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WORKING MEMORY, SYNTA, AND ATTENTION: PSYCHOLINGUISTICS INSIGH INTO COGNITIVE LOAD DURING SENTENCE PROCESSING

Desry Nurliana[1], Adrian Prasetya Telaumbanua[2], Muhammad Faiz[3], Yani Lubis[4]
Universitas Islam Negeri Sumatera Utara[1,2,3,4]

desrynurliana19@gmail.com

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Abstract

This study investigates how cognitive load affects learners' sentence processing during English learning, focusing on junior high school students in Medan, Indonesia. Using a qualitative descriptive design within a psycholinguistic framework, data were collected through classroom observations, sentence-based comprehension tasks, and semi-structured interviews with twelve eighth-grade students. The findings revealed that students experienced notable cognitive strain when processing long or syntactically complex English sentences, often manifested through hesitation, rereading, and verbal confusion. Three key aspects emerged: working memory limitation, syntactic complexity awareness, and attention management. Learners with limited working memory struggled to maintain meaning across lengthy sentences, while those with higher syntactic awareness managed complexity more effectively through chunking or focusing on key structures. Attention fluctuations were also observed, influencing comprehension consistency. The study concludes that sentence processing in EFL contexts is shaped by the interaction of cognitive capacity, grammatical understanding, and attentional control. Pedagogically, the findings suggest that English teachers should design learning tasks that minimize unnecessary cognitive load while fostering metacognitive awareness and self-regulation in sentence comprehension.

Keywords: attention management, cognitive load, EFL learners, psycholinguistics, sentence processing, working memory, syntactic awareness

INTRODUCTION

In the dynamic process of learning a language, understanding how learners mentally process sentences is central to grasping the cognitive mechanisms that shape language comprehension and production. Language as a tool of communication has been learned since children were grown. The way to acquire language needs to be explored to guide children's language development. (Ramli et al., 2022). The ability to process and interpret sentences accurately requires the integration of various cognitive skills such as working memory, attention, and linguistic knowledge. In psycholinguistics, this process is often explained through the concept of cognitive load, which refers to the amount of mental effort being used in the working memory at any given time (Mehmood, 2025). When learners encounter complex linguistic structures or unfamiliar vocabulary, their cognitive load increases, affecting their ability to comprehend or produce sentences effectively (Ahmed & Yahya, 2025). Therefore, examining the role of cognitive load in learners' sentence processing provides valuable insights into how mental resources are allocated during language learning, especially among adolescent learners who are still developing both their linguistic and cognitive capacities.

This research focuses on understanding how cognitive load affects sentence processing among junior high school learners in Medan, Indonesia. In many educational contexts, including Indonesian schools, English is taught as a foreign language and often perceived as a cognitively demanding subject (Dewi et al., 2025). Students are required to process linguistic input that differs significantly from their native language structures, which increases the cognitive burden during learning. In the observed context a public junior high school in Medan students often struggle with understanding complex English sentences, particularly those involving subordinate clauses or unfamiliar syntactic patterns. Teachers have reported that students can recognize individual words but face difficulties constructing meaning from longer sentences. This situation highlights the importance of examining sentence processing not merely as a linguistic skill but as a psycholinguistic process influenced by the learners' mental capacity and the cognitive demands of the learning tasks (Malyk, 2024).

The significance of this study lies in its potential to bridge psycholinguistic theory and practical language teaching. While English language instruction in Indonesian schools primarily focuses on grammatical accuracy and vocabulary mastery (Boy Jon et al., 2021), less attention has been given to the cognitive processes underlying comprehension. By analyzing how cognitive load influences sentence processing, this research can provide useful implications for designing classroom tasks that are cognitively manageable yet linguistically effective. Understanding the relationship between task complexity and mental effort can help teachers scaffold learning activities to prevent cognitive overload, allowing students to build comprehension skills more efficiently (Zhao et al., 2024). Moreover, this study contributes to the growing field of educational psycholinguistics, where insights about mental processing are applied to improve teaching methodologies and learning outcomes.

Previous studies have explored various aspects of cognitive load in language learning (Asma & Dallel, 2020). For example, (Brunken et al., 2010) emphasized that learners have a limited working memory capacity, and excessive cognitive demands can hinder learning efficiency. In the context of sentence processing, Linck (2016) found that working memory plays a crucial role in maintaining syntactic and semantic information simultaneously during comprehension. Similarly, Martin & Ellis (2012) highlighted that sentence interpretation relies heavily on the phonological loop and central executive components of working memory.

However, despite the growing literature on cognitive load and sentence processing(Surbakti et al., 2024), few studies have been conducted in the Indonesian EFL context, especially among secondary school learners. Most existing research focuses on university students or adult learners, leaving a gap in understanding how younger learners, who are still developing both cognitive maturity and linguistic awareness, manage the mental demands of English sentence processing. Moreover, the Indonesian language differs syntactically and morphologically from English, which may increase the cognitive demands of understanding English sentences. For instance, Indonesian follows a relatively flexible word order and does not use inflectional endings as extensively as English does. These differences can contribute to higher cognitive load when learners attempt to interpret English syntactic structures. Therefore, investigating this issue among junior high school students in Medan provides a valuable contribution to both local and global discussions on psycholinguistic learning processes.

The focus of this research is to identify and describe how different levels of cognitive load affect students' sentence comprehension and production. Specifically, it seeks to understand which sentence types or task conditions trigger higher mental effort and how this effort influences learning performance. The study also explores whether students with higher working memory capacity demonstrate better comprehension under high cognitive load conditions. By analyzing learners' behavioral responses and comprehension outcomes, this research aims to uncover the psycholinguistic mechanisms that operate when students process sentences under varying degrees of cognitive demand.

The significance of this inquiry extends beyond theoretical understanding. In classroom practice, teachers often assign reading and grammar tasks without considering the cognitive limitations of their students. When tasks are too demanding, students may disengage or resort to rote memorization rather than meaningful processing. On the other hand, tasks that are too simple may not stimulate cognitive growth. Thus, understanding cognitive load dynamics can help teachers calibrate task difficulty, integrate scaffolding techniques, and promote deep learning through manageable challenges. This balance aligns with the psycholinguistic view that successful language learning depends not only on exposure and practice but also on the efficient use of cognitive resources.

METHOD

This study employed a qualitative descriptive design grounded in a psycholinguistic perspective to explore how cognitive load shapes learners' sentence processing during English language learning. The qualitative approach was chosen because the study aimed to understand the internal mental experiences and strategies that learners employ when processing sentences under varying cognitive demands, rather than to measure statistical relationships or numerical differences (Creswell & Creswell, 2017). Within the field of psycholinguistics, qualitative inquiry allows researchers to access the mental and behavioral dimensions of language comprehension that cannot be captured solely through quantitative instruments.

The design focused on eliciting rich, in-depth descriptions of learners' thought processes, difficulties, and coping mechanisms during classroom sentence comprehension activities. By focusing on natural classroom interaction, the study sought to uncover how cognitive load manifests in observable behavior such as hesitation, rereading, or verbal confusion and in learners' self-reported reflections about task difficulty. This design was particularly suited to the study's context in an Indonesian junior high school, where learners are still developing foundational linguistic and cognitive skills.

Participants

The participants in this study were twelve eighth-grade students from one of junior high school in Medan, North Sumatra, Indonesia. They were selected using purposive sampling, based on recommendations from the English teacher who identified students with intermediate English proficiency and varied academic performance. The selected group consisted of six male and six female students aged between 13 and 14 years old. These students had been learning English for at least three years and were considered capable of engaging in reflective discussions about their learning experiences.

The choice of this group was motivated by their familiarity with basic English grammar but evident difficulty in processing complex sentence structures, which provided an ideal context for observing cognitive load effects. The school is located in an urban area of Medan where English is taught as a foreign language, primarily for academic purposes. All participants provided informed consent, and permission was obtained from the school administration and parents before the research. The study adhered to ethical considerations including voluntary participation, anonymity, and confidentiality.

Instruments

The main instruments used in this research were classroom observation sheets, sentence-based learning tasks, and semi-structured interviews. The observation sheet was designed to capture behavioral indicators of cognitive load such as signs of confusion, rereading, hesitation, or self-correction while completing English sentence tasks. The sentence-based tasks functioned as a stimulus to elicit natural sentence processing behavior; they consisted of short reading comprehension exercises containing both simple and complex English sentences. The semi-structured interviews served as the primary source of qualitative data, providing access to learners' reflections and mental experiences during task performance. The interview guide included open-ended questions focusing on students' perceptions of task difficulty, strategies used to understand the sentences, moments when they felt mentally overwhelmed, and how they managed comprehension under such conditions. The combination of classroom observation and interviews allowed for data triangulation between external behaviors and internal cognitive experiences.

Data Collection

Data collection was conducted over two consecutive weeks in the participants' English classroom. The researcher collaborated with the English teacher to integrate the sentence processing activities naturally within ongoing lessons, ensuring that students remained in a familiar learning environment. Each session began with short reading tasks where students were asked to comprehend and respond to English sentences of varying complexity. During these activities, the researcher acted as a non-participatory observer, documenting verbal and non-verbal indicators of mental effort. For instance, instances of long pauses, repeated reading of the same line, or verbal expressions of confusion ("Miss, what does this mean?") were noted as possible reflections of cognitive load in action.

After each session, the researcher selected several students for brief reflective interviews. These interviews were conducted individually in a quiet corner of the classroom to maintain comfort and authenticity. Students were

encouraged to speak in Indonesian to freely express their thoughts. The interviews typically lasted between 10 to 15 minutes, allowing students to describe what they found easy or difficult, which sentences took more time to understand, and what mental or linguistic strategies they used. Throughout this process, the researcher maintained a reflective field journal to record contextual details, emotional cues, and spontaneous remarks that enriched the interpretive understanding of learners' cognitive experiences. This approach ensured that the collected data represented not only the observable effects of cognitive load but also the subjective, introspective dimension s of learners' experiences. By situating data collection within real classroom activities, the study captured the authentic interaction between mental effort and sentence comprehension as it naturally unfolded in the learning process.

Data Analysis

Data analysis followed a thematic qualitative approach, emphasizing interpretation over measurement. The researcher began by transcribing the interview recordings and compiling observation notes into a unified dataset. The data were then repeatedly read to identify recurring patterns and meaningful segments related to cognitive load during sentence processing. The coding process involved labelling excerpts that indicated moments of mental struggle, processing strategies, and shifts in comprehension behavior. For example, statements like "aku harus membacanya dua kali panjang sekali" (I had to read it twice because it was too long) or "aku coba terjemahkan dulu di kepalaku"(I tried to translate it in my head first) were coded under themes such as mental effort, repetition as a strategy, and translation-based processing.

As themes emerged, the researcher categorized them into broader conceptual groups aligned with psycholinguistic constructs such as working memory limitation, syntactic complexity awareness, and attention management. These thematic categories were then analyzed in relation to observation data to ensure interpretive coherence. Observational patterns like extended silence or visible frustration were cross-referenced with interview statements describing mental fatigue or confusion, thereby validating the findings through triangulation. The interpretive stage of analysis aimed to link students' lived experiences with theoretical explanations of cognitive load. Through this analysis, the study sought to illuminate how learners' subjective perceptions of difficulty correspond to the psycholinguistic realities of limited cognitive capacity.

Rather than seeking generalizable results, the qualitative analysis provided deep insights into the internal and behavioral manifestations of cognitive load among junior high school learners. This process revealed not only how learners struggled with complex English sentences but also how they consciously adapted their comprehension strategies to manage cognitive pressure.

FINDINGS AND DISCUSSION

The findings of this study revealed that learners experienced varying degrees of cognitive load during sentence processing, particularly when encountering complex grammatical structures or unfamiliar vocabulary. Most students demonstrated visible signs of mental strain such as long pauses, rereading sentences, or asking clarification questions when faced with compound or passive constructions. In contrast, when presented with simpler, familiar sentence patterns, students processed meaning more quickly and with greater confidence. Observations also showed that moments of hesitation often occurred mid-sentence, especially when students attempted to mentally translate English sentences into Indonesian. These behavioral indicators reflected the shifting mental effort students exerted depending on sentence complexity and familiarity.

Further insights emerged from students' self-reported reflections during interviews, where they described their struggles with understanding lengthy or syntactically complex sentences. Several students mentioned needing to reread sentences multiple times or translate them word by word to make sense of the meaning. Some reported feeling "mentally tired" after processing longer tasks, indicating the presence of cognitive overload. Students also shared that they often lost track of sentence meaning midway, forcing them to restart the comprehension process. Despite these challenges, many showed awareness of their limitations and expressed attempts to regulate their effort, such as taking short pauses or focusing on key words to reduce confusion.

The data indicated that students' ability to process English sentences was strongly influenced by the interaction between sentence length, structure, and individual coping strategies. The combination of behavioral observations and interview data suggested that when cognitive demands exceeded learners' processing capacity, their comprehension performance decreased noticeably. However, the findings also revealed instances of adaptive

behavior, where students developed spontaneous strategies like simplifying the meaning, rephrasing in their own words, or skipping difficult parts to maintain understanding. These findings highlight the dynamic nature of cognitive load in real classroom contexts, showing that learners continuously adjust their mental effort in response to linguistic challenges during sentence comprehension.

Working Memory Limitations

The results of this study revealed that the limitation of working memory is one of the strongest determinants of students' success or failure in sentence processing. During the classroom activities, learners often struggled to retain the beginning of long sentences while trying to comprehend their endings. This aligns with Demir (2021) model of working memory, which posits that information must be temporarily stored and manipulated during language comprehension. However, when the sentence length or grammatical complexity exceeds the learner's capacity, the stored information decays quickly, resulting in partial or distorted understanding. In the observed classroom context, several students showed visible signs of this limitation, such as rereading the same sentence multiple times, stopping midway to recall earlier parts, or even asking the teacher to repeat the sentence.

One student said during the interview "Aku harus baca dua kali karena kalimatnya panjang banget, pas di tengah aku lupa awalnya ngomong apa." "I had to read it twice because the sentence was really long in the middle, I forgot what it said at the beginning." This statement vividly illustrates the transitory nature of working memory in second language comprehension. The student's inability to maintain sentence meaning throughout processing reflects the cognitive overload caused by limited memory span. In psycholinguistic terms, learners must allocate part of their cognitive resources to decoding words and syntax, leaving less capacity for retaining the earlier segments of the sentence.

Moreover, classroom observations confirmed that this limitation was particularly pronounced during reading tasks that involved complex or unfamiliar vocabulary. Students tended to pause and subvocalize words, signaling that much of their working memory was occupied by decoding lexical items rather than constructing sentence meaning. When this happens, the central executive function of working memory responsible for coordinating attention and retrieval becomes overloaded. Consequently, comprehension is interrupted, forcing students to restart their reading.

Interestingly, several students developed spontaneous coping strategies to overcome memory constraints. They used gestures, whispering repetition, or summarizing aloud to keep track of meaning. For instance, one student was noted whispering, "Oh, ini tentang hewan… terus, apa tadi?" ("Oh, this is about animals… then, what was it again?"), which reflects an attempt to maintain information through rehearsal. Such behaviors support Brunken et al. (2010) cognitive load theory, emphasizing that when intrinsic and extraneous loads are too high, learners rely on self-regulation to stabilize processing. In short, the findings suggest that working memory limitation is not merely a passive barrier but an active cognitive battleground where learners negotiate meaning using compensatory strategies.

Syntactic Complexity Awareness

Another major finding of this study concerns learners' awareness of syntactic complexity and its influence on comprehension. Students consistently found sentences with embedded clauses, passive voice, or relative pronouns ("who," "which," "that") to be more mentally taxing than simple ones. This corresponds with capacity theory of comprehension, which suggests that syntactic processing requires simultaneous storage and integration of multiple linguistic elements. When learners encounter a sentence containing nested or unfamiliar grammatical structures, they must hold several parts in mind while parsing new information a task that heavily taxes cognitive capacity.

During interviews, many students reported losing track of sentence meaning because they could not identify the grammatical relationships among the words. One student explained "Kalimat yang ada dua 'yang'-nya itu bikin pusing, aku bingung siapa yang melakukan apa."

"Sentences with two 'that' parts make me confused, I don't know who is doing what." This reflection indicates limited syntactic awareness. The student recognizes that something about the structure is difficult, but cannot articulate the grammatical cause. Such findings highlight how learners' syntactic knowledge and metalinguistic awareness are crucial in reducing cognitive burden. Students with better grammatical awareness demonstrated higher accuracy and faster comprehension, even when facing complex structures. For instance, one more proficient learner mentioned "Kalimatnya panjang tapi aku potong-potong di kepala, jadi tahu mana subjek dan

predikatnya.”“The sentence was long, but I divided it in my head, so I could see which part was the subject and which was the predicate.” This indicates an intuitive syntactic segmentation strategy, a psycholinguistic process where learners reorganize complex input into manageable chunks to aid comprehension.

Observation data supported these self-reports. Students who lacked syntactic awareness tended to focus only on individual words, failing to integrate them into coherent sentence meaning. Conversely, those aware of grammatical functions showed fewer signs of confusion and completed tasks more efficiently. This difference underscores the pedagogical importance of teaching grammar not merely as rules but as cognitive tools for meaning-making. Syntactic complexity awareness functions as a bridge between linguistic knowledge and cognitive efficiency, allowing learners to manage complexity proactively rather than reactively (Jaya, 2025).

Attention Management

The third theme that emerged from the data involves how learners manage their attention during sentence comprehension. Attention acts as the cognitive gatekeeper that determines which linguistic information enters working memory. In the observed English classroom, attention fluctuations were frequent and closely tied to task difficulty. When students encountered sentences that were too long or abstract, they often lost focus, skipped lines, or became disengaged. This behavioral evidence supports the notion that high cognitive load competes with attentional control, making it difficult for learners to maintain sustained focus.

In interviews, students described their struggle to stay attentive when sentences were dense or required translation. One student noted “Kalau kalimatnya panjang dan banyak kata susah, aku suka hilang fokus, jadi nggak ngerti semuanya.” “When the sentence is long and has many difficult words, I lose focus and don’t understand the whole thing.” This self-report reflects attention drift, a psycholinguistic phenomenon where excessive cognitive effort reduces attentional endurance. The more mental energy students spend decoding words, the less they can sustain global comprehension. However, some students demonstrated awareness of their attentional lapses and employed corrective strategies. Another student said “Kalau mulai nggak fokus, aku ulang dari awal tapi baca pelan-pelan supaya ngerti.” “When I start to lose focus, I go back to the beginning and read slowly to understand.” Such self-regulatory behaviors align with the executive attention model, which views attention as a limited but trainable resource that interacts with working memory. By consciously slowing down or rereading, students attempt to reallocate mental resources to regain comprehension.

Observational data revealed that successful learners were those who maintained a steady rhythm of attention, often using gestures, underlining, or subvocal rehearsal to keep engagement consistent. Those who failed to manage attention tended to exhibit fragmented understanding, skipping key syntactic cues. This suggests that attention management is not separate from working memory it is its gatekeeper. When attention collapses, even adequate memory capacity cannot ensure comprehension. Attention management emerged as both a challenge and a skill among junior high school learners. The findings show that students’ ability to monitor and redirect attention under cognitive strain determines how effectively they process English sentences. Enhancing learners’ metacognitive control over attention through structured reading strategies and guided self-awareness could thus substantially reduce cognitive load in EFL classrooms.

CONCLUSION

This study has demonstrated that cognitive load plays a decisive role in shaping junior high school learners’ ability to process English sentences in a foreign language context. The qualitative findings revealed that students’ comprehension difficulties often stem from the limitations of working memory, the complexity of sentence structure, and the challenge of sustaining attention throughout processing. Learners exhibited various behavioral signs of mental effort such as rereading, hesitating, and pausing, all of which reflect the cognitive strain imposed by syntactic and lexical demands. Importantly, the study uncovered that these challenges are not purely obstacles but also opportunities for learners to develop adaptive strategies. Many students displayed awareness of their cognitive limitations and engaged in compensatory actions such as rereading slowly, chunking sentences, focusing on key words, or translating mentally into their first language.

The interplay among working memory limitation, syntactic complexity awareness, and attention management illustrates the multidimensional nature of sentence processing in EFL contexts. When sentence structures became longer or grammatically intricate, learners’ working memory often reached its capacity limit, leading to breakdowns in understanding. However, those who possessed better syntactic awareness or self-regulated attention

were able to reduce cognitive load and maintain comprehension. These findings provide pedagogical implications for language teaching in Indonesian classrooms, where English exposure is still limited. Teachers should carefully balance linguistic difficulty with cognitive manageability, use scaffolded instruction, and integrate reflective learning tasks that help students become more aware of how they think and process sentences. By addressing the cognitive dimensions of language learning, educators can support students not only in mastering grammar and vocabulary but also in developing sustainable mental strategies for comprehension. Ultimately, this study reinforces that effective language learning is as much about managing the mind as it is about mastering linguistic form.

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