

A Research on the Instruction of Complex Sentence Structures for English Majors from the Perspective of Cognitive Load Theory

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Abstract: Complex sentence structures, as a core component of the English language system, are crucial for English major students to achieve precise language expression, enhance comprehensive language application skills and academic literacy. They are also the main bottleneck that most English major students encounter in the improvement of various language skills, including listening, speaking, reading, writing and translation. The teaching effect of complex sentence structures directly affects the quality of English major talent cultivation. The cognitive load theory, as an important theory in educational psychology, focuses on the limitations of human cognitive processing and the laws of resource allocation, providing a scientific theoretical perspective and practical guidance for solving difficult problems in the teaching of complex sentence structures and optimizing teaching design. This paper takes English major students as the research object, combines the requirements of the English major teaching syllabus and the cognitive development characteristics of students, and uses research methods such as literature analysis and logical induction to systematically analyze the cognitive load imbalance problems existing in the current teaching of complex sentence structures in English major, deeply explore the causes behind them at the levels of teaching content, teaching methods, and students' cognitive foundation, and based on the core viewpoints of the cognitive load theory, propose targeted teaching optimization strategies, aiming to reasonably allocate cognitive load, reduce ineffective cognitive load, and enhance effective cognitive load, effectively improve the effectiveness of teaching complex sentence structures in English major, further provide certain theoretical support and operational practical references for the teaching reform and mode innovation of complex sentence structures in English major, and help English major

students break through the bottleneck of complex sentence learning and comprehensively enhance their language comprehensive application abilities.

Keywords: Cognitive Load Theory; English Majors; Complex Sentences; English Language Teaching

1. Introduction

Complex sentence structures are a core element in English professional teaching, serving to connect students' basic grammar knowledge with their pragmatic abilities. The degree to which students master these structures is an important indicator of their language proficiency, and it also directly affects their overall language skills. English complex sentence structures, characterized by their rigorous structure, rich logical hierarchy, high information density, and large semantic carrying capacity, require a significant amount of cognitive resources to be mobilized during students' learning process. However, due to the prevalent phenomenon of "emphasizing rules but neglecting application" in current teaching, the teaching effectiveness of teachers is poor, and students encounter problems such as cognitive overload or insufficient load when learning English complex sentence structures, thereby affecting both the teaching and learning of students.

The cognitive load theory was first proposed by John Sweller in 20C80S. He classified cognitive load into three types: intrinsic cognitive load, extrinsic cognitive load, and related cognitive load. The balance among these three is the key to improving students' learning outcomes and has been widely applied in related language teaching fields. Meanwhile, English major college students, as advanced second language learners, the core of their learning of complex English sentence structures lies in the rational allocation of cognitive resources, and the regulation of cognitive load is of vital importance. Currently, some scholars' research has laid the foundation

for this article. Liu Jinlu and Yang Nan further clarified the measurement indicators of the syntactic complexity of English complex sentences [1]; Zhang Bijiang conducted in-depth discussions on the cognitive processing ideas of complex sentence structures [2]; in addition, foreign scholars have also focused on the theoretical development of English complex sentence structures and the processing mechanism of sentence structures [3,4]. Based on this, this article, under the guidance of the cognitive load theory, aims to explore the current teaching situation of English complex sentence structures, the cognitive load mechanism, and optimization strategies, in order to further facilitate teaching reform.

2. Concept Definition

2.1 Complex Sentence Structures

Based on the research by Liu Jinlu and Yang Nan, English complex sentence structures are those composed of two or more clauses and having complex semantic logic [1]. They are an important type distinct from simple sentence structures. Through connecting means, specific logical relationships are formed, and their three core features are nesting, logical diversity, and semantic richness. Specifically, nesting refers to the possibility of multiple layers of clause embedding, with more layers requiring higher cognitive processing demands; logical diversity is reflected in the existence of various logical relationships between clauses, and precise understanding of conjunctions is necessary; semantic richness can carry complex and complete information and meet the needs of intermediate and advanced English expression. For college students majoring in English, the complex sentence structures they learn mainly include compound sentences such as nounal, attributive, and adverbial sentences, as well as multi-layered nested sentence structures. These are the core of advanced English grammar teaching, and they require students not only to master the relevant rules but also to be able to use them flexibly. The dual requirements make the cognitive load in students' learning become more complex to a certain extent, and have become a long-standing teaching focus.

2.2 Cognitive Load

Cognitive load is the core concept of the cognitive load theory. This theory states that the total

amount of cognitive resources consumed by learners during the learning process is the cognitive load. Based on the research by Pang Weiguo, cognitive load can be classified into three categories: The first category is determined by the complexity of the learning task itself, such as the nested hierarchies and logical relationships of complex English sentence structures, which can be regulated through reasonable task design; the second category is caused by external factors, such as the inappropriate presentation of teaching and task design, which is unrelated to the learning content and can be reduced by optimizing teaching methods and simplifying presentation forms; the third category is the effective relevant cognitive load that helps learners understand knowledge and achieve knowledge transfer [5], which can be enhanced by guiding active processing and strengthening knowledge associations. For the teaching of complex sentence structures in English majors, the three-category division of cognitive load has significant guiding significance - reasonably regulating the balance of the three types of cognitive load can effectively reduce the cognitive burden of students when learning complex sentence structures, improve teaching effectiveness, and this is also the core starting point of this research.

3. Theoretical Basis

The core assumption of the cognitive load theory is that limited working memory capacity and cognitive overload can affect learning outcomes. Fred Paas et al. proposed principles for combining the cognitive load theory with instructional design [6]; the School of Education at the University of New South Wales and others further improved the cognitive architecture [3], providing scientific guidance for English language teaching. Tang Jianlan and Zhou Ying believed that achieving rational allocation of cognitive resources through regulating three types of load is the core value of the cognitive load theory [7]; Chen Qiaofen clearly stated that the core essence of the cognitive load theory is "reducing burden and increasing efficiency", providing guidance for the teaching of complex sentence structures in English [8]. Peter C. Gordon et al. discovered that cognitive load and syntactic complexity are positively correlated in the processing of complex sentence structures in English [4]; Yuan Hui and Xu Jian conducted further empirical research to show that the cognitive load in the conception of complex

sentence structures by second language learners has a hierarchical nature [9]. All of these verified the universal applicability of the cognitive load theory.

4. Teaching Status and Analysis of Cognitive Load Issues

4.1 Current Teaching Situation

Currently, in the teaching of complex sentence structures for English major students, teachers mostly adopt the traditional "rule explanation + mechanical practice" model. Although this model enables students to quickly master the basic sentence structure framework, it violates the core requirement of the cognitive load theory, which is "reasonable allocation of cognitive resources", and is difficult to adapt to the cultivation of students' comprehensive application ability. It mainly presents three characteristics. First, it overly focuses on the systematicity of sentence grammar rules, neglecting semantic logic and pragmatic scenarios. It breaks down complex sentence structures into isolated grammar points for explanation, resulting in students' mechanical memorization and inability to understand the contextual functions. It is difficult to achieve knowledge transfer and prone to logical confusion when dealing with multi-layer nested structures, increasing additional cognitive burden [3]. Second, some teachers lack the understanding and application of cognitive laws and the cognitive load theory, and their teaching methods are simple, mostly "teacher explanation, students passively taking notes". They do not decompose complex sentence structures layer by layer, present them visually, or design step-by-step tasks based on students' cognitive levels. This easily leads to cognitive overload or insufficient cognitive load, making it difficult to motivate students to actively participate [1,2]. Third, the evaluation method is single, mainly relying on paper-and-pencil tests, focusing on the memorization and mechanical application of sentence grammar rules, while ignoring students' ability to flexibly apply complex sentence structures in actual scenarios. It solidifies the "rote learning" model, which is not conducive to knowledge internalization and language use improvement. Liu Jinlu and Yang Nan pointed out that students have a deviation in their understanding of the complexity of English grammar and are unable to flexibly apply it [1]. This is closely related to the limitations of the

existing teaching model, essentially reflecting the neglect of students' cognitive load and insufficient regulation.

4.2 Cognitive Load Issue

4.2.1 Inadequate regulation of internal cognitive load

The complexity of English sentence structures inherently carries a high level of internal cognitive load. Their multi-layered nesting and complex semantic associations place high demands on the cognitive processing capabilities of English major students. Currently, some teachers often overlook the differences in students' cognitive abilities and basic levels in their daily teaching, often adopting a "one-size-fits-all" teaching model without designing teaching content or setting learning goals based on students' different levels of foundation. As a result, some students with weak English foundations experience cognitive overload due to difficulty in quickly digesting the complex sentence rules, unable to effectively complete cognitive processing; while some students with strong English foundations encounter insufficient cognitive load due to overly simplistic teaching content, failing to meet their cognitive development needs and unable to achieve deep internalization and transfer of knowledge. Zhang Bijiang proposed that the "flattening" processing of English complex sentence structures can reduce internal cognitive load. By reasonably decomposing sentence structures and clarifying semantic logic, it helps students optimize the cognitive processing process. However, due to the lack of such scientific decomposition and guidance in current teaching, the imbalance of students' cognitive load is further exacerbated [2].

4.2.2 Excessive external cognitive load

Excessive external cognitive load mainly stems from the unreasonable presentation of teaching materials and teaching methods, unrelated to the difficulty of complex sentence structures themselves, but it wastes a large amount of cognitive resources and affects learning outcomes. In the teaching of English complex sentence structures for English majors, improper presentation of teaching materials and teaching methods often lead to excessive external cognitive load. For example, some teachers present teaching content that lacks logical organization, unnecessary word repetition, overly complex and disconnected example sentences that often increase the burden of students in

filtering and processing effective information, occupying a large amount of cognitive resources. At the same time, the traditional "lecture-style" teaching mode forces students to no longer actively accept knowledge and actively engage in cognitive processing, but passively receive information transmitted by teachers, unable to mobilize their own cognitive resources to participate in sentence understanding and application, thereby causing waste of cognitive resources and further exacerbating the imbalance of external cognitive load, hindering the internalization and transfer of complex sentence knowledge.

4.2.3 Lack of relevant cognitive load

Relevant cognitive load is crucial for promoting students' knowledge integration and ability improvement. Reasonable relevant cognitive load can drive students to actively associate previously learned knowledge with new content, achieving pragmatic transfer and the cultivation of metacognitive abilities. However, in the current teaching of English complex sentence structures for English majors, a single and dull grammar rule explanation and mechanical repetition of sentence training remain the teaching focus. This inappropriate teaching orientation often neglects the cultivation of students' knowledge integration, pragmatic transfer, and metacognitive abilities, resulting in some students being unable to effectively utilize the previously learned basic sentence structures and pragmatic knowledge to integrate complex sentence structures with specific pragmatic scenarios, unable to establish internal connections between knowledge, and thus lacking relevant cognitive load for the deep mastery and flexible application of complex sentence knowledge, contrary to the goal of cultivating students' comprehensive pragmatic abilities in English.

4.3 The Causes of Cognitive Load

Currently, some teachers, due to insufficient and incomplete understanding of the cognitive load theory in their teaching, result in their teaching designs lacking specificity, often merely making superficial and general statements; at the same time, because some teachers do not have a sufficient understanding of the cognitive load theory, they occasionally make deviations in setting teaching goals, merely focusing on the simple grammatical rules in sentences and neglecting the cultivation of students' abilities; moreover, some teachers have relatively

simplistic evaluation methods for students both in and outside the classroom, which usually cannot objectively and truly reflect the students' cognitive processes; and because there are certain differences between English and Chinese sentence structures, negative transfer of the mother tongue occurs during the learning process, which to a certain extent increases the cognitive load.

5. Optimization Strategy

5.1 Regulate Internal Cognitive Load and Align with Students' Cognitive Levels

Match the difficulty of teaching tasks with students' cognitive abilities, thereby reducing redundant cognitive load and adapting to students' existing cognition. According to the measurement indicators of Liu Jinlu and Yang Nan, teachers can break down complex sentence structures and divide them into three layers of progressive levels based on the basic, improvement, and application aspects [1]; in addition, based on Zhang Biejiang's "flattening" concept, they can break down relatively complex English nested sentence structures and design layered teaching tasks for different and complex nested sentence structures for teaching purposes, striving to implement individualized teaching [2].

5.2 Reduce External Cognitive Load and Improve Teaching Presentation Methods

In daily English teaching, teachers should try to reduce students' external cognitive load during learning and continuously improve their teaching presentation methods in the classroom. Insights can be gained from the research of Wang Ming and Cao Daoping: Teachers can use some visual teaching tools in the classroom to assist students in further understanding and memorization, such as mind maps, videos, etc., observing students carefully and observing life, and trying to select examples with rich life atmosphere and close to students' daily lives [10]; in addition, based on the sample effect discovered by Fred Paas et al., teachers can provide students with relatively classic examples in daily teaching [6]; at the same time, adopt interactive and inspiring teaching methods, strive to reasonably control the classroom rhythm, actively use educational wit to deal with unexpected situations in the classroom, and effectively prevent the occurrence of cognitive overload in students.

5.3 Strengthen Related Cognitive Load and Promote Knowledge Transfer and Application

In daily teaching, teachers should strive to actively guide students to actively process knowledge, systematically sort out the rules and internal logic of English complex sentence structures, and systematically construct the related knowledge network. The research results of Yuan Hui and Xu Jian also pointed out that it is necessary to actively strengthen pragmatic orientation and promote the transfer of related knowledge through some comprehensive tasks, such as reading, writing, and translation [9].

5.4 Reforming Teaching Evaluation and Strengthening Cognitive Orientation

Teaching evaluation is an important feedback on teaching effectiveness and a key to guiding the direction of teaching. Currently, the teaching evaluation of complex sentence structures in the English major has problems of being monotonous and utilitarian, making it difficult to reflect students' cognitive processes and learning outcomes. Therefore, the teaching evaluation methods should be optimized, and a comprehensive evaluation system combining "process evaluation + terminal evaluation" should be established to strengthen the cognitive orientation of evaluation.

Process evaluation mainly focuses on students' cognitive performance during the learning process of complex sentence structures, including the application of cognitive strategies, the regulation of cognitive load, the processing and construction of knowledge, etc. It can be conducted through classroom observation, homework feedback, group evaluation, and learning logs, etc., to promptly identify students' cognitive problems and provide targeted guidance; Terminal evaluation focuses on students' comprehensive application ability of complex sentence structures and can be conducted in various forms such as writing, translation, and oral expression, with a focus on examining students' ability to flexibly apply complex sentence structures in real communicative scenarios rather than simply memorizing rules. Through comprehensive evaluation, it guides students to pay attention to the improvement of cognitive abilities, actively regulate cognitive load, and achieve "reduction of burden and increase of efficiency" in the learning of complex sentence structures.

6. Conclusion

This article systematically reviews the relevant research on cognitive load theory and the teaching outcomes of complex sentence structures in English, and deeply analyzes the current situation of complex sentence structure teaching for English major students, the problem of cognitive load imbalance, and its causes. It also combines the rules of second language acquisition and grammar teaching to propose targeted teaching optimization strategies. The research shows that applying cognitive load theory to the teaching of complex sentence structures for English majors can effectively regulate internal cognitive load, reduce external cognitive load, and strengthen related cognitive load, providing scientific theoretical support and operational practical paths for solving the problems of complex sentence structure teaching and improving teaching effectiveness. Currently, the exploration of the integration of cognitive load theory and English complex sentence structure teaching in the domestic academic circle has accumulated beneficial experience for grammar teaching reform and the cultivation of students' syntactic abilities. However, due to the complexity of cognitive load regulation and the processing mechanism of complex sentence structures, related research still needs to be further deepened. Future research can be based on cognitive load theory, focus more on the systematic construction and long-term empirical verification of English major complex sentence structure teaching, continuously improve the teaching model, promote teaching innovation, and help English major students break through the bottleneck of complex sentence structure learning and comprehensively enhance their language comprehensive application ability.

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