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Study of English Reading Teaching Strategies in Senior High School based on Cognitive Load Theory

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ABSTRACT

This study first explores the feasibility of applying cognitive load theory to high school English reading teaching by defining core concepts such as cognitive load and schema, combining with the current situation of middle school English reading learning and the current English core literacy and curriculum objectives. The main part of the study starts from the three elements under the cognitive load theory, and combined with the teaching design practice of Unit 1 The Monarch's Jourey of FLTRP Edition, the final aim is to further integrate and explore the classroom teaching strategies of middle school English reading based on the cognitive load theory, emphasizing the student-centered approach. To promote students' efficient schema construction and reading comprehension automation, create a better English reading learning environment, help students improve reading skills, and get closer to the goal of middle school English teaching.

KEYWORDS

Cognitive Load Theory; Middle School English Reading; Teaching Strategy.

1. DEFINITION OF CORE CONCEPTS

1.1. Background of Cognitive Load Theory

In the 1980s, cognitive psychologists reached the following theoretical consensus: human memory can be mainly divided into working memory and long-term memory. Working memory is conscious, slow, and requires attention resources. It is generally believed that the capacity of working memory is 7±2 blocks. Long-term memory is fast, automatic, and takes almost no attention resources. The cognitive process can be automated with sufficient practice. Knowledge in long-term memory has structure, and schema is its basic unit, which can be grouped into chunks to reduce the burden of working memory, and there is no need for conscious control and resource consumption when highly automated schema activation. Based on this, cognitive load theorists believe that complex cognitive tasks may lead to working memory overload, and reducing the cognitive resource occupancy of information units can release working memory capacity. The automation of schema construction and operation can reduce cognitive load [1].

1.2. Types of Cognitive Load

The impact of cognitive load on working memory can be subdivided into three categories: intrinsic cognitive load, extraneous or cognitive load, and germane cognitive load, which are closely related to learners' information comprehension during the cognitive process.

Intrinsic Cognitive Load primarily stems from the complexity of the knowledge itself and is independent of its presentation, learners' study methods, and learning optimization strategies. For a specific learning task and learners' knowledge level, intrinsic cognitive load is constant and cannot be altered. To reduce intrinsic cognitive load, it is necessary to enhance learners' abilities or indirectly decrease the difficulty of the course.

Improper instructional design can impose additional burdens on working memory, which is known as Extraneous or Ineffective Cognitive Load. How to effectively design the reading instruction process to reduce extraneous cognitive load is a primary concern of cognitive load theory. Depending on the learning content, adopting appropriate methods can facilitate learning and reduce extraneous cognitive load. In the design of middle school reading courseware, reducing extraneous cognitive load plays a crucial role. Poorly designed multimedia courseware consumes a significant amount of learners' working memory to process information not directly related to the course content, making the limited teaching time even more constrained.

Germane or Effective Cognitive Load refers to the resources in working memory occupied by students' schema construction and automation processes. While extraneous cognitive load hinders learning, germane cognitive load promotes it. In the process of designing reading courseware, it is essential to allocate some space for germane cognitive load and avoid presenting too much learning content simultaneously, as this may impede learners from constructing long-term memory schemas and subsequently affect teaching effectiveness[1].

2. ANALYSIS OF HIGH SCHOOL ENGLISH READING LEARNING

2.1. Overview of Core Competencies and Curriculum Objectives in High School English

In the current field of senior high school English teaching, the realization of core literacy and curriculum goals is deeply influenced by teaching methods and students' learning situation. With the advancement of the new curriculum reform and the increasingly prominent background of globalization, the primary task of teaching is to improve students' practical English ability. According to the English Curriculum Standards for Senior High Schools issued by the Ministry of Education, the core quality of senior high school English consists of four dimensions: language knowledge, language skills, emotional attitude and cultural awareness, and learning strategies. Within this framework, students are expected to develop intercultural competence and a global perspective through effective language input and output.

The development of curriculum objectives is based on the future academic and career needs of high school students, aiming to improve the quality of thinking and language use ability of students through active interaction and reflective learning. Specifically, the academic curriculum aims to emphasize the cultivation of critical thinking, emphasizing the ability of students to analyze, synthesize and evaluate information. Vocational goals tend to improve students' problem-solving skills, teamwork and project management skills [2].

With the revision of the 2020 edition of English Curriculum Standards for Senior High Schools and the implementation of the 2021 National College Entrance Examination English reform, English reading teaching, as one of the teaching courses for the cultivation of students' core literacy, how to better implement reading teaching has become the meaning of the topic. The reality is that many senior high school English reading classroom teaching still adopts the traditional reading teaching method, and the cognitive load of students in the process of reading learning increases significantly and leads to the decline of learning quality and other problems.

In order to solve this problem, we must deeply combine the current situation of English reading teaching in senior high school, and accurately identify the cognitive obstacles and learning

bottlenecks in the teaching process. On the basis of clarifying the problem, this paper makes strategic optimization and adjustment to English reading teaching. At the same time, it is the responsibility of educators to continuously explore and practice a student-centered teaching method that not only meets the requirements of the syllabus, but also pays attention to the satisfaction of the individual needs of students, as well as their future survival and development needs in a globalized society. Therefore, attaching importance to the implementation of curriculum objectives in teaching practice and creating conditions to cultivate students' core qualities will be the key to improving the quality of senior high school English teaching.

2.2. Analysis of High School English Learning Situation

In the exploration of high school English reading learning situation analysis, through extensive reading of relevant literature, this study finds that most students face significant challenges in reading long texts and extracting abstract information. Among them, limited vocabulary has become a key factor hindering most students from smoothly understanding reading materials. More severely, students generally have weak abilities in using background knowledge to assist in understanding the implicit meanings in texts, which is evident from their nearly blank practical performance in aspects such as image comprehension, metaphor mastery, and inference ability. The lack of awareness of metacognitive strategies among students is also a major cause of difficulties in reading courses for middle school students. Further research finds that although students may have received a series of guidance on reading skills, they often struggle to translate these skills into practically usable knowledge, and it is even more difficult for them to flexibly apply them in actual reading scenarios.

It is worth mentioning that the outdated nature of some teaching materials and methods, which rarely involve current popular culture and real-time news, directly weakens the bridge function connecting teaching with students' real world, further exacerbating the unnecessary increase in students' extraneous cognitive load. In response to this, preliminary suggestions for teaching adjustments are proposed, including moderately introducing interdisciplinary reading materials, adopting multimedia-assisted learning, and implementing tiered teaching, all aimed at achieving the core competencies and curriculum objectives of high school English.

3. FEASIBILITY OF APPLYING COGNITIVE LOAD THEORY TO HIGH SCHOOL ENGLISH READING TEACHING DESIGN

Through analyzing the learning situation of high school English reading, we have found that the major challenges faced by students in the process of English reading teaching are closely related to the elements of cognitive load. Specifically, by adjusting classroom content, deepening students' background knowledge, and enhancing teaching interactivity, we can significantly improve students' schema activation speed and the automation of reading comprehension, thereby optimizing their learning experience and reading effectiveness. At the same time, in past high school English teaching practices, teachers and students generally neglected the practical guiding role of cognitive load theory in reading teaching. In recent years, as research on cognitive load has gradually deepened, it has become clear that applying it to teaching design can effectively enhance students' reading comprehension abilities. Based on cognitive load theory, teachers can adjust and optimize the way information is presented by considering the difficulty of high school English reading materials and students' existing background knowledge. At the operational level, integrating cognitive load theory into high school English reading teaching is mainly reflected in how to reduce extraneous cognitive load, strengthen effective germane cognitive processing, so as to improve students' learning efficiency and depth of understanding.

In summary, the introduction of cognitive load theory, with its unique scientific nature and applicability, provides a new perspective for high school English reading teaching that is different

from traditional teaching methods. It focuses on how students can process reading information in the most efficient way, providing new strategic directions for the reform and development of high school English teaching. It is expected to achieve a qualitative leap in teaching reading comprehension abilities, which are the core of the subject.

4. IMPLICATIONS OF COGNITIVE LOAD THEORY ON HIGH SCHOOL ENGLISH READING STRATEGIES

In brief, the focus of cognitive load theory lies in the pressure exerted on students' limited working memory space by complex problems. The core principles of teaching design are to moderate the complexity of intrinsic cognitive load, free up working memory space by reducing extraneous cognitive load, and optimize cognitive load by adjusting germane cognitive load [3].Based on this, and combined with the teaching design practice of Unit 1 "The Monarch's Journey" from the first selective compulsory textbook published by Foreign Language Teaching and Research Press, this study proposes three main strategies.

4.1. Reducing Intrinsic Cognitive Load

Combining Unit 1 "The Monarch's Journey" from the First Selective Compulsory Textbook Published by Foreign Language Teaching and Research Press, we can conduct a specific analysis from the following aspects and adopt corresponding strategies to optimize teaching design and reduce students' intrinsic cognitive load:

Firstly, to alleviate the high intrinsic cognitive load caused by vocabulary barriers in English reading, teachers need to employ effective strategies to guide students in valuing and enhancing vocabulary learning and accumulation [4]. Teachers can provide appropriate textual materials in daily teaching to guide students in effectively learning and mastering high-frequency vocabulary expressions in actual contexts [5]. Additionally, teachers should make full use of classroom time to help students deepen their memory and consolidate learned vocabulary by repeatedly presenting relevant words. Lastly, teachers can also guide students in using strategies such as root and affix memorization, thematic modular categorization, etc., to achieve efficient vocabulary input. Through interactive methods like games and role-playing, students can grasp vocabulary in practical applications, enabling flexible use of learned vocabulary.

Secondly, regulate text difficulty to ensure accessibility for students. In terms of difficulty regulation, the concept of the Zone of Proximal Development (ZPD) provides a strong fulcrum for regulating students' intrinsic cognitive load. By rationally allocating tasks within the ZPD, students are neither overly challenged, leading to cognitive overload, nor underwhelmed, but instead feel motivated by noticeable growth and learning incentives. Teachers can select core new words and phrases, design interactive memory activities or use flashcard applications to familiarize students with these vocabularies before they actually engage with the text. Encouraging students to preview beforehand to understand basic concepts of migration, the life cycle of butterflies, and natural factors affecting migration is also beneficial. Teachers can also provide a list of questions beforehand to guide students in targeted text processing. Simultaneously, teachers can organize group discussions on difficult and complex sentence patterns in the text, allowing students to share preview outcomes and promote information integration and thinking collision through communication. To further enhance preview effectiveness, teachers can design relevant preview quizzes to help students consolidate preview content and prepare for subsequent classroom learning.

4.2. Optimizing Extraneous Cognitive Load

According to Cognitive Load Theory, extraneous cognitive load is related to the organization, presentation, and instructional design of learning materials. In current English reading instruction in

middle schools, many teachers adopt a top-down reading teaching mode, which involves conducting syntactic analysis and translation of the reading material word by word and sentence by sentence in oral language, requiring students to grasp everything . This leads to an excess of redundant information and a failure to highlight effective reading information, not only causing high extraneous cognitive load for students but also affecting their overall understanding of the text, failing to prioritize student-centeredness. Additionally, in order to activate classroom atmosphere, teachers may design questions unrelated to the main theme of the text and lacking specificity for students to consider during the introduction phase of reading classes [4]. These questions, not necessary for teaching activities, undoubtedly increase students' extraneous cognitive load.

In English reading instruction in high schools, practical strategies for optimizing extraneous cognitive load can be approached from three levels: precise alignment of reading questions, effective hierarchical decomposition of teaching content, and creative utilization of cross-linguistic cognitive activities, to alleviate relevant cognitive load for students. To enhance reading questioning strategies, teachers can design and adjust the pertinence and depth of questions, making questioning no longer a straightforward information retrieval process but setting up corresponding question chains based on the text's inherent characteristics and logical connections, guiding students to conduct deep analysis. For example, in the text "The Monarch's Journey," after showing students a video about animal migration during the introduction, teachers can ask students to directly find the keyword "migration" and its meaning in the text. The introduction question directly corresponds to the article's theme, smoothly transitioning from perceiving the text structure to finding key information and decoding the article's connection techniques, effectively stimulating students' thinking activity and concentration. Some question chains designed in this teaching practice are as follows:

Para 1: What are those animals doing in this video? (Find the keyword and its meaning in the text.) Which animal migrates in this passage?

Para 2: Complete the details of monarch butterflies. Since one detail involves their flight distance, teachers can directly transition from this point to ask students: "What prepared those butterflies for this long journey?" Thereby entering the next part of the article.

As pointed out by Sweller in "Element interactivity and intrinsic, extraneous, and germane cognitive load" (2010), if the learning objective is to understand certain concepts contained in the text, using jargon may constitute additional cognitive load [6]. Meanwhile, the practice of translanguaging expands the concept of "language," viewing it as a process of constructing meaning in cross-modal and multimodal communication. This linguistic view treats language resources as broader multi-symbol resources in fields such as classrooms, daily interactions, digital media, rather than a series of codes [7]. Therefore, optimizing teaching language and broadening the concept of language is also particularly important in cognitive activities with many abstract conceptual elements, such as English reading instruction. Specifically, when the conceptual understanding of the text is difficult, teachers can utilize native language resources in reading instruction and can directly convert the text into clearer charts or flowcharts for presentation. For example, in the text "The Monarch's Journey," which involves strong logical connections and some concepts such as hyponymy, teachers can directly introduce concepts using Chinese diagrammatic techniques for explanation.

上义词: Animal Fruit

下义词: Elephant Apple

4.3. Stimulating Students' Effective Germane Cognitive Load

According to cognitive load theory, the effective reduction of extraneous cognitive load allows students to allocate more cognitive resources to the schema construction of valid information. Therefore, in the teaching process, teachers utilize information technology tools such as PPT, emphasizing key content through colors and adjusting font sizes, presenting charts directly with

appropriate white space, effectively guiding students' attention. This enables students to quickly identify important elements in reading tasks, further reaching the deep meaning and understanding of the main idea of the article, and enhancing their abilities in intensive and extensive reading.

Simultaneously, teachers should also cultivate students' metacognitive awareness by presenting specific problem-solving strategies in PPT, such as how to identify the main idea of an article and how to quickly find it, guiding students to autonomously regulate their cognitive activities and construct valid information.

At the same time, based on cognitive load theory, guiding students to engage in effective self-explanation activities can also promote the construction of relevant schemas and stimulate their effective germane cognitive load. For example, in the teaching design practice of "The Monarch's Journey," for the language point of causality in the text, after guiding students to derive it, teachers can ask students to provide more examples to facilitate the automation of this schema[8].

Additionally, arranging post-reading retelling activities or using mind map presentation activities in the classroom can encourage students to actively learn in group cooperation and review important information points in the text. During this process, students need to exchange information with each other, organize and reconstruct what they have learned, which not only contributes to the deep encoding and automation of schema knowledge but also motivates students to deepen their understanding of reading materials in the process of extracting and integrating information, and promotes the collision of thinking and information sharing among students.

The design details of these teaching strategies aim to mobilize students' active participation, consolidate and expand their English schema knowledge through carefully constructed learning activities and skill training, and ultimately achieve the learning goals of efficient reading and automated understanding. Through practical application, it is foreseeable that these improved English reading teaching schemes based on cognitive load theory will greatly optimize the learning process, help students build a more solid knowledge structure, and promote the continuous development of their cognitive skills.

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