

Cognitive Processing of Meaning in Language in Brain during English Comprehension

Ira Tiara Rahayu¹, Lusiana Suciati Dewi²

¹²Universitas Subang

Corresponding Author's E-mail: iratiaraaxx@gmail.com

Abstract

Language is a complex cognitive system that functions not only as a means of communication but also as a mental process occurring in the human brain. This study examines the cognitive processing of meaning within a linguistic framework in the brain during English comprehension among English as a Foreign Language (EFL) learners. The study focuses on how learners actively process and construct meaning when exposed to English input. From a neurocognitive perspective, this process involves the interaction of multiple brain regions responsible for language processing, memory retrieval, semantic interpretation, and contextual integration, indicating that comprehension is supported by distributed neural networks rather than a single localized area. The study uses a qualitative approach with a think-aloud protocol to capture learners' cognitive processes in real-time while completing a video-based comprehension task. The findings indicate that comprehension involves dynamic cognitive activities such as translating, inferring meaning, predicting content, and utilizing contextual and visual cues. These processes demonstrate that language comprehension is not passive but requires active mental engagement and the integration of prior knowledge with new input. In addition, the brain continuously coordinates these processes through simultaneous neural activation, enabling learners to construct meaning efficiently. The study highlights that multiple cognitive mechanisms operate simultaneously in the brain during language comprehension. Furthermore, the study emphasizes the importance of focusing on learners' internal processing rather than solely on the final comprehension outcome. The results provide deeper insights into how language is processed in the brain and suggest that teaching strategies should align with brain-based learning principles, supporting active cognitive engagement to enhance the effectiveness of language learning.

Keywords: *language in the brain, cognitive processing, English comprehension.*

INTRODUCTION

Language is widely recognized as a complex cognitive system that extends beyond its role as a medium of communication. It represents a dynamic mental process that takes place within the human brain, involving the interaction of perception, memory, attention, and interpretation. In the perspective of language in the brain, understanding language is not a passive activity but an active cognitive process in which individuals continuously construct meaning from linguistic input. This process is supported by interconnected neural networks in the brain, where different

regions collaborate to process sounds, recognize words, interpret meanings, and integrate contextual information in real time.

When learners engage with a second or foreign language such as English, they must process unfamiliar structures, decode meanings, and integrate new information with their existing knowledge, all of which occur simultaneously within the brain. Neurologically, this involves the activation of multiple brain areas responsible for phonological processing, semantic interpretation, working memory, and executive control. The process of comprehending language involves several stages, including receiving input, transforming it into meaningful information, and producing responses, when necessary, all of which are coordinated through rapid neural signaling.

The concept of comprehensible input suggests that learners acquire language when they are exposed to input that is slightly beyond their current level but still understandable through context and prior knowledge. However, not all input is automatically processed; only the portion that receives attention and is cognitively processed becomes meaningful for language development. From a brain-based perspective, attention plays a crucial role in determining which linguistic input is selected for deeper neural processing and stored in memory.

From a neurolinguistic perspective, language comprehension engages multiple areas of the brain that work together to process syntax, semantics, and contextual information. These processes are highly complex and occur rapidly, involving continuous interaction between memory systems and higher-order cognitive functions. As a result, many studies in English as Foreign Language (EFL) contexts tend to focus on observable outcomes, such as correct or incorrect answers, rather than exploring how learners arrive at those answers. This creates a gap in understanding the actual mental processes that underlie language comprehension.

To address this limitation, researchers have increasingly turned to methods that allow access to learners' internal cognitive activities. One such method is the think-aloud protocol, which enables participants to verbalize their thoughts while performing a task. This approach provides valuable insights into the strategies learners use, such as translating, making inferences, predicting meanings, and relying on contextual or visual cues. These strategies reflect underlying neural processes in which the brain actively organizes, evaluates, and integrates information to construct meaning.

By capturing these real-time thought processes, researchers can better understand how meaning is constructed in the brain during language comprehension. Based on this background, this study aims to investigate how learners process meaning during English comprehension within the framework of language in the brain. Specifically, it seeks to identify the cognitive strategies employed by learners and to describe how these strategies contribute to the construction of meaning. By focusing on the internal processes of comprehension, this study is expected to provide a more comprehensive understanding of how language is processed in the brain and to offer

insights that can inform more effective language teaching practices, particularly those aligned with brain-based learning principles.

RESEARCH METHODOLOGY

This study employed a qualitative descriptive research design to explore cognitive processing of meaning within the framework of language in the brain during English comprehension. The research focused on identifying learners' internal cognitive processes and strategies as they engaged with English-language input.

The subjects of this study were EFL learners selected using purposive sampling, based on their intermediate level of English proficiency. A small group of participants was chosen to allow for in-depth analysis of individual cognitive processes. The main instrument used in this study was the think-aloud protocol, supported by video-based comprehension tasks designed to stimulate natural language processing activities.

The research procedure consisted of three main stages. First, participants were given instructions and brief training on how to verbalize their thoughts while completing tasks. Second, they were asked to watch English-language videos and simultaneously express their thoughts in real time. Third, follow-up clarification was conducted when necessary to ensure the accuracy of the verbalized data.

Data were collected through audio recordings of participants' verbalizations during the think-aloud sessions. These recordings were then transcribed for analysis. The data analysis was conducted using thematic analysis, focusing on identifying patterns of cognitive strategies such as translation, inference, prediction, and the use of contextual and visual cues.

FINDINGS AND DISCUSSIONS

FINDINGS

The findings were interpreted to describe how learners process meaning in the brain during English comprehension.

This study reveals that English comprehension is a dynamic cognitive process in which learners actively construct meaning through the interaction of multiple strategies operating in the brain. The data obtained from observation sheets and think-aloud transcripts show that both participants, Kalip and Sifa, were able to grasp the general idea of the video, indicating that global comprehension was successfully achieved. Kalip demonstrated a very high frequency in identifying the main idea (4), while Sifa showed a slightly lower but still strong frequency (3). This suggests that both learners were capable of processing macro-level meaning despite encountering some linguistic challenges.

To provide a clearer overview of learners' cognitive behavior, the observation results are summarized in the following table:

Table 1 Comparison of Cognitive Strategy Use

Cognitive Strategy	Kali p	Sif a
Identifying main idea	4	3
Difficulty in understanding	2	2
Use of translation (L1)	3	2
Guessing meaning from context	3	3
Use of visual cues	4	3
Ignoring unknown words	2	3
Pausing during thinking	3	3
Use of fillers	3	2
Self-correction	3	3

The table illustrates that both learners relied on a combination of strategies rather than a single dominant approach. Visual cues emerged as one of the most significant supports, particularly for Kalip (frequency 4), who explicitly stated that images, gestures, and situations in the video were “very helpful.” Sifa also confirmed this, indicating agreement that visual elements facilitated comprehension. This finding highlights that language processing in the brain is not limited to linguistic input alone but is strongly influenced by multimodal information, allowing learners to compensate for limited vocabulary knowledge.

Translation into the first language was another prominent strategy, especially for Kalip. The think-aloud data show that both learners consciously translated English into Indonesian in their minds to aid understanding. However, translation was not used in isolation. It was combined with contextual guessing, as both participants reported inferring the meaning of unfamiliar words. This indicates that learners engage in flexible cognitive processing, switching between strategies depending on the level of difficulty they encounter.

The transcripts also reveal how meaning is constructed through interpretation and prior knowledge activation. Kalip interpreted the video as a description of a new work environment, while Sifa connected it to everyday life and a new job context.

These responses demonstrate that comprehension involves integrating incoming input with existing cognitive schemas stored in memory. This process reflects higher-level cognitive functioning in which learners do not merely decode language but actively interpret and personalize meaning.

In addition, both participants exhibited signs of real-time cognitive monitoring, such as pausing, using fillers, and performing self-correction. These behaviors indicate that the brain continuously evaluates comprehension and adjusts processing strategies when difficulties arise. Although both learners reported experiencing some confusion, the relatively low frequency (2) suggests that comprehension breakdowns were manageable and did not significantly hinder overall understanding.

The presence of a mixed strategy pattern in both participants further supports the idea that language processing is non-linear and simultaneous. Translation, inference, and visual interpretation were used together rather than sequentially, reflecting the complexity of cognitive activity in the brain. This finding aligns with the concept that comprehension is an active mental process involving multiple interconnected mechanisms working at the same time.

Overall, the findings demonstrate that English comprehension in an EFL context is not a passive reception of information but an active, strategic, and cognitively demanding process. Learners rely on a combination of linguistic knowledge, contextual clues, visual input, and prior experience to construct meaning. These results emphasize the importance of designing learning environments that support rich input and encourage the use of diverse cognitive strategies, as such conditions can enhance the effectiveness of language processing in the brain.

DISCUSSIONS

The findings of this study highlight that English comprehension is fundamentally an active cognitive process that occurs within the brain, where multiple strategies are employed simultaneously to construct meaning. The learners did not rely on a single approach; instead, they demonstrated a flexible and adaptive use of strategies such as translation, contextual guessing, and the use of visual cues. This supports the concept of language in the brain, which views language understanding as a dynamic interaction between linguistic input and cognitive mechanisms including attention, memory, and interpretation.

One of the most prominent aspects observed is the continued role of first language (L1) translation in supporting comprehension. Although modern language learning theories often encourage minimizing dependence on L1, the findings suggest that translation remains a useful cognitive scaffold, particularly when learners encounter unfamiliar vocabulary. However, translation was not used in isolation. It functioned alongside other strategies, indicating that learners are capable of shifting between different cognitive processes depending on task demands. This reflects a more nuanced view of bilingual processing, where L1 serves as a supportive rather

than inhibiting factor in meaning construction.

Another important point is the significant role of contextual and visual information in facilitating comprehension. Both learners relied heavily on images, gestures, and situational context to interpret meaning. This indicates that language processing in the brain is inherently multimodal, integrating verbal and non-verbal information simultaneously. Such findings reinforce the idea that comprehension is not solely dependent on linguistic knowledge but also on the ability to interpret contextual cues, which can compensate for gaps in vocabulary or grammatical understanding.

The use of inference as a strategy further demonstrates higher-level cognitive engagement. When learners guessed the meaning of unfamiliar words, they were actively forming hypotheses and testing them against the context. This process requires not only linguistic knowledge but also critical thinking and prediction skills. It shows that learners are not passive recipients of input; instead, they are actively involved in constructing meaning through continuous mental effort.

In addition, the presence of pauses, fillers, and self-correction indicates that learners engage in ongoing monitoring and evaluation of their comprehension. These behaviors reflect metacognitive awareness, where learners recognize difficulties and attempt to resolve them in real time. This aligns with cognitive theories that emphasize the importance of self-regulation in learning, as learners must constantly assess whether their understanding is accurate and adjust their strategies accordingly.

The relatively low level of reported confusion suggests that the combination of strategies used was effective in supporting comprehension. Even when difficulties arose, learners were able to manage them through strategic processing rather than experiencing complete breakdowns in understanding. This further supports the idea that successful comprehension depends not only on language proficiency but also on the ability to employ appropriate cognitive strategies.

Overall, the discussion underscores that language comprehension in an EFL context involves complex, interconnected cognitive processes. Learners actively integrate prior knowledge, linguistic input, and contextual information while continuously monitoring their understanding. These findings suggest that language instruction should move beyond focusing solely on correct answers and instead emphasize the development of cognitive and metacognitive strategies. By encouraging learners to actively engage with input and utilize multiple strategies, educators can better support the natural processes of language in the brain and enhance overall comprehension skills.

CONCLUSION AND SUGGESTIONS

CONCLUSION

This study concludes that English comprehension among EFL learners is a complex and active cognitive process that occurs within the brain, involving the

simultaneous use of multiple strategies to construct meaning. Learners do not passively receive information; instead, they actively engage in processing input through translation, contextual guessing, and the use of visual cues. These strategies work together in a flexible and dynamic manner, reflecting the non-linear nature of language processing in the brain.

The findings show that learners are able to grasp the main idea of the video despite encountering some difficulties, indicating that successful comprehension does not solely depend on full linguistic understanding but also on the effective use of cognitive strategies. Translation into the first language remains a supportive tool, while contextual and visual information play a crucial role in helping learners interpret meaning. Additionally, the presence of pauses, self-correction, and inference demonstrates that learners continuously monitor and adjust their understanding during the comprehension process.

Overall, this study highlights that language comprehension is an interactive mental activity that integrates prior knowledge, input, and cognitive strategies. Therefore, language learning should emphasize not only outcomes but also the processes that occur in the learner's mind. Encouraging the use of diverse cognitive strategies and providing rich, context-based input can enhance learners' ability to process and understand language more effectively.

SUGGESTIONS

Based on the findings of this study, several suggestions are proposed. First, English lecturers are encouraged to implement teaching strategies that support students' cognitive processing during English comprehension. Learning activities should promote active meaning construction through contextualized reading and listening tasks, vocabulary enrichment, critical thinking exercises, and opportunities for discussion and reflection. These approaches may help students process linguistic information more effectively and improve their overall comprehension. Second, students are encouraged to strengthen their English comprehension by engaging in regular reading and listening activities, expanding their vocabulary, and applying cognitive strategies such as predicting, inferencing, summarizing, and monitoring their own understanding. Developing these strategies can facilitate deeper processing of meaning and enhance language comprehension.

Finally, future researchers are recommended to investigate cognitive processing in English comprehension using broader participant groups, different educational levels, or cross-cultural contexts. Future studies may also examine the influence of cognitive factors such as working memory, attention, metacognitive awareness, and language proficiency on English comprehension. In addition, employing neurocognitive methods, such as eye-tracking, electroencephalography (EEG), or functional magnetic resonance imaging (fMRI), may provide deeper insights into how the brain processes linguistic meaning during English comprehension.

REFERENCES

- Afrianto. (2018). ENGLISH LANGUAGE TEACHING AND RESEARCH Being a Professional Teacher in the Era of Industrial Revolution 4.0: Opportunities, Challenges and Strategies for Innovative Classroom Practices Afrianto Faculty of Teachers Training and Education (FKIP), Universitas. *English Language Teaching and Research*, 2(1), 1–13.
- Anggraeni, C. W. (2018). Promoting Education 4.0 in English for Survival Class: What are the Challenges? *Metathesis: Journal of English Language, Literature, and Teaching*, 2(1), 12. <https://doi.org/10.31002/metathesis.v2i1.676>.
- Bautista, A., & Oretga-Ruiz, R. (2015). Teacher Professional Development: International Perspectives and Approaches. *Psychology, Society, & Education*, 7(3), 240–251. <https://doi.org/10.25115/psye.v7i3.1020>.
- Lisnawati, I. (2019). The Professionalism of Indonesian Teachers in The Future. *JETL (Journal of Education, Teaching and Learning)*, 3(1), 28. <https://doi.org/10.26737/jetl.v1i1.458>.
- Petrie, K., McGee, C., & Petrie, K. (2012). Teacher Professional Development: Who is the learner ? 37(2).
- Tanang, H., & Abu, B. (2014). Teacher Professionalism and Professional Development Practices in South Sulawesi, Indonesia. *Journal of Curriculum and Teaching*, 3(2), 25–42. <https://doi.org/10.5430/jct.v3n2p25>.