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Research on the Improvement of English Teaching Efficiency Based on Cognitive Load Theory

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Abstract

English learning is influenced by both teaching methods and learners' cognitive factors. Therefore, in order to improve English learning effciency, the role of cognitive factors needs to be adequately considered in teaching methods, and cognitive load theory has become one of the most influential theoretical frameworks in the field of learning and teaching. Cognitive load theory, an instructional design theory based on human cognitive structure, centers on the finite nature of working memory. Therefore, effective learning can only occur if the cognitive load is kept within the limits of what working memory can carry. In this paper, it is argued that teachers should regulate students' cognitive load by using appropriate teaching strategies to keep their total amount within a reasonable level so as to enhance the efficiency of English teaching.

Keywords

Cognitive load theory; Instructional design; Educational psychology.

1. Introduction

As an emerging theory guiding instructional design, cognitive load theory has recently attracted increasing attention in education. Also, it was first researched by some studies on mental load or psychological load. Psychologist Sweller applied cognitive load to education in 1988, and he considered the cognitive load to be the level of mental energy required to process the information given[1]. When a learner is processing task information, it will hinder the learning activity's compelling performance if the total cognitive load exceeds the working memory capacity. Cognitive load theory suggests that the instructor can reduce the learner's cognitive load and improve learning efficiency by guiding optimal instructional design from theory to practice.

2. Literature Review

Cognitive Load Theory (CLT) was initiated by educational psychologist John Sweller in the 1980s. Cognitive load is the total amount of information available to be processed during human information processing, consisting notably of the total amount of information stored and processed by working memory (Sweller, 2008). Based primarily on finite resource theory and schema theory, cognitive load theory scrutinizes learning and problem solving from the perspective of resource allocation. In accordance with the finite resource theory, human resources are finite, and if one engages in several activities simultaneously, it involves the problem of resource allocation, with the basic principle that " the total amount is constant, but this is more than that". In the process of learning or problem solving, each cognitive activity requires the consumption of cognitive resources. If the total amount of resources required for each activity exceeds the total amount of resources afforded by the individual, the problem of inadequate resource allocation will arise, which will affect the effectiveness of learning or

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problem solving. Mayer et al. proposed a cognitive theory of multimedia learning on the basis of cognitive load theory and dual coding theory.[2]

Kost, Foss, and Lenzini analyzed the effects of three presentation modes: text, picture, and text-combined picture, and they found that images and text are not as effective as the combination of images and text [3] Yagoub Z. and Mortaza A took 40 freshmen females who are non-English majors as subjects and divided them into a control and experimental group. The control group was taught with a traditional presentation, while the experimental group was taught with visual aids, including pictures, videos, and visual actions of the teacher, etc. The study found that the teaching with visual aids was significantly better than the traditional teaching [4].Wei Liping et al. found that in the process of daily reading, students often had problems of low reading efficiency caused by redundancy effect and split-attention effect. Therefore, she suggested that to improve students' reading comprehension and vocabulary memory, it's necessary for writers to consider how to present materials inappropriate ways when compiling a textbook.[5]Peng Lihui investigated the redundancy effect under different hearing presentation modes, and found that the two-channel information presentation mode would make learners integrate information from two sources, which would cause extraneous cognitive load in the learning process, making the cognitive load higher than that under the single-channel information presentation mode.[6]

3. Current Problems of Students' Cognitive Load in English Teaching

3.1. Students' Inadequate Reading Background Knowledge and Vocabulary Reserves Lead to Their High Endogenous Cognitive Load

According to cognitive load theory, endogenous cognitive load is in correlation with the difficulty of the learning material itself and the student's current level of expertise. The problem of insufficient vocabulary accumulation is prevalent among current students, and vocabulary is the basis of reading. Insufficient vocabulary reserves will obviously cause a certain degree of reading impairment among students, affecting their comprehension of the chapter they read and making it difficult to read fluently, thus increasing the relative difficulty of the reading material. As well, students lack the necessary background knowledge of the material they are reading, further exacerbating their difficulties in reading comprehension and creating a higher level of endogenous cognitive load in their English reading learning, which naturally makes it hard for them to achieve better learning outcomes in the English reading classroom.

3.2. High Exogenous Cognitive Load of Students Due to Unreasonable Presentation and Instructional Design uf English Reading Materials

According to cognitive load theory, exogenous cognitive load correlates with the way learning materials are organized, presented, and the teaching design. In the current process of teaching English reading in schools, many teachers adopt the "top-down" reading teaching mode, in which they verbally analyze and translate reading materials word by word and sentence by sentence, and require students to master all of them, resulting in too much redundant information, which not only causes a high exogenous cognitive load for students, but also affects their overall grasp of the chapter. Furthermore, in order to liven up the atmosphere of the classroom, teachers may design a question that is not very relevant to the main idea of the text and not very directive in the introduction of the reading class for students to think about, which will undoubtedly increase the exogenous cognitive load of students because the questions they ask are not necessary for the teaching activity. The redundant information generated by excessive English text descriptions in the textual content presentation of the reading class also adds to the exogenous cognitive load of the students.

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3.3. Insufficient Teacher Attention to Instructional Strategies for Students Leads to Low Cognitive Load of Relevance

According to cognitive load theory, these additional cognitive resources invested by students facilitate the construction of schemas, and the load generated by these additional cognitive resources is the associative cognitive load. For example, students use text-marking strategies to enhance their understanding of the content of reading materials in English, which promotes effective learning despite the increased cognitive load of relevance in the process. Research has shown that the use of various types of learning strategies can facilitate the construction and automation of schemas by learners, although they increase the cognitive load of learners' associativity. From the current state of teaching, teachers give little attention to teaching and training students reading strategies, but rather focus on explaining language knowledge in reading chapters, which has caused most students to be overly concerned with detailed information in chapters, such as grammatical rules or sentence structures, in reading comprehension, but fail to use various reading strategies spontaneously to read effectively. Because students are less likely to use reading strategies when reading, their associative cognitive load is naturally at a lower level, and thus their reading self-efficacy and motivation are correspondingly lower.

4. The Application of Cognitive Load Theory in Improving the Efficiency of English Teaching

This paper is designed in two dimensions of reducing external cognitive load and optimizing internal cognitive load. On the one hand, internal cognitive load is mainly influenced by the variability of learners' individual knowledge and experience backgrounds as well asthe complexity of the learning tasks, so corresponding strategies should be adopted in instructional design to reduce the intrinsic cognitive load. On the other hand, for factors influencing the external cognitive load, instructional design should focus on the improvement of the organization and presentation of learning materials.

4.1. Reducing External Cognitive Load

Information redundancy is another major factor contributing to extrinsic cognitive load. Redundant information mostly refers to decorative or repetitive information that is unrelated or less relevant to the important information for learning. For example, in order to liven up the classroom or increase the so-called fun, some teachers provide learning materials with decorative information such as images and music that do not actually support the learning activity itself, which actually distracts learners' attention from the important learning materials and increases the extraneous cognitive load, which is not beneficial to learning. Therefore, teachers need to review and analyze the information in the learning materials in their instructional design and eliminate redundant information to reduce the extraneous cognitive load.

Focus on essence is to delete the so-called "Seductive Details" such as texts, pictures and sounds that are not related to the achievement of instructional objectives in multimedia instructional design. Mayer suggests that those redundant words and symbols should be deleted in addition to those interesting but irrelevant words and pictures, sounds and music, which is aimed at minimizing the cognitive load and making effective use of learners' limited cognitive resources. “Seductive Details” can not only "distract" learners' attention and "take up" their limited working memory, but also "mislead” them to organize irrelevant learning materials into the original knowledge structure system, thus "destroying" the cognitive schema in learners' long-term memory and failing to achieve the predetermined instructional objectives. The principle

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of focus on essence is more effective for the learners with low working memory capacity or low level of domain knowledge.

4.2. Improving Internal Cognitive Load

4.2.1. Integration and Optimization of Learning Resources

To integrate and optimize learning resources, redevelop learning content, and reasonably design learning tasks to avoid overloading learners' cognition by overly complex and difficult task structures, which invariably increase internal cognitive load and negatively affect learning outcomes. To do this, teachers need to refine the English course objectives according to the learners' reality, align the learning task design with the course objectives, and reorganize the course content and allocate learning resources as necessary. At the same time, teachers can design the necessary steps to break down the learning tasks before, during, and after class to guide students to successfully complete the series of related learning tasks, which can effectively reduce the internal cognitive load. For example, teachers can arrange a pre-class introductory session to increase the relevance of learners' schematic knowledge to the learning content by means of questions and study plans, solve difficult learning points in the in-class session by means of appropriate feedback, teaching pointers, and encouraging group study and discussion to reduce the difficulty of the learning tasks, and consolidate the results of the learning tasks by means of supplementary learning and extension in the post-class session.

4.2.2. Creating the Task-centered Teaching Schemes

The task-centered principle means that efforts should be made to provide the predetermined instructional objectives that are able to achieve in connection with learning in simulated or realistic task situations in the instructional design. The education based on goal attainment should first be able to ensure that learners have a full command of the current knowledge before proceeding to the next task, reaching the goal of mastering the learned content in an individualized learning manner. Moreover, it is the basic feature and requirement of micro-lecture to make clear the instructional objectives. The task-centered teaching principles can help learners strengthen their intrinsic learning motivation, as well as offer them opportunities to learn in real task situations so as to facilitate their trying to explore new knowledge and to complete tasks.

5. Conclusion

English teaching design based on cognitive load theory can optimize the control of learners' cognitive load and promote learners' effective learning, reflecting the transformation of English teaching to be learner-centered and value-oriented to effective learning. The cognitive load optimization strategies discussed in this paper and the teaching methods constructed on this basis can provide some reference for the improvement of English teaching efficiency, but also require continuous reflection, revision and improvement in English teaching practice in order to truly achieve the purpose of promoting students' effective learning.

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