article belongs to the category of narrative explanatory text, with clear structure, accurate wording, and the use of many numbers to make the content precise. The language is simple, easy to understand, and full of authenticity.

4.2. Analysis of students

The student comes from the first year of high school. After three years of English learning in junior high school, they have mastered the basic abilities of obtaining information, processing information, analyzing problems, and common reading skills. Before teaching, students have already previewed new vocabulary and cleared obstacles to reading the text. However, students' logical and critical thinking abilities still need to be strengthened. They may want to learn more about the Aswan Dam project and how to protect cultural heritage.

4.3. Teaching objectives

At the end of this course, students will be able to: obtain basic information and text structure of the Aswan

Dam project; understand the importance of cultural heritage protection and cooperation among major countries; summarize by using reading skills to acquire, organize, forming one's own insights and cultivating abstract thinking abilities; apply the problem-solving steps learned to analyze cultural relic protection cases, and solve practical problems in daily life through group debates.

4.4. Teaching key and difficult points

The teaching key point is that students can obtain basic information and text structure of the Aswan Dam project. The teaching difficult point is that students can express their views on cultural heritage protection and apply the knowledge they have learned to solve practical problems.

4.5. Teaching procedure

(1) Warm-up (Participation Stage)

The teacher shows a photo of the Abu Simbel Temple and asks the students to guess which country the photo is about and whether they know the name of the attraction.

Justification: To lead students into the theme of this lesson and attract their interest through visual aids such as images.

(2) Lead in (Participation Stage)

The teacher will first present two questions:1.What happened to the statues? 2.Please use some adjectives to describe your feelings. Then play a video about the Abu Simbel Temple and ask the students to answer the above two questions. Then ask the students what more information they would like to know about the Abu Simbel Temple?

Justification: To further educate students about the history of the Abu Simbel Temple through visual means such as videos, and to stimulate their desire to explore.

(3) Pre-reading (exploration stage)

Activity 1: Prediction

Next, the teacher says to the students: Now let's enter today's learning and see if we can learn what you want to know. Then the teacher asks the students: What question do you think of when you read the title? (Based on keywords: problems and solutions)

Justification: Encourage students to ask questions themselves and become active explorers of knowledge.

(4) While-reading (exploration and explanation stage)

Activity 2: Read for structure

Scenario one: We are now going on a trip to the Abu Simbel Temple. You and your desk mate will play the role of tourists, while the other will serve as a tour guide. Tourists can ask the tour guide questions that come to mind during the prediction process, and the tour guide will answer them based on the text. During this process, tourists need to design a fish-bone diagram based on the tour guide's answers (you can connect them together using when, what, where, who, how, why, etc., and then write the theme idea on the fish-bone spine).

Activity 3: Read for details

Scenario 2: Your friend Xiao Ming also wants to learn about the history of the Abu Simbel Temple. Please introduce to him what happened during each time period. Students complete the timeline under the guidance of the teacher

(5) Post-reading (elaboration stage)

Activity 4: Think and debate

Scenario 3: Xiaoming is also from Guangdong. There is an ancient architectural complex in his hometown, but it is currently facing demolition due to Guangdong's "Three Olds Renovation" (old factories, old villages, and old urban areas). What is your opinion on this? Do you think it should be demolished or preserved? How to strike a balance between economic development and the protection of the surrounding cultural heritage?

The teacher shows the students the mind map, and then the students are grouped according to the prompts on the mind map for a debate competition. The teacher then completes the mind map on the blackboard based on the students' expressions.

(6) Summary (Evaluation Stage)

The teacher guides the students to summarize what they have learned in class and asks them to complete an evaluation form.

(7) Homework

Students write a letter of about 100 words to the government based on the mind map on the blackboard, stating their views and suggestions on the "Three Olds Renovation". Through homework, students can further consolidate, transfer, and apply the knowledge they have learned. Using mind maps to complete writing helps students organize their article structure and improve their communication skills.

5. Conclusion

Integrating visual thinking into the 5E teaching model provides a new perspective and method for high school English reading teaching, making students' learning process more vivid, interesting, and effective, as well as giving teachers more direction and improving their teaching efficiency. However, the 5E teaching model is not yet widely adopted in English classrooms in China, which requires teachers to have strong teaching abilities and the ability to control the classroom. Otherwise, giving students too much autonomy may not be conducive to their success in exam-oriented education, especially for students with lower levels and poor self-control. Therefore, more exploration and practice are needed to prove its effectiveness in this study.

In future English reading teaching, it is hoped that scholars can continue to explore and practice more visual thinking forms to continuously improve teaching quality and students' learning experience. The study believes this teaching method will open a door to a wider world for students, help them better understand and master English reading skills, and lay a solid foundation for future learning and life.

Disclosure statement

The author declares no conflict of interest.

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