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Utilizing Cognitive Flexibility Theory to Promote EFL Postgraduates' Academic Reading Comprehension and Selective Attention

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Abstract

The present study investigated the impact of Cognitive Flexibility Theory (CFT) in promoting EFL academic reading comprehension and selective attention for EFL postgraduate students. The participants were fifty-eight (n=58) postgraduate students enrolled in an EFL pre-MA program in the Faculty of Specific Education in the academic year (2023-2024). Participants were divided equally and randomly into experimental (n=29) and control (n=29) groups. The study adopted a quasi-experimental design with two instruments prepared by the researcher. The instruments of the study included an academic reading comprehension test and a selective attention scale. Both instruments were pre- and post- administered to the study participants and pre-and post- the CFT-intervention. T-tests for independent and paired samples were calculated in addition to Black 's formula to measure the gain ratio of the overall intervention. The results demonstrated significant improvements in academic reading comprehension and selective attention for the experimental group compared to control group, highlighting CFT's effectiveness in promoting EFL academic reading comprehension and selective attention for postgraduate students.

Key Words: *Cognitive Flexibility – Academic Reading Comprehension – Selective Attention – EFL Postgraduates*

استخدام نظرية المرونة المعرفية في تحسين الفهم القرائي الأكاديمي باللغة الإنجليزية والإنتباه الإنتقائي لدى طلاب الدراسات العليا

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مستخلـص

هـدفت الدراسة الحالية إلى تحسين الفهم القرائي الأكاديمي باللغة الإنجليزية والإنتباه الإنتقائي لدى طلاب الدراسات العليا بالسنة الثانية ببرنامج مناهج وطرق تدريس اللغة الإنجليزية بكلية التربية النوعية في العام الأكاديمي (٢٠٢٣-٢٠٢٤) وذلك بتوظيف تعلّم قائم على نظرية المرونة المعرفية. وطُبقت الدراسة على عينة قِوامها ثمانية وخمسون طالباً ، مقسمين عشوائياً إلى مجموعتين متساويتين ، مجموعة تجريبة (٢٩) تلقّت تعلم قائم على المرونـة المعرفيـة ، ومجموعة ضابطة (٢٩) تلقت التدريس المعتاد. واستخدمت الدراسة أدوات تمثلت في اختبار الفهم القرائي الأكاديمي ، ومقياس متدرج لقياس الإنتباه الإنتقائي (أعدّهما الباحث). وأجرت الدراسة **اختبار (ت)** للمقارنة بين متوسطات المجموعتين المشاركتين في الدراسة ، كما أُجريت معادلة '**بلاك**' للتحقق من فعـالية المعالجة التدريسية المقدمة. وأسفرت نتائج الدراسة عن فروق دالة إحصائياً بين متوسطات درجات التطبيق القبلي والبعدي لاختبارات الدراسة للمجموعة التجريبية لصالح التطبيق البعدي ، كما وجدت فروق دالة حصائياً بين متوسطات درجات طلاب المجموعة التجريبية والمجموعة الضابطة في التطبيق البعدي لاختبارات الدراسة لصالح المجموعة التجريبية. وأثبتت نتائج الدراسة أن توظيف المرونة المعرفية فعـّالاً في تحسين الفهم القرائي الأكاديمي باللغة الإنجليزية وكذلك الإنتباه الإنتقائي لدى طلاب الدراسات العليا.

الكلمات المفتاحية : المرونة المعرفية – الفهم القرائي الأكاديمي – الإنتباه الإنتقائي – طلاب الدراسات العليا

Introduction

EFL academic reading comprehension is the centerpiece in academic development, achievement and excellence. Comprehension, generally, within EFL reading process, entails extraction and reconstruction of the meaning presented, bringing about the formation of mental representations a reader constructs internalization of thoughts, concepts, information, and knowledge especially when tackling informational discourse or academic material. Therefore, academic reading comprehension is mainly discipline-specific and context-dependent varying according to the nature and content of the subject matter and based on academic language. It does require 'cognitive juggling' readers to be skilled and effective deploying strategic reading practices in order to elicit, reconstruct, and represent interdisciplinary meaning from multiple written sources and genres. Regarding these features and the ultimate targeted academic meaning-construction, prior knowledge and existing background have to be optimized to enable the reader to successfully interact, manipulate and respond to challenging academic material to decode the text, synthesize information and engage in scholarly discourse.

Teaching EFL academic reading comprehension skills requires a multifaceted approach that integrates cognitive, linguistic, and strategic elements, enabling students to navigate complex academic texts effectively. Jo (2021) and Minsyzbayeva and Kassymova (2024) underscore the necessity of explicit instruction in academic vocabulary and syntactic knowledge to support comprehension, warning against oversimplification that may hinder progress in dealing with complex academic material. Further, Hasan, Seraj and Shabdin (2016) confirmed strong positive correlation between the depth of vocabulary knowledge with reading academic texts for EFL learners. Academic reading emphasizes extracting essential ideas while engaging with discipline-specific vocabulary and structures, which often challenge EFL learners (Nergis, 2013; Zipoli, 2016). Effective instruction incorporates foundational cognitive skills, such as decoding and fluency, with advanced strategies like critical analysis and metacognitive regulation, facilitating both literal and inferential comprehension (Swanson, Howard, & Saez, 2017).

Research highlights the importance of teaching learners to use strategies like skimming, scanning, information allocation, situational details extraction, and contextual analysis to foster reading efficiency and enhance self-regulation during reading (Saengpakdeejit & Intaraprasert, 2014). Effective teaching materials, combining authentic and adapted texts, provide meaningful practice and help learners engage actively with planned reading tasks which scaffold learners' engagement with texts, activating prior knowledge, fostering analysis, and consolidating understanding (Escudero, Cruz, & Méndez, 2015; Lopera, 2012). By addressing linguistic barriers

and cognitive challenges, educators can create a supportive environment that empowers EFL learners to excel in academic reading tasks, develop lifelong learning habits, and achieve their academic goals (El-Koumy, 2019; Minsyzbayeva & Kassymova, 2024).

Challenges of EFL academic reading comprehension are varied and interrelated and they hinder the EFL postgraduate learners to purposefully deconstruct and reconstruct the academic material. Nejadghanbar, Atai, and Snow, (2022) identified eight key challenges impacting academic reading comprehension among students: time constraints, inadequate information literacy skills, deficiencies in critical literacy abilities, insufficient content knowledge of the subject matter, difficulties navigating diverse writing styles and textual conventions, unclear expectations and ambiguous instructions from instructors, a lack of statistical literacy, and limited opportunities for collaborative learning through peer interaction. Consequently, the difficulties students encounter in academic reading are not solely attributable to linguistic proficiency or a lack of familiarity with genre conventions. The complex and discipline-specific nature of academic reading introduces a multifaceted range of obstacles and difficulties for learners, extending even to the postgraduate level (Johnson, 2017). Additionally, limited exposure to advanced cognitive skills and strategies is also challenging for EFL learners while processing academic comprehension which necessitates recalling and integrating prior knowledge to form coherent interpretation. This requires an understanding of the cognitive processes that support overall comprehension, including *selective attention*, which plays a crucial role in filtering and prioritizing information within texts (Richards & Schmidt, 2013; Sajid & Fraidan, 2019).

In regard to understanding the academic context, learners are able to comprehend and synthesize information proficiently through selective attention (SA), whether it be perceptual or conceptual, at the word or sentence level, which enables the learner to allocate information, identify salient ideas, disregard in pertinent details, follow arguments and manage information. Moreover, the attempt to identify and mediate significant modulators of selection attention, whether they are text-related, reader-linked or task-related, will assist facilitate reading comprehension difficulties in cognitively-overloaded materials (Sanford and Graesser, 2006). Developing mechanisms of selective attention is particularly crucial for EFL learners because they tend to suffer from cognitive overload because of unfamiliar vocabulary and syntactic structures (Baddeley, 2007). The issues with SA are mostly derived from cognitive load stemming from complex tasks that tend to create attentional bottlenecks, thereby impairing performance. This is particularly evident as language learners attempt to deal with novel vocabulary and syntax (Ahmadi and Pourhossein, 2012; Saengpakdeejit and Intaraprasert, 2014) .

Cognitive Flexibility Theory (CFT) was constructed and developed by Spiro and his colleague's over about three decades. This theory is a flexible and multi-dimensional solution for dealing with such issues because it encourages and manipulates and adaptive thinking. This studies suggests that learners utilize, rotate, reinterpret, and other means to manipulate a concept in order to cross and apply it to many different contexts to encourage the learner to switch as well as move through complex and inter-structured knowledge domains.

Applying CFT in EFL reading instruction enables students to make connections, use different strategies, engage in multitasking, and interact with multiple contents actively; therefore, it can improve their ability to understand sophisticated academic texts. CFT relieves learners from fixed-mindset patterns that restrict comprehension and interdisciplinary knowledge acquisition by promoting flexible cognitive processes and strategies (Spiro, Collins, Thota, & Feltovich, 2003). Cognitive flexibility encompasses being adaptive or spontaneous and consists of three basic elements: Flexible Coding, Flexible Assembly, and Flexible Comparison (Dillon & Vineyard, 1999). Also, these stressors that someone can generate and adapt to with confidence and flexibility in behaviors are very basic to understanding cognitive flexibilities at work. This understanding of these components is vital for developing cognitive interventions and assessments that foster flexibility among language learners in more communicative and intercultural contexts where flexibility is highly needed (Spiro, Klautke, Cheng, & Gaunt, 2017; Karakuş, 2024) .

CFT has the potential of addressing this emerging need by flexibly managing attention during dynamically changing contextualized learning tasks.

New research explains how cognitive flexibility enables readers to access, modify, and integrate various textual elements which makes it a fundamental part of executive control (AL Zahrani, 2021; Cole, Duncan, & Blaye, 2014). Cognitive Flexibility's sub-dimensions like adaptability, transfer of knowledge, and perspective taking as defined, are indeed closely associated with academic reading comprehension and its processes. Adaptability is the ability to change knowledge structures based on new information which is crucial in understanding a wide array of academic texts (Spiro et al., 2017). The ability of learners to use previously learned concepts in new situations demonstrates the transfer of knowledge as an essential process through which learners link different concepts and form interpretations. Considering other constraining views to tackle problems enhances critical reading by evaluating arguments, identifying assumptions, and determining the potential outcome (Arman, Bhais & Tair, 2023; Karakuş, 2024).

Context of the Problem

In order to verify the existing problems and difficulties of attention and reading comprehension among EFL postgraduate students, a pilot study with 63 participants from pre-MA EFL programs was conducted. Students were evaluated using **an academic reading comprehension test** and **a selective attention scale**. The results revealed that 84.7% of the students demonstrated significant difficulties in reading complex academic texts, struggling particularly with knowledge transfer, prior knowledge integration, switching between scanning and skimming, assembling ideas from diverse contexts, eliciting relevant information from different texts, inference-making, and understanding implicit ideas, representing new connected ideas. Additionally, 87.5% showed poor performance in selective attention tasks, exhibiting low level in focusing on relevant information, filtering out extraneous details, situating essential parts, ignoring less important explanations, managing cognitive load, and managing multiple-source reading tasks.

Academic reading comprehension is a cornerstone of advanced education and professional success; it receives low attention compared to academic writing, or even studied beneath the umbrella of academic literacy (Bhatt & Samanhudi, 2022; Grabe & Stoller, 2019).

However, most studies assured the challenging nature of academic material, complex informative texts, depth of academic vocabulary and overall difficulty EFL learners experience when comprehending academic material (e.g. Dardjito, 2019; Davoudi & Yousefi, 2015; Hasan et al., 2016; Jo, 2021; Johnson, 2017; Nejadghanbar et al., 2022). Additionally, most EFL Arab learners face persistent difficulties in developing these skills due to limited exposure to complex academic texts and inadequate instruction tailored to their needs. (Alotaibi, 2022) also reported similar problems like limited academic vocabulary, difficulty in grasping the meaning of the given text, lack of self-study exercises and practice and limited discussion within the class either in peers or group work, lack of wide/extended reading and insufficient reading fluency.

Ahmed and Daff-Alla (2023) reported difficulties related to complex vocabulary and text structure the clearly hinder comprehension. Gobert and Demirci (2019) recorded similar problematic points and recommended educators and teachers to employ new innovative methods to enhance EFL academic reading comprehension particularly in MENA (Middle East and North Africa).

Going a step forward, Ismail and Edi (2023) analyzed needs of the EFL learners and confirmed the necessity of enhancing academic reading comprehension through myriad of methods and strategies. Moreover, existing EFL curricula almost prioritize rote learning and linguistic correctness, leaving little room for developing higher-order reading skills, such as critical thinking, inference, and synthesis (Hyland, 2021; Ohata & Fukao, 2014). Such limitations create a significant

gap between learners' actual abilities and the demands of academic and professional tasks. On the other side, selective attention (SA), a critical cognitive executive operation, plays an essential role in successful reading comprehension. It allows learners to focus on relevant content while ignoring extraneous information, thereby facilitating efficient processing of a given text. However, research has shown that EFL learners often struggle with selective attention due to cognitive overload caused by unfamiliar vocabulary and complex syntactic structures (Baddeley, 2007; Grabe, 2009; Prichard, 2014; Prichard & Atkins, 2019; Qiu & Ismail, 2023). For Egyptian learners, these challenges are exacerbated by classroom environments that lack interactive and engaging strategies to foster attention control and focus (El-Koumy, 2019). The aforementioned argumentation clearly reveals a need to advance EFL academic reading comprehension and SA among postgraduate students.

Statement of the Problem

The study problem could be formulated in the following statement "EFL postgraduate students showed some observable deficiencies in academic reading comprehension and low level in selective attention". The present study, accordingly, tried to answer the questions below:

1. What is the impact of utilizing CFT on promoting EFL postgraduates' academic reading comprehension skills?
2. What is the impact of utilizing CFT on promoting EFL postgraduates' selective attention?

Hypotheses

The study attempted to verify these hypotheses:

1- There may be a statistically significant difference between the mean scores of the CFT-treatment group and those of the control group on the post-assessment of the EFL academic reading comprehension test in favor of CFT-treatment group.

2- There may be statistically significant difference between the mean scores of CFT-treatment group on the pre-post assessments of the EFL academic reading comprehension test in favor of the results of the post-assessment.

3- CFT-based instruction is effective in promoting EFL postgraduates' EFL academic reading comprehension (both overall and across its dimensions(

4- There may be statistically significant difference between the mean scores of CFT-treatment group and those of their peers in the control group on the post-assessment of the Selective Attention Scale in favor of CFT-treatment group.

5- There may be statistically significant difference between mean scores of CFT-treatment group on the pre-post assessments of the Selective Attention Scale in favor of the results of the post-assessment.

6- CFT-based instruction is effective in promoting EFL postgraduates' Selective Attention (both overall and across its dimensions).

Significance of the Study

The current study may hopefully be significant for:

1. **Education Development:** It addresses pressing issues among EFL postgraduate students regarding the reading comprehension of complex academic texts and their sustained selective attention. This study adds to the advancement of EFL education at higher levels by advancing evidence-based strategies from CFT.
2. **Teaching Practice-Based Issues:** If applied, this study will provide new teaching strategies from CFT, like norm-referenced case-based instructions and a non-linear sequence of instruction, as indicated above. These methods can assist teachers in preparing students to handle academic reading texts and high cognitive loads more effectively.
3. **Research Gaps:** Much has been said about CFT in education, but only a small portion of its application in EFL has received attention. The focus on academic reading comprehension and selective attention in EFL education is relatively rare and sparse. This study addresses how CFT tenets and strategies will aid in meeting the demands of EFL postgraduate students, hence filling an evident gap.
4. **Theoretical Understanding:** The study contributes to learning achievement by applying CFT, which might aid soft skills in EFL learning.
5. **Policy Planning and Curriculum Development:** The findings of this study might be useful in developing more effective programs for EFL students at the policy and curriculum design levels. Given the contemporary educational objectives of developing adaptive learning strategies and cognitive skills, this research seeks to foster critical thinking and efficiency of language learning.

Definition of Terms

EFL Academic Reading Comprehension

Academic reading comprehension in EFL involves the ability to understand, interpret, and critically evaluate academic texts written in English. It is a multifaceted skill requiring vocabulary knowledge, syntactic awareness, inference abilities, and metacognitive strategies to construct

meaning from complex texts. It is essential for academic success, as it supports learners in engaging with disciplinary content effectively (Grabe & Stoller, 2019, p. 23).

Operationally, academic reading comprehension is a multi-dimensional goal-oriented process to access, understand, manipulate and respond to academic texts/material which may be linguistically, informationally, ideationally, and conceptually challenging for EFL learners. It consists of a continuum of interrelated skills working together and orchestrated in forms of layered comprehension levels. It requires highly engaging reading multiple-practices for seeking information, re/construction meaning, adapting prior knowledge, and knowledge re/building from various perspectives and sources to achieve some academic purposes, i.e. broaden understanding, deepen learning, enlarged academic expertise, and expanded academic repertoire of EFL postgraduate students.

Selective Attention

SA refers to the cognitive process of focusing on relevant information while disregarding distractions, enabling efficient task execution. It is a critical component of executive functioning that allows individuals to prioritize specific inputs or stimuli, which is particularly important in environments with competing demands. In the context of academic tasks, it enhances learners' ability to process essential information accurately while filtering out irrelevant details (Prichard & Atkins, 2019).

Operationally, SA refers to a cognitive executive operation/function performed by EFL postgraduate students to intentionally focus on specific information, prioritize particular details, filter out irrelevant points, sustain attention and cognitive control, and adapt task switch within reading texts while executing academic-oriented reading tasks.

Literature Review

EFL Academic Reading Comprehension

Academic reading comprehension is a complex multimodal cognitive process that includes interpretation, construction and recovery of meaning from written academic texts. It is characterized by the reader's prior expertise, text content and dynamic interaction between broader relevant factors that affect global comprehension. This simultaneous top-down bottom-up interaction activates higher cognitive skills, as meaning-inference, critical thinking, negotiating meaning, and problem-solving, and enables readers to integrate information into blocks of meaning, i.e. sentences and paragraphs to create a coherent overall understanding (Kintsch, 1998; Ohata & Fukaos, 2014). This process also requires instant engagement in decoding the surface level meaning and the

conceptual messages inherited within the text, integrating the reader ’s background knowledge, linguistic awareness and cognitive strategies (Fitriana, 2018; Pardo, 2004).

Reading academic texts requires selective focus on the relevant textual aspects, as the goal and structure of the material. According to Urquhart and Weir (1998, p. 17), it entails “the whole parcel of cognitive activities” required to capture the meaning, including flow in decoding, arguments for understanding language syntax and making a relationship between ideas. This is to say that the understanding of academic reading is a selective process where readers actively choose the most productive signals to explain the text effectively (Liu & Chu, 2019). Moreover, academic texts often include instructional vocabulary, sophisticated syntactic structures and abstract ideas, which require students to deploy effective strategies to question, summarize, and predict information (Carrillo, 2010; Snow, 2010). Comprehending academic texts involves creating a mental model or status which integrates meanings of the text with the reader's prior knowledge to represent a broad understanding. The process also includes meta-cognitive skills, such as monitoring performance, reflecting on understanding and adapting strategies to solve the challenges emerging while comprehension (Shin & Dronjic, 2019).

Within the context of educational settings, academic reading comprehension equipped students with skills to contact knowledge-to-knowledge material including essays, reports, research articles and textbooks (Carrillo, 2010; Wagar, 2008). This promotes their ability to synthesize information, evaluate serious arguments and generate insights from text materials. This ability is crucial for academic success and knowledge acquisition, reading comprehension is inherently linked to linguistic proficiency and cognitive development (Minsyzbayeva & Kassymova, 2024). Thus, it is not a single skill but a synthesis of several layers of abilities, including decoding, inference-making, and the integration of prior knowledge with textual information (Snow, 2002, p. 11). Academic reading comprehension, in particular, requires readers to engage with dense, specialized texts that demand higher-order thinking, concentration, and a strong command of academic language (Janne, 2007, p. 13; Nergis, 2013).

Reading in a foreign language, especially academic reading, is selective and sophisticated in nature. It requires the application of various strategies to work with specialized information and content. Research shows the reading comprehension spans several aspects from phonological processing, vocabulary knowledge, reading fluently, and pragmatically comprehending. Block (2004) and Kuzborska (2015) further argue that comprehension is a multidimensional process where readers construct meaning by integrating knowledge and language. Comprehension begins with some basic skills such as decoding but includes higher levels of thinking like reasoning and

synthesizing information which is essential for understanding texts in a deeper sense (Escudero et al., 2015) .

Furthermore, reading comprehension is also influenced by the context of the reading, like the environment where it is being done, the reason for reading, and their prior knowledge on the text. Proficient readers utilize situational knowledge and background knowledge as cognitive tools to help them decipher the words, the arrangement of the sentences, and the relationships between stments both in the text and outside of it. Some academic texts, as remarked Lubis and Sulistyo (2018), are particularly difficult because they have a hierarchical organization of information along with the use of technical language. Thus, it becomes pertinent the academic English learners need instruction in vocabulary and comprehension skills while cautioning that oversimplification, can cause stagnation in language progress (Fitriana, 2018; Hirvela, 2016).

Balanced integration of competencies is the most effective approach toward improving reading comprehension, which includes the basic skills of decoding and fluency, along with the more sophisticated skills, such as evaluation and contextual thinking (Swanson et al., 2017). Comprehension, Johnson (2017) argues, is a complex multilayered phenomenon that includes both explicable and inexplicable components which makes it relatively difficult to effectively observe and evaluate in classroom situations. To meet the different requirements of learners, teachers need to adopt scaffold instruction that connects the acquisition of fundamental skills with the more complex academic texts. In the case of EFL contexts, learners need to be taught how to tackle heavily loaded academic content while overcoming language and cultural barriers (Nergis, 2013)

In this regard, reading comprehension, particularly academic reading comprehension, is a multidimensional aspect with and without effect that makes learners able to apply higher order thinking towards written information for their study and occupational progression. From this view, reading comprehension in this context does not constitute the rote reading or shallow decoding of text, but rather a productive outcome of the interplay of linguistic, cognitive, and social resources that build meaning. This means understanding the language of the text, inferring its relevance, and integrating sufficient information to form a rational mental representation of its meaning.

In this context, I would like to remind you that reading comprehension is the most important skill needed by students for the successful achievement of educational goals and requirements posed by the classes and coursework. Comprehension, in turn, assists students in determining what useful information there is, how lines of text should be paired with the intended objectives, and

what parts need not to be considered (Clarke, Truelove, Hulme, & Snowling, 2013). As students progress through successive educational stages, understanding and evaluating a number of books becomes increasingly important, especially when academic work calls for more intricate and specialized comprehension skills. Therefore, students are required to develop advanced reading comprehension skills in order to deal with academic texts, develop meaning out of interpretation, and present their view. Expertise in reading, according to Gilakjani and Sabouri (2016), is displayed by employing global strategies for derived meaning from the text, whereas low-skilled readers rely on several, mostly self-defeating techniques.

Reading comprehension is often divided into levels, and literal, inferential, and evaluative comprehension are typically the basic ones. Literal comprehension refers to grasping the meaning of specific words and understanding the text's concepts as it is, without any imaginative interpretations. Inferential comprehension requires readers to make use of derived meaning, which is not specially spelled out but can be understood through the use of prior knowledge and contextual clues to figure out relations between concepts (Sylvia & Nancy, 2014). At the evaluative level, comprehension involves assuming a more active stand, whereby one analyzes the arguments, tone, and purpose of the text and makes independent decisions based on what they have read. Critical and creative comprehension are even higher levels, which engage the reader in deeper analysis and imagination. These levels encourage interaction with the text and ideas inspired by it, which results in the development of new concepts (Clarke et al., 2013; Sylvia & Nancy, 2014).

The combination of these levels is critical for achievement because reading university materials requires people to possess integration and evaluative skills to interpret texts written in very formal and sophisticated manners (Sajid & Fraidan, 2016). In reading these types of texts, other combinations such as skimming and scanning, summarization, and analysis of discourse structures (problem-solution or cause-effect) are important in enabling the reader to understand the text. Moreover, deeper levels of understanding and coherence creation require elementary paraphrasing, self-questioning, and information synthesis (Sylvia & Nancy, 2014; Zhang & Liu, 2017).

Perfetti and Stafura (2014) distinguish between comprehension as an advance and text comprehension on situational level as an integration of prior and post knowledge. Comprehension at the text level deals with putting together pieces of text while at the situational level one imagines mental models that integrate relevant prior knowledge and other information. The situational level captures readers' attention actively, encouraging them to interpret and make inferences. Therefore, academic reading comprehension goes beyond the understanding of literal meaning to include

“higher order” activities such as theme identification, argument analysis, and integration. All of these not only positively impact academic success, but they also build self-efficacy and self-regulated learning. In addition, students' ability to fragment discourses, identify linguistic features, and use the texts to exercises their knowledge is crucial for learning. Reading comprehension consists of a number of components and, according to Grabe & Stoller (2019), also includes sub-skills such as decoding, fluency, vocabulary, and strategic skills such as setting goals or monitoring understanding.

For the purposes of discipline specific reading and comprehension, learners have to use more advanced strategies than with general reading since the variety of academic materials can be more intricate. Academic learners engage in reading by using strategies that involve the use of topic sentence, context, concept visualization, and making contrasts and comparisons in order to read effectively. Additionally, actively managing one's own progress, predicting what is about to come, or stating the purpose of the text are crucial when dealing with texts specific to a certain discipline. (Saengpakdeejit & Intaraprasert, 2014).

At its most basic level, academic understanding is a complex phenomenon that combines language, thinking, and context processes for making meaning from texts. Reading, as described by Grabe and Stoller (2019), is a two-way process in which the text contains linguistic and other information which the reader possesses in his or her long-term memory. With this interaction, a reader is able to make meaning through recognizing core sentiments, making conclusions, and perceiving the purpose of the author (Anderson, 2010). For one to achieve effective academic understanding, more stringent processes of the lower-level, such as vocabulary and grammar recognition, and even higher-level, such as analyzing and interpreting texts, an equilateral balance of, control of, and higher level processes is required. Furthermore, the reader should also utilize metacognitive techniques, such as supervision of understanding, modification of reading actions, and evaluation of comprehension (Brown, 2003; Koda, 2007).

Readers must blend information from a text and their prior knowledge for comprehension to happen. Koda (2007) underscores that this blend goes beyond new information being added because it has to be integrated and modified within the reader’s cognitive schema. Accomplishing this task entails not only having language skills, for example, with vocabulary, sentences, and content, but also having situational and background knowledge about the society and culture that the text represents. Without these factors, readers may find it difficult to understand the writer’s purposes and other implications in the content (Brown, 2003; Kuzborska, 2015). Readers are able to comprehend only when they have access to and quality of instructional materials. Authentic and

adapted texts (produced and modified for teaching communication) are effective teaching materials. They help students learn through different text types, such as informative, instructional, or exploratory, and are often altered by being added to, deleted from, simplified, or reorganized to better meet learners' needs. Furthermore, these texts have accompanying exercises, such as predicting, pattern identifying, and discussing, are meant to be responded to actively, thereby aiding comprehension (Pardo, 2004; Clarke et al., 2013).

Fundamentally, comprehension in academia is guided by explicit teaching and student-focused approaches. The contribution of the teachers is to create instructional events that contain both the sequencing of skills and the possibility for learners to work with the texts independently. In addition, journal, peer, and self-assessment techniques promote comprehension through engaging learners in reflecting and interacting with the content at a deeper level. Having academic comprehension intertwines several aspects including a learner's thought process, language skills, and teaching methodologies. Teachers can enable students to succeed academically by equipping them with essential skills and documents and materials that offer guidance on how to navigate, interpret, and utilize information from sophisticated academic texts (Grabe & Stoller, 2019; Lopera, 2012).

Alongside other skills, academic reading comprehension is vital for achieving success academically and personally. It facilitates understanding and mastery of various disciplines, allows the student to employ critical thinking towards the information presented in a text, and meets the expected classroom standards. It is asserted by Clarke et al. (2013) that as students move up the educational ladder, reading comprehension becomes useful since scholarly activities demand the comprehension of complex prose. Comprehension, reading or otherwise, allows students to extract important information while sifting through irrelevant and redundant details before arriving at crucial concepts aimed at in-depth learning. These skill pairs are also necessary for completing assignments, for analysis and synthesis of information, and for the application of knowledge to various activities. A student who lacks these skills would, after some time, find it hard to achieve their academic goals and would miss out on developing the necessary skills for self-directed learning for life (Grabe and Stoller, 2019).

Considering that context, reading comprehension poses a higher challenge since textbooks and scholarly materials are written in sophisticated and decontextualized language. Zipoli (2021) emphasizes the role of syntactic and grammatical knowledge in enhancing students' ability to navigate such advanced texts, highlighting the need for explicit instruction in language forms and functions. Hence, students must gain control over the specialized language of academic disciplines,

as understanding how language shapes content leads to a deeper comprehension of subject matter. By teaching students the nuances of academic language, educators can help them develop the skills needed to access and analyze disciplinary knowledge effectively (Snow, 2010). Moreover, academic reading comprehension compels the development of effective reading strategies, which are critical for navigating diverse types of texts. Saengpakdeejit and Intaraprasert (2014) note that strategic reading behaviors, such as skimming, scanning, and using contextual clues, can significantly enhance comprehension outcomes. The new research shows that students who are motivated in learning performed better when each student was taught different strategies tailored to their individual needs. Strategic reading not only aids in reading comprehension but also instills positive reading habits that promote ongoing learning and personal development (Kalbfleisch, Schmitt, & Zipoli, 2021; Minsyzbayeva & Kassymova, 2024).

The importance of reading comprehension in an academic context progresses to higher education, where it acts as a gateway of information to specialized dependency on a particular field. Abbott (2013) notes the impact of Extensive Reading (ER) on the development of academic literacy, arguing that ER provides language deficient learners with favourable opportunities to acquire the language essential for further studies. In English for Academic Purposes (EAP) programs, reading comprehension is a means to an end that helps learners to deal with scientific and technical information. Learners will find it easier to read and understand academic material which helps them to adapt to the challenges of globalization and rapid technological change (Kalbfleisch et al., 2021).

Moreover, working through academic texts improves readers' reasoning skills and deep mental participation, helping learners form proper mental images of concepts and appreciate text intentions. According to Lubis and Sulistyo (2018) comprehension is not simply fact retrieval or main idea recognition; it is context analysis, argument evaluation, and interpretation building. The proficient application of these skills is what makes most students perform well academically and helps them communicate their ideas and use information effectively. In addition to its cognitive benefits, academic reading comprehension fosters independent learning by empowering students to take control of their reading processes. When students are taught strategies that improve their understanding, they gain confidence in their ability to engage with complex materials. This sense of self-efficacy encourages them to explore texts independently and develop a deeper appreciation for academic inquiry (Liu & Chu, 2019).

Acknowledgeably**,** one of the primary challenges in academic reading comprehension is the ability to decode complex texts while constructing meaning, because automatic word recognition is

critical for focusing cognitive resources on understanding rather than decoding words (Johnson, 2017, p. 110). However, many students, particularly English foreign learners, struggle with automaticity and lack the deep stores of vocabulary and concept knowledge necessary for connecting information to prior experiences. This deficit results in reading comprehension difficulties and an inability to fully grasp grade-level content. Additionally, academic reading comprehension becomes increasingly complex as students advance to higher levels of education, particularly due to the shift from familiar social language to dense, specialized academic language. Snow (2010) emphasize that academic language is characterized by conciseness, precision, high information density, and grammatical compression of ideas. These features, essential for efficient communication of complex ideas, pose significant challenges for students, especially those with limited exposure to academic discourse (Kalbfleisch et al., 2021). The specific linguistic features of academic texts, such as nominalizations, abstract vocabulary, and grammatical embeddings, further exacerbate comprehension difficulties. Snow (2010) highlights the need for explicit instruction in academic vocabulary and the structures used in scientific and social studies texts to help students access content effectively. Teaching cross-disciplinary language skills and making them visible to educators can bridge comprehension gaps and improve academic outcomes (Bhatt & Samanhudi, 2022). Unskilled readers are highly likely to struggle with drawing inferences, which is particularly more difficult for them to understand. Skilled readers are able to make inferences effortlessly, while unskilled readers require scaffolded instruction on how to infer and bridge ideas from other concepts. Teaching question-answer relationships and methods of inferring can improve comprehension abilities for lower skills readers (Johnson, 2017) .

In consideration of comprehension covered by Alotaibi, the difficulties appeared to stem from situational, instructional, and mental processes (2022). Commenting on shed and Davoudi and Yousefi (2015),. they suggested common neglect problems, like lack of vocabulary, undermined background knowledge, absence of definite reading objectives, and ineffective reading as strategies which could deal with problems of comprehension. The problems embrace difficulty in the integration of non-visual and visual information, distinguishing between the various levels of text structure, and making inferences. Moreover, the overreliance on superficial techniques such as dictionary overuse has been associated with failed comprehension. As observed by Bang and Zhao (2007), unskilled readers rely on shallow techniques too often, which makes failure to engage deeply with the text very easy. Resolving these concerns, which require instruction in some comprehensive reading strategies, including context, summarization, and visualization, aim at

enabling students to cope with more advanced materials confidently (Basaffar, 2017; Oktadela, Zaim & Hamzah, 2014).

As indicated in previous sections, academic reading comprehension presents tension and challenges because of linguistic sophistication, lack of prior work, and strategic unawareness or lack of sufficient training. A well-designed instruction, together with appropriate scaffolding, can help overcome these challenges to enable learners to function in academic and real world scenarios.

Cognitive Load Theory suggests that such factors may have a strong negative impact on comprehension. Weaker students struggle, for example, with the grammatical density, abstract vocabulary, and complex sentence patterns of academic prose. Perfetti and Stafura (2014) highlight that failure to identify the organization of a text and draw requisite inferences are barriers to efficient information processing. Moreover, instructors' inappropriate choices of materials to be read do not enhance understanding because, in many cases, ad materials do not correspond to the learners' proficiency and interest level and therefore foster demotivation. Metacognition is also important. Atai et al., (2018) confirmed that at the level of strategy use, questioning, inferring, and visualizing contribute greatly to understanding. The gap emerges as students are unprepared to use these tools in the first place due to the absence of educational guidance. For example, limited classroom hours and poorly qualified teachers lead to unreasonably simplistic strategies being taught, which inevitably, yields low understanding of the students (Oktadela et al., 2014).

Working memory, attention, and motivation are examples of cognitive factors critical to successful understanding. According to Kintsch and Kintsch (2005), working memory helps meaning construction by integrating new information with existing knowledge. Conversely, learners with memory problems tend to have severe comprehension difficulties due to their inability to retain and integrate information. Similarly, one's level of motivation can aid or obstruct comprehension; unmotivated students tend not to engage with the texts on a deeper level, while those who are intrinsically motivated and confident tend to understand more. The students' level of reading comprehension is also determined by the speed at which they can decode and recognize the words of the text. Slow decoding hinders fluency, preventing readers from focusing on constructing meaning; while vocabulary knowledge enhances decoding speed, enabling students to infer meanings from context and read more efficiently. However, students with limited vocabulary often resort to ineffective strategies, such as overusing dictionaries, which disrupt the reading process (Bang & Zhao, 2007).

Additional factors include students' attitudes toward reading and their familiarity with reading strategies. Negative attitudes or lack of exposure to effective strategies often result in poor

comprehension outcomes. Minsyzbayeva & Kassymova (2024) stressed that systematic instruction in strategies such as skimming, scanning, and summarizing can empower students to approach texts more confidently and effectively. However, insufficient teacher training and reliance on traditional methods limit the adoption of such strategies in classrooms.

Related Studies

A significant corpus of research has focused on addressing the difficulties and strategies associated with improving academic reading comprehension in EFL contexts, emphasizing factors such as linguistic complexity, vocabulary depth, and instructional interventions. Studies pertinent to academic reading comprehension are somehow few; the main interest has focused on academic writing; however, it has been tackled under the umbrella of academic literacy (Abbott, 2013; Bhatt & Samanhudi, 2022; Jo, 2021; Kalbfleisch et al., 2021). Most of other studies focused on exploring the correlation between academic reading comprehension and other influencing factors and very few targeting developing academic reading comprehension. For example, Nergis (2013) investigated the predictive power of syntactic awareness, vocabulary depth, and metacognitive strategies on academic reading comprehension. The findings underscored the strong influence of metacognitive strategies on academic comprehension outcomes.

Atai et al., (2018) conductive a qualitative study to describe how academic reading was conceived by the EFL linguistic graduates (from 8 universities) with some intervention to help them be academic readers. Fitriana (2018) investigated the learning strategies used by lower and higher students in comprehending academic reading, recording five influencing factors: linguistics competences, motivation, interests, characteristics of the text genre and the environment role. Conducting a factorial quasi-experimental study, Lubis and Sulistyo, (2018) compared the effect of two strategies on academic are reading comprehension among university sophomores. The findings proved PRWR to have the more significant improvements. Dardjito (2019) explored the correlation between metacognitive awareness of 373 university students and their reading comprehension while dealing with academic English texts.

Employing a register-based methodology, Jo (2021) investigated academic English proficiency, conceptualized as a constellation of skills supporting academic literacy and operationalized through analysis of lexical, syntactic, and discourse features. The findings indicated that academic English proficiency scores more accurately predicted a specific subset of academic language skills crucial for effective academic writing. Ismail and Edi (2023) attempted to develop academic reading learning models using two different approaches, i.e. problem-based learning and blended learning among a student sample of two different universities. The findings showed that

students' learning of academic comprehension was influenced by their own problem-solving skills, and both of them were influenced by team-management, communication, collaboration, personal creativity, and team management skills.

Selective Attention

SA in foreign language comprehension, as proposed theoretically by Anderson (1982) is a process through which important ant language elements receives additional attention and attentiveness. Here, it is regarded as a distinctive strategy adopted by skilled readers and listeners in language comprehension. This strategy encompasses other strategies referred to as cognitive processes such as concentrating on key words' and detecting basic information and ideas. Sanford and Graesser (2006, p. 100) conceptualize selective attention as an integral executive function modulating the depth to which linguistic input is processed. From "*Depth of Processing*" perspective, it challenges a uniform processing model, positing instead a hierarchical cognitive architecture wherein textual and aural stimuli are differentially engaged with. Input demanding greater cognitive resources – owing to factors such as referential ambiguity, lexical unfamiliarity, or pragmatic salience – elicits deeper processing. Conversely, predictable or semantically impoverished input receives attenuated attentional allocation, optimizing cognitive efficiency.

Moreover, SA is a cognitive ability that allows individuals to focus on relevant stimuli or information while simultaneously filtering out irrelevant or distracting elements. This is a complicated process that requires both perceptual and cognitive mechanisms, which, in collaboration, enable selective attention to be an important element in successful learning and task performance. As such, according to Lavie (2005), irrelevant stimuli are suppressed so that cognitive resources can be preserved for pruned goal-orientated behavior and let individuals concentrate on given inputs. Hence, both external or stimulus salience and intensity, as well as the individual's goals, prior knowledge, and cognitive load are internal factors which determine performance. Selective attention splits into simpler interrelated processes affected by external and internal stimuli. Such integration makes the process of selective attention holistically singular with parts that are collaboratively interdependent .

Therefore, it can be depicted how SA is deployed during language processing in two main steps: center-level and word-level. Center level is represented as increasing attention to particular units, which include content words and prosodically highlighted lexical items. This focused processing facilitates rapid lexical access and subsequent semantic integration. Conversely, the sentence-level involves the preferential processing of propositional units that encapsulate the

macrostructure of the text, prioritizing the derivation of the gist or paraphrased representation over verbatim syntactic retention. This distinction between levels of SA possesses significant pedagogical implications, informing the explicit instruction of targeted comprehension strategies. While the selective attention on the word-level aligns with techniques such as keyword identification to enhance lexical inferencing, the sentence-level necessitates the cultivation of strategies centered on macro-propositional extraction of, i.e. "detecting major information", and the development of a coherent situation model, i.e. "grasping main ideas" to achieve deeper textual understanding (Qiu & Ismail, 2023, p. 791).

"*Text structure*" as a term, advancing a step forward, is a preeminent modulator of attention on the sentence-level. Rooted in seminal models of text comprehension positing that meaning is constructed from interconnected propositions, this construct underscores the impact of textual organization on cognitive processing while comprehension. Text structure is commonly conceptualized as comprising two interrelated levels: microstructure and macrostructure. The former encompasses the local coherence and cohesive ties among individual propositions, reflecting the fine-grained details and interrelationships within the text. Conversely, the later represents the global coherence and overarching thematic organization, encapsulating the main idea or gist of the text and providing a framework for integrating individual propositions into a unified mental representation (Qiu & Ismail, 2023; Reynolds, 1992).

Elaborating the concept of selective attention strategies (SAS), the concept of Selective Attention Strategies (SAS), Sanford and Graesser (2006) identified several modulating factors that influence attentional allocation of specific information during cognitively demanding language comprehension tasks. These modulators can be broadly categorized as relate to the text (e.g., the degree of information density, complexity), related to the reader (e.g., the actual prior knowledge activation, cognitive resources), and related to the reading task (e.g., inferential questions, purpose of reading). Concurrently, they posited the existence of attention-modulating devices inherent within the linguistic input, encompassing syntactic structures (e.g., clefting, passivization), prosodic features, and textual organization (e.g., topical focus, discourse markers), as well as semantic features (e.g., metaphor, irony).

On a psychological perspective, SA as a cognitive process relies on a range of cognitive skills, including inhibition, cognitive flexibility, and sustained attention. **Inhibition** represents an ability to discard all irrelevant or distracting items, enabling individuals to focus on task-relevant information (Nobre & Kastner, 2014). This skill is crucial in academic contexts, where learners must ignore environmental distractions or extraneous details in reading materials. The ability to

concentrate on a particular task for an extended period while dividing attention between multiple ongoing activities refers to cognitive flexibility and is especially pertinent in cases where learners need to switch attention between diverse problem-solving strategies or different information analyses. The ability to sustain attention, or concentrate on one thing for a long period of time, is important for accomplishing highly complicated and intellectually demanding activities such as reading or analyzing texts (Fisher, Godwin, & Seltman, 2014; Diamond, 2013) .

Moreover, SA is also associated with higher order skills like cognitive flexibility and inhibitory control. For example, learners are able to suppress irrelevant information due to inhibitory control, while cognitive flexibility shifts their focus due to task-specific needs (Diamond, 2013). The ability of these learners to multitask in complex, fast-paced academic settings remain unquestionable. These students work with numerous competing informational and attentional demands. Controlling contextual factors may also affect selection attention. For instance, learners' concentration on instruction becomes undermined in distracting environments, like noisy classrooms or digital disruptions. However, solid and helpful environments aid learners in dividing attention toward sustained tasks, which enables them to tune their cognitive resources toward tasks aimed at achieving academic success (Fisher et al., 2014; Sweller, Ayres & Kalyuga, 2017).

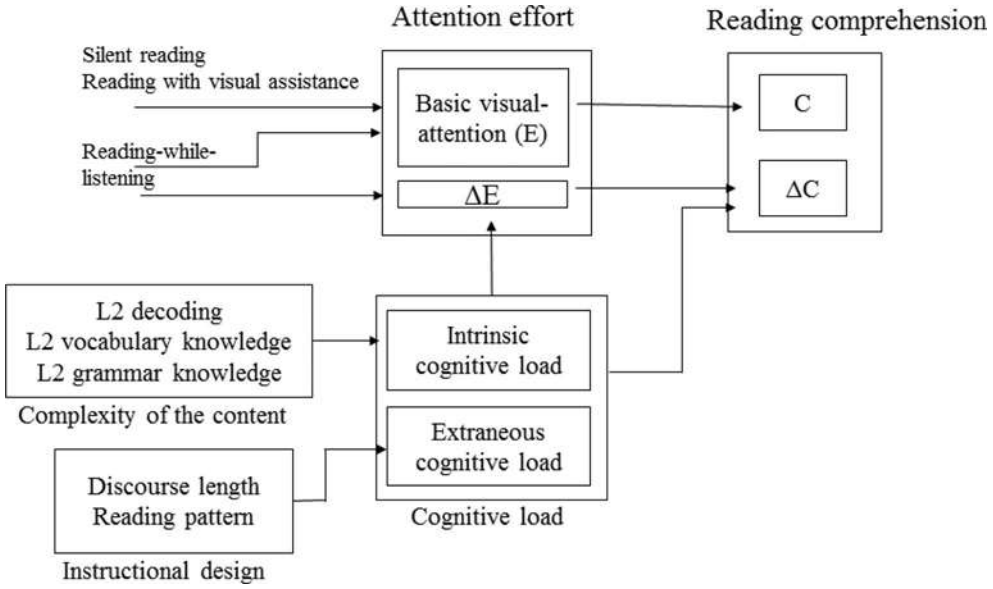
Additionally, SA functions on three principal levels: sensory selection, perceptual filtering, and cognitive prioritization. Sensory selection takes place at the level of attention and means filtering the inputs from the sensory channels: auditory or visual. It ensures that only relevant information is sent for further processing. The second level is Perceptual filtering, which looks at specific stimuli within the selected channel, e.g., focusing on a particular person's voice among many others. The highest level, Cognitive prioritization, entails the individual actively and deliberately focusing on information and tasks at hand as guided by the goals, previous knowledge, or information deemed worthwhile. This level is greatly governed by executive functions and working memory, which enable learners to focus on distant academic goals and ignore distractions (Liu & Chu, 2019; Nobre & Kastner, 2014).

To provide greater detail, SA is a cognitive skill that preliminary describes multilayered skills working in tandem to isolate a specific piece of information relevant to a particular task from an overflowing volume of sensory data. Moreover, SA may be characterized as a complex process that integrates an individual, his or her environment, and a given task into a single action. This skill enables an individual to concentrate on things that matter to a particular task while ignoring irrelevant stimuli. Selective attention is not a single skill but rather a blend of perceptual, cognitive, and executive skills that function individually and cooperatively. SA incorporates the withdrawal

from irrelevant stimuli, the shift of attention to important stimuli, and the maintenance of attention on relevant information. This makes selective attention difficult to define and measure directly because its functioning is interrelated to a number of dimensions of cognitive functioning (Dennis, 2008; Nobre & Kastner, 2014).

Typically, SA is regarded as a specific form of multitasking in which perceptual filtering, cognitive control, and task switching happen simultaneously. The role it plays as an "invisible" process is often very challenging to observe firsthand, but is essential for cognitive functioning. This 'dual life' creates difficulties for educators and researchers to determine what features of selective attention a student has difficulty with and how it can successfully be remediated. In addition, selective attention is contextually bound, which means it relies heavily on the task at hand, personal traits, and outside conditions (Petersen & Posner, 2012; Shin & Dronjic, 2019). In classroom context, SA is one of the essential processes involved in using information and learning. Students with well-developed abilities of selective attention can greatly more easily discern important pieces of information in the texts, keep track of the arguments, and relate the information presented in different parts of texts. In addition, SA allows readers to apply effective reading strategies such as skimming and scanning, as well as ignoring non-essential information (Sweller et al., 2017; Yang, Qi, Wang, Sun & Zheng, 2022).

The efficacy of this method can be limited by factors like constrained working memory, elevated cognitive load, and distracting environments. Students suffering from selective attention often struggle with identifying significant details, sustaining attention, and cognitive resources. These issues are noteworthy among EFL learners who may face additional challenges from insufficient vocabulary or unfamiliar text structures (Dennis, 2008). Anderson (2010) proposed that selective attention involves the processes of identifying pertinent stimuli, blocking out irrelevant ones, focusing, and changing attention when appropriate. This process is multi-dimensional which is needed during learning especially in academic environments where students are expected to manage and deal with numerous challenges at the same time (Yang et al., 2022).



Reading Comprehension, Attention, and Cognitive Load (Yang et al., 2022)

Earlier, Brown (2003) had pointed out that effective SA includes capturing the dominant ideas, following directions, understanding the context, and filtering out non helpful details. Koda (2007) pointed out that, just like perception and thought are integrated, SA is a higher-level skill that involves the use of self-questioning, predictions, and inference as contextual clues. This procedure has both automatic and controlled processes within it: automatic attention recognition happens when people see patterns they are used to and their recognition is rapid, while control attention is characterized by an attentional focus on a new or more complex issue that is by nature regulated (Qiu & Ismail, 2023).

Studies show that selective attention is guided by situational knowledge, background knowledge, and other factors. For instance, while reading academically, students scan the text for specific language features, like headings or highlighted portions that portray the author's focus. Low vocabulary knowledge or non-familiarity with the structure can also affect the filtering process. In addition, metacognitive awareness plays a significant role, since effective selective attention requires monitoring and focus shift depending on task demand. Some strategies for attention control include skimming for important details, scanning for particular words, and thorough reading of difficult texts to understand (Prichard & Atkins, 2019). To conclude, selective attention is a complex phenomenon that studies revealed to incorporate both automatic and controlled features which help learners to sift, rank, and process information. Knowing how selective attention operates provides educators with the basis for design interventions aimed at directing students' attention in order to improve learning. This skill is crucial when responding to academic demands and achieving success in the long run (Sweller et al., 2017).

The importance of self-regulation appears to increase as students advance through academic levels and the cognitive demands of tasks become more complex. In reading, for example, students must pay attention to identify key details, derive meanings, and integrate new information with existing knowledge while trying to avoid distractions like vocabulary they do not understand or unrelated personal thoughts. Likewise, during lectures, students pay selective attention to focus on main ideas and important details while ignoring other relatively unimportant information. This ability is helpful for second-language learners who already have to deal with unfamiliar and structured cultures and language (Dennis, 2008; Liu & Chu, 2019). On the other hand, learners who have poor selective attention usually cannot distinguish between important and unimportant information, which reduces their efficiency and increases their cognitive load. This is particularly the case when the learners are surrounded by competing stimuli such as digital learning environments which tend to be rich in distractions and require the learner to navigate and manage the cognitive load involved (Yang et al., 2022).

Studies on SA are remarkably limited. According to Grabe (2009), FL readers often exhibit limitations in their capacity to effectively deploy selective attention mechanisms, which are crucial for constructing a robust and coherent representation of textual meaning. Despite its theoretical significance, explicit investigation of selective attention in FL reading research remains scarce. While many L2 reading studies have indirectly addressed selective attention as a component of broader metacognitive strategies—such as previewing, predicting, and monitoring—these global strategies are typically examined for their capacity to activate, reflect upon, or indirectly enable selective attention minor processes, subsequently influencing overall reading comprehension (Prichard & Atkins, 2019).

Furthermore, research investigating the relationship between reading proficiency and specific sub-dimensions of selective attention reveals a positive association when measured through strategy use. For instance, in a study examining the correlation between scores on the Survey of Reading Strategies (SORS) and English examination performance, Zhang and Wu (2009) found that among 249 Chinese high school students, the reported use of selective attention strategies—specifically, purposeful reading and strategic material selection—demonstrated a significant positive correlation with final comprehension scores. This suggests that conscious engagement with selective attention during reading is associated with enhanced reading achievement in foreign language learners.

In a study examining the reading strategies employed by 447 Japanese students learning English at the university level, Prichard (2014) reported a significant correlation between reading proficiency and the self-reported use of specific selective attention strategies. Specifically, higher

proficiency readers indicated a significantly greater tendency to (a) establish a clear purpose prior to reading and (b) actively evaluate the relevance of textual content to their pre-defined purpose. This suggests that metacognitive awareness of reading goals and purposeful monitoring of text relevance are key components of effective L2 reading comprehension. Concerning online material, Prichard and Atkins (2019) examined selective attention as a reading strategy to task-relevant. They conducted two experiments with different selective attention-driven strategies. They concluded selective attention is directly related to task performance, ensuring the positive improvements in reading performance as result of strategy training. Regarding SA as an essential strategy for EFL effective listeners and readers, Qiu and Ismail (2023) examined SA as a mechanism from psychological and linguistic perspectives. They conducted a survey on studies examining SA while comprehension, classifying its levels, models and the modulators affecting it. Their findings provide promising inspirations in the academic research and application in listening and reading practices.

Cognitive Flexibility Theory

CFT is rooted in constructivist and cognitive learning paradigms, emphasizing the ability to adapt knowledge and thinking across diverse and complex contexts. The theory was developed to address how learners acquire, apply, and reorganize knowledge when confronted with ill-structured domains. CFT suggests that learners are required to deploy flexible different perspectives to achieve deep understanding and effective learning. Learning is not fabricated along a straight path; instead, it is flexible and adaptive which shifts with context. This particular facet of CFT underscores the necessity of "case-based learning" where learners are required to shift their understanding from one viewpoint to another which then teaches them how to solve problems and think critically in the process (Spiro et al. 2003; Spiro et al., 2017) .

Theoretical Underpinning in CFT is in tandem with cognitive psychological principles such as schema theory, aconstructivist premise that within a tower of knowledge language learners create, information is stored in chunks and can be drawn upon when a person is retrieving data, integrated with rote learning. In pedagogical approaches within CFT, the other side of learners is blanketed by pre-existing understanding which allows them to 'restructure' and transform their former knowledge with complete autonomy to deal with new remarkable stimuli. In relation to pedagogy, CFT focuses on how learning may take place in varied, uncontrolled, structured environments. For example, learners gain knowledge through multifaceted and non-linear techniques by the so called 'random-access instruction'. This was contextualized to the idea that

knowledge should not just be acquired; rather, applied actively instead (Cheng & Koszalka, 2016; Spiro et al 2017).

From another perspective, Viewing cognitive flexibility, as a crucial metacognitive resource for navigating complex learning environments, it encompasses three interrelated facets: (a) an awareness of multiple perspectives, interpretations, and potential solutions within challenging or ambiguous situations; (b) a dispositional willingness to adapt cognitive strategies and adjust behavioral responses in alignment with situational demands; and (c) a belief in one's own capacity (self-efficacy) to effectively implement these adaptations and achieve desired learning outcomes (Karakuş, 2024). Further, it encompasses four dimensions, i.e. realization of the need to change, generating alternatives and options, modification and cognitive construction, and strategic diversity and adaptability (Spiro et al., 2017). Dillon and Vineyard (1999) identified cognitive flexibility as including three core components, crucial for adaptive learning: (a) *Flexible Coding*: the capacity to interpret a given stimulus through multiple representational frames, enabling the extraction of diverse meanings and interpretations; (b) *Flexible Assembly/Grouping*: the ability to generate a repertoire of potential solution strategies through inductive reasoning, facilitating the selection of the most contextually appropriate approach from a diverse set of alternatives; and (c) *Flexible Comparison*: an aptitude to dynamically switch between tactical solutions in response to evolving task demands, enabling a learner to compare different elements of various solutions in diverse situations and contexts. These elements highlight the self-regulating and context-responsive features of flexible behavior within the intellectual domain.

According to Farrant, Fletcher, and Mayb (2014), there are two categories of flexibility: Adaptive Flexibility is the capacity to shift one’s cognition and methods in order to provide an effective answer to a problem. It entails being open, mentally rotating places, analyzing the events, and creating possible solutions. Actually this adjustment indicates absence of rigid thinking. It leads to problem solving and coping with new environments in the most unorthodox and effective ways. Spontaneous Flexibility does not have an operational definition but describes the capacity to produce different or novel responses to a particular issue or challenge. It focuses on the capability to shift between concepts rapidly, independently from a predetermined structure, and to create various possibilities.

From a pedagogical perspective, the CFT theory of constraints takes on the form of an instructional technique aimed at nurturing adaptive transfer of learning in poorly defined, real world environments. CFT suggests that learners develop deeper comprehension of complicated subject matter when different contexts are provided with multiple representations of the same information.

By encountering different angles of the same concept or phenomenon learners construct mental frameworks that enable effective application of knowledge in novel situations. The term Flexibility in this context refers to the way knowledge is organized and identifies fundamental principles for constructing learning materials that learners are encouraged to view from multiple angles. A core proposition of the CFT is that mastery and sophisticated application of complex knowledge is achieved through repeated exposure to material at various times, in various contexts, for various purposes, and from different perspectives (Cheng & Koszalka, 2016; Güner & Gökçe, 2021).

The principal elements of CFT, as stated by Spiro and associates in approximately two decades, are: (1) Ill-structured domains which, as the name indicates, CI domains are those areas where the processes of attaining knowledge is complex, context steeped, and for the most part, there do not exist simple or universal rules. In these domains, Spiro emphasizes, knowledge must be used contextually and from different angles. (2) Case-based instruction, which indicates that CFT advocates for learning through exposure to a multitude of cases as opposed to learning through the use of abstract principles. This enables learners to appreciate the domain within context. (3) Multiple representations, which tell that learners should be presented different images of the same concept and different important facets of it. This is essential as it assists in understanding complexity rather than oversimplification. (4) Knowledge interconnection which suggests that CFT interrelates new knowledge with the old and demonstrates how different pieces of information and facts form a coherent whole (Spiro et al., 2017; Zarei & Esfandiari, 2017).

According to the CFT outlined by Arman et.al (2023) Nasri & Biria (2021), it is possible to envision and devise new strategies stemming from these important ideas, including incorporating varied case studies into lessons, which entails providing learners with a complex array of real or simulated cases. Another approach consists of encouraging perspective taking, and this focuses on getting learners to interpret information from different angles. Promoting knowledge mapping includes assisting learners in developing proactive cognitive visualizations of concepts and their interrelations. Facilitating hypertext and other non-linear pedagogy encourages learners to navigate through interconnected information and different pieces of multiple viewpoints. Place and context of the knowledge, commonly referred to as context-dependent, draws specific attention to how different situations modify the application of knowledge.

The principles that govern the design of efficient case based learning environments are identified by CFT as proposed by Spiro et al. (2003) as six. These comprise (1) distinct representations of knowledge including the integration of real world applications of abstract concepts, as well as the representation of complex knowledge in its interconnected web-like form.

Further, (2) representation of higher-order themes, thematic searches and their extensive interconnections, convoluted ideas, and perceptual overlays must be supported in the learning environment to enhance the scope of learners. (3) CFT builds upon these foundational principles by incorporating its other established interdisciplinary framework features, such as open and flexible learning environments, contending that cognitive flexibility is the hallmark of an integrated system. In addition, (4) instruction must shift from passive knowledge reproduction to proactive construction of knowledge, cultivate both conceptual and domain complexity at the onset, and engage learners actively in the learning process. (5) Other principles may include promoting the break apart and the coming together of ideas that go beyond simple concept pairs, using "crossroads cases" that suggest different directions for investigation, and exposing learners to a pedagogical plurality of cases while stressing on conceptual variance. In addition, flexibility in the design of learning lies in the temporal openness which allows learners' reframing of knowledge over time.

Deriving from the previously mentioned principles, CFT-based learning environments are capable of enabling nuanced deep learning in students so that they approach complex matters from various angles (Güner & Gökçe, 2021; Spiro et al., 2017).

Tasks designed around CFT principles also involve blended learning, hypermedia authoring tools, and even case study activities that motivate flexible approach application. That approach enables learners to integrate the actual text and their previous knowledge with multiple and often contradictory positions as perspectives. Fulfilling CFT principles, learners reframes knowledge in an interactive way, which enhances their capability to understand complex academic texts and deal with abstract concepts. Above all, CFT instructional strategies enable learners to cope with different concepts and cultures, which improves their understanding in EFL environments. However, the importance of CFT in fostering focused attention differs in its exclusion of irrelevant information. CFT assignments often engage learners in sustained and selective attention, which is necessary in capturing and integrating pertinent ideas from lengthy or complicated texts. By enabling cognitive flexibility and focused attention, CFT not only improves reading comprehension but enhances the academic performance of learners in many adverse educational situations (Arman et al., 2023; Zarei & Esfandiari, 2017).

CFT diverges from traditional learning theories on account of its focus on the non-linear progression of acquiring a skill or knowledge, giving learners the agency to utilize different approaches to achieve a holistic understanding of academic texts. Of particular importance is the role of CFT in enhancing academic learning, especially in complex and flexible areas such as reading comprehension. Centrally, CFT focuses on the ability to adaptively restructure knowledge

through retelling across contexts, which is vital, especially to EFL learners, who struggling navigating through complex language, abstraction, and non-linear sophisticated arguments (Toprak, Metin, & Ünalan, 2023). In academic reading comprehension, CFT assists learners in developing the ability to deal with various materials constructively. This includes information integration, inference making, and critical thinking directed towards abstraction. CFT encourages learners to take different perspectives towards a topic, thus promoting a non-repetitive learning process that is not restricted to mere rote memorization, but deeper understanding and application of knowledge (Zheng, Akaliys, Ma, & Xu, 2024; Spiro et al., 2017).

One notable use of CFT in learning is in its focus on tackling ill-structured domains, which is usually the case in academic reading. The CFT equips learners with the ability to shift perspectives and apply knowledge in a flexible manner, thus enabling them to tackle intricate texts from different complex sources. Spiro et al. (2003) showed how modular instructional approaches based on CFT principles strengthened students' abilities to analyze and synthesize information. Such approaches help learners to interrelate unrelated concepts which makes it easier for them to comprehend and think critically. In addition, metacognitive practices, which are vital for academic achievement, are also fostered by CFT. Students adjusting the reading strategies they employ depending on a text's level of difficulty and prioritizing critical information over non-essential details are some of the fundamentals of CFT-based learning. This correlates with the notion that hypermedia-based CFT interventions are found to enhance learners' ability to manage cognitive load, focus on relevant details, and approach texts with a problem as given (Eldesoky & Esmail, 2021; Toprak et al., 2023).

The integration of multimodal resources and hypertext learning environments into CFT applications has further deepened its learning impact. With these tools, learners can obtain supplemental materials, including case studies, videos, and explanatory notes, which aid the comprehension of sophisticated topics from various angles. These environments not only aid understanding, but also thinking on higher levels, such as synthesis, evaluation, analysis, etc. The application of CFT was found to foster students' ability to learn in a more sophisticated way which greatly enhanced their cognitive and academic achievements. In addition, CFT has working value for practical learning settings. The focus on flexibility and shift of point of view enables learners to respond to a range of academic, professional, and social issues. CFT promotes the use of diverse information sources and the interpretation of uncertainty which encourages skills applicable beyond the classroom. These are important skills for EFL learners because such skills allow people to use

texts in a critical manner by looking beyond the linguistic and cultural barriers to understanding (Lin, 2013; Arman et al., 2023).

CFT is exceptionally useful in overcoming the language and EFL learner barriers. Grabe and Stoller's (2019) suggest these barriers usually involve the decoding of complex sentences, comprehension of abstract concepts, and synonym phrases. Implementing CFT-based instructional strategies like interactive case studies and modular readings enables students to approach the materials in multiple forms, which helps in adaptive learning. Such adaptability is vital for EFL learners as it assists in the development of self-regulation, strategic reading, and filtering and prioritizing information. These learners would not only understand but also cognitively develop and operate independently and confidently as readers of academic texts (Nasri & Biria, 2021; Zarei & Esfandiari, 2017).

CFT implements non-linear and flexible approaches as a means of reducing cognitive load and improving attention control. Usually, in a typical linear way of teaching, learners are presented with so much detail that they are unable to focus on the most important parts of the information. CFT attends to the management of cognitive load by creating environments that allow the interconnection of knowledge chunks while enhancing attention control. For learners of English as Foreign Language (EFL), CFT permits selective attention to new information in both linguistic and conceptual forms without getting lost in irrelevant details. In general, these strategies allow learners to adapt better by using more sophisticated ways of learning such as filter case based problem solving activity where learners are taught to focus on important things and ignore those that are not useful, which enhances their understanding and retention of the information (Cheng & Koszalka, 2016; Zarei & Esfandiari, 2017).

In addition, CFT places focus on the use of adaptive attitude, problem solving, and critical thinking analysis as important techniques in education. With this approach, many teaching methods have been created to help learners cope with the management of complex information and knowledge utilization in different contexts. Among these methods, case teaching is one of the most effective. Case teaching is consistent with CFT in that learners are required to solve problems considering different angles and flexibly use their knowledge. This approach helps learners of English as a foreign language because they can work with real academic materials and learn to think critically as opposed to just memorizing. Case-method teaching helps students analyze real situations and increases their ability to understand complicated information and relate what is learned to real-life activities (Cheng & Koszalka, 2016; Spiro et al., 2003).

Another cornerstone of CFT education is hypertext learning environments, which encourage non-sequential learning processes. Hypertext differs from traditional learning methods because students can pace themselves to their level of understanding by reorganizing and revisiting content freely. The importance of hypertext environments in facilitating cognitive flexibility comes from the possibility of interaction with multimedia, hyperlinks, and other interactive tools. For English as a Foreign Language (EFL) learners, who often find it difficult to adjust to the rigid format of a traditional textbook, hypertext offers a less stressful and more personalized learning environment. This strategy enhances comprehension by enabling learners to navigate information freely, concentrate on interesting topics, and re-examine difficult concepts. Furthermore, the inclusion of videos, graphics, and other multimedia elements increases motivation and participation, enabling the learners to appreciate complex academic texts more profoundly (Spiro et al., 2017).

Lin (2013) researched the impact of cognitive flexibility on academic achievement of 770 undergraduate students. He applied a modified version of the cognitive flexibility scale, which showed a positive correlation between students' academic performance and cognitive flexibility in these students. Firat University, and notably Önen and Koçak (2014) look at the relations between cognitive flexibility and study methods of 554 high school students as well. They employed the Cognitive Flexibility Scale for assessing cognitive flexibility and a Study Attitudes Inventory for studying the study strategies. Their findings demonstrated notable positive relations of the sub-dimensions of the CFS and scores on the SAI. Thus, it can be said that more adaptive and effective study strategies in high school learning are associated with higher cognitive flexibility. Ahmed (2020) stated that the two cognitive flexibility and profession competence demonstrated robust positive correlation. This finding suggests that greater cognitive flexibility may be associated with enhanced professional competence in early childhood instructors, potentially impacting their ability to adapt to the dynamic and unpredictable demands of the kindergarten classroom. Mohamed (2020) investigated the relationship between cognitive flexibility and perceived academic competence, along with the interrelationships among their respective sub-dimensions, within a sample of mentally gifted faculty of education students. Employing a descriptive correlational design, the study revealed a statistically significant positive relationship between the students' overall cognitive flexibility scores (both total and dimensional) and their overall perceived academic competence scores.

Eldesoky and Esmail (2021) examined the relationship between cognitive flexibility, cognitive beliefs, and academic performance among 286 university students. A central aim of their study was to determine the relative contributions of cognitive flexibility and epistemic beliefs to

academic performance. The findings indicated that both dimensions of cognitive flexibility—specifically, cognitive restructuring and need for cognitive change—significantly predicted academic performance. More predicable academic performance is predicable through cognitive beliefs and across its sub-dimensions, i.e. knowledge source, knowledge structure and learning ability. Statistical results also showed that students with high level of cognitive flexibility significantly outperformed in the academic performance those of the medium level and low level students also proved that high level of cognitive flexibility.

In a study involving 1628 students across three grade levels (4th, 8th, and 12th), Güner and Gökçe (2021) explored the interrelationships between cognitive flexibility, critical thinking dispositions, and mathematics achievement. The findings indicated a significant positive correlation between cognitive flexibility and critical thinking dispositions, and further demonstrated that both cognitive flexibility and critical thinking dispositions exerted a strong positive effect on maths achievement. They study recommended that cognitive flexibility and critical thinking may function as mutually reinforcing cognitive resources that contribute to enhanced performance in learning. Demirtaş et al. (2023) examined and proved the correlation of cognitive flexibility with tendencies of critical thinking among prospective teachers. Among 2085 adolescents aging 13-14, Toprak et al., (2023) explored how cognitive flexibility mediated academic motivation and its relation to and fear of negative evaluation. Their findings provided partial support for the hypothesis that cognitive flexibility partially mediated the association between the two constructs. Employing multilayer analyses, Zheng et al., (2024) confirmed positive correlation of cognitive flexibility with global academic performance among thousands of adolescents from 57 diverse countries.

Methodology

Participants

The current study involved 58 postgraduate students enrolled in the second-year diploma, EFL Curricula and Instruction program at the Faculty of Specific Education, **Zagazig University**. This sample was selected because these students are at a stage where they need to cultivate some academic reading comprehension and selective attention skills, which are crucial for their academic success. The participants were divided into experimental and control groups. To ensure homogeneity, students in both groups were at the same average age (23–24 years) and had completed four years of undergraduate studies in English Section. Additionally, their EFL academic **reading comprehension** and **selective attention levels** were pre-tested to confirm the absence of significant differences of the study participants before implementing the targeted intervention.

Table 1

T-test results of both study groups in the pre-administration of the EFL Academic Reading Comprehension Test & Selective Attention Scale

Dimension	Group	N	M	S.D	*t.* Value	Sig.
Academic Reading Comprehension	**Exp.**	29	25.09	1.897	0.501	0.618
	Cont.	29	25.38	2.850		
Selective Attention	**Exp.**	29	64.97	6.952	0.251	0.803
	Cont.	29	65.41	7.532		

Study Design

The quasi-experimental design was adopted, including two groups (experimental group participants received CFT-instruction and the control group participants got regular instruction) assigned to achieve the study objectives. The experimentation took about three months in (2023–2024) academic year. For the sake of data collection, a pre-post academic reading comprehension test and a selective attention scale were carefully prepared and administered to determine any significant differences between the study groups. The obtained data were statistically analyzed employing *t*-tests to examine the impact of the intervention.

Instruments

A pre-posttest on EFL academic reading comprehension (See Appendix C) and a pre-post scale on selective attention (See Appendix D) were developed to assess students' levels before and after the intervention. Both instruments were submitted to a panel of TEFL expert specialists to ensure their validity. The experts evaluated the clarity, wording, accuracy, and appropriateness of the instruments for the participants' proficiency level. Additionally, the test and the scale were piloted with thirty students outside the study sample to gather feedback on instructions clarity and individual items suitability. To determine reliability, a test-retest method was employed, and the internal consistency was calculated (alpha coefficient = 0.89). Scoring reliability for the test was ensured using a rubric designed to evaluate responses (See Appendix B). The scoring scale ranged from A (highest performance) to D (lowest performance). For the selective attention scale, students were asked to choose among three responses (always, sometimes, or never) to reflect their performance on the assessed items.

Study Material

Based on the literature review and previous studies, four units were designed incorporating principles and strategies of CFT to promote both academic reading comprehension and selective attention (See Appendix E). These units aimed to:

1. Achieving the learning objective of the formal course.
2. Enhance students' EFL academic reading comprehension skills, including decoding complex texts, situating key information, switch between texts, integrating prior knowledge, generating new meanings, and synthesizing ideas from multiple sources.
3. Develop students' selective attention by training them to prioritoze relevant details, disregard extraneous information in texts, master cognitive control across texts, and sustain attention within multiple reading tasks.
4. Encourage adaptive learning strategies to handle non-linear and complex academic texts.
5. Improve students' ability to connect information across various contexts and perspectives to deepen their understanding of academic content and to reproduces information from another perspective.

Content of the Units

Aligned with the learning objective with the formal course, the content was carefully designed according to the tenets and principles of CFT and prepared to be presented through CFT strategies. It was based mainly on the current syllabus materials (Selected Reading Texts from various resources). Each of the four units was tailored and specified to focus on particular academic reading skills and attention dimensions, providing a variety of activities and tasks to help students effectively manipulate complex academic texts effectively.

Unit One: Recognizing Multiple Perspectives in Texts (Flexible Coding)

Students were introduced to strategies for identifying and interpreting multiple viewpoints in academic readings. They were guided to distinguish between explicit and implicit ideas in a text and trained to use graphic organizers to map out contrasting perspectives. Learning activities included reviewing academic article excerpts and analyzing the authors' presentation of various arguments or sides of issues. Students then practiced summarizing from different points of view while integrating concepts.

Unit Two: Hypertext and Non-Linear Reading (Flexible Assembly)

The primary focus of this unit was the interpretation of non-linear texts like hypertexts and multimedia resources. Students learned how to find information in hyperlinked materials as well as

the relevance of various content components. They were also taught the use of digital information organization tools like annotations and bookmarks for ranking the importance of the information. Analyze multimedia case studies was one of the tasks to facilitate discussion on how different formats affect comprehension and selective attention.

Unit Three: Focused Attention and Prioritization (Flexible Comparison)

In this lower level unit, students focused on gradually developing selective attention by constructing and ignoring relevant and non-relevant details in academic texts. In order to practice scanning, students participated in timed reading exercises and marked relevant details using digital tools and highlighters. Activities involved composing topic sentences, supporting sentences to the main idea and summarizing the main idea after filtering out irrelevant information. Students participated in pairs to discuss their choices of focus and analysis points and how they can enhance directing attention.

Unit Four: Integrative Generated Comprehension across Texts

This final unit aimed to help students integrate information from multiple texts to form cohesive and comprehensive understandings. Students analyzed thematic connections between different readings and synthesized information into coherent summaries. Tasks included comparing research findings from various academic articles, eliciting information, identifying common themes, differentiating similar/different relations, discussing implications, and constructing meaning. Collaborative, groups or peers, activities encouraged students to share insights and critique each other's interpretations, promoting deeper understanding, and ultimate oriented-comprehension.

Results

The results were introduced according to the study stipulated hypotheses. Paired and independent samples t-tests applied to analyze the data collected. Descriptive and inferential statistics were calculated using the SPSS.

Testing Hypothesis One

It states that “There is a statistically significant difference between the CFT-treatment group students' mean scores and those of the control group students on the post-assessment of the EFL academic reading comprehension test in favor of the CFT-treatment group”. In order to test this hypothesis, independent samples t-test was used.

Table 2

T-test Results Comparing the study groups in the Post-Administration of the EFL Academic Reading Comprehension Test

Dimension	Groups	N	Mean	St	*t.* Value	Sig.
Academic Vocabulary Knowledge	**Exp.**	29	8.53	0.992	16.38	0.01
	Cont.	29	5.06	0.736		
Informational/Textual Comprehension	**Exp.**	29	8.62	0.954	17.99	0.01
	Cont.	29	5.06	0.649		
Organizational & Referential Comprehension	**Exp.**	29	8.47	0.992	17.00	0.01
	Cont.	29	4.94	0.694		
Skimming and Scanning Skills	**Exp.**	29	8.62	0.954	17.22	0.01
	Cont.	29	5.06	0.736		
Syntactic and Structural Knowledge	**Exp.**	29	8.56	0.927	17.85	0.01
	Cont.	29	4.97	0.717		
Metacognitive knowledge	**Exp.**	29	8.09	0.793	17.38	0.01
	Cont.	29	4.79	0.770		
Regulating & Integrating Prior Knowledge	**Exp.**	29	8.35	1.070	14.55	0.01
	Cont.	29	5.09	0.753		
Rotating & Reorganizing skills	**Exp.**	29	13.71	1.142	28.85	0.01
	Cont.	29	6.85	0.784		
Academic comprehension	**Exp.**	29	13.62	1.129	29.18	0.01
	Cont.	29	6.85	0.744		
Total	**Exp.**	29	86.39	3.021	60.98	0.01
	Cont.	29	48.69	1.967		

Significant *t*-value

Table 2 illustrates that the CFT-treatment group students significantly outperformed their control peers in EFL academic reading comprehension overall and across all measured dimensions. The experimental group students' mean scores in the post-assessment were notably higher: Academic Vocabulary Knowledge (8.53), Informational/Textual Comprehension (8.62), Organizational & Referential Comprehension (8.47), Skimming and Scanning Skills (8.62), Syntactic and Structural Knowledge (8.56), Metacognitive Knowledge (8.09), Regulating &

Integrating Prior Knowledge (8.35), Rotating & Reorganizing Skills (13.71), and Academic Comprehension (13.62).

In comparison, the control group exhibited significantly lower mean scores across the same dimensions: Academic Vocabulary Knowledge (5.06), Informational/Textual Comprehension (5.06), Organizational & Referential Comprehension (4.94), Skimming and Scanning Skills (5.06), Syntactic and Structural Knowledge (4.97), Metacognitive Knowledge (4.79), Regulating & Integrating Prior Knowledge (5.09), Rotating & Reorganizing Skills (6.85), and Academic Comprehension (6.85).

The total mean score for the EFL Academic Reading Comprehension Test was 86.39 for the treatment group, compared to 48.69 for the control group. These differences were statistically significant, as reflected by the t-values: 16.38 for Academic Vocabulary Knowledge, 17.99 for Informational/Textual Comprehension, 17.00 for Organizational & Referential Comprehension, 17.22 for Skimming and Scanning Skills, 17.85 for Syntactic and Structural Knowledge, 17.38 for Metacognitive Knowledge, 14.55 for Regulating & Integrating Prior Knowledge, 28.85 for Rotating & Reorganizing Skills, and 29.18 for Academic Comprehension. The overall t-value of 60.98 confirms the intervention's significant impact at the 0.01 level of significance. Hence, this hypothesis was verified.

Testing Hypothesis Two

It states that “There is a statistically significant difference between the CFT-treatment group students' mean scores on the pre-post assessments of the EFL academic reading comprehension test in favor of the post-assessment results”. In order to test this hypothesis, for paired samples *t*-test was used.

Table 3

T-test results comparing experimental group pre- and post- administrations of the EFL Academic Reading Comprehension Test

Dimension		N	Mean	S.D	T. Value	Sig.
Academic Vocabulary Knowledge	**Post**	29	8.53	0.992	23.89	0.000
	Pre	29	2.38	0.985		
Informational/Textual Comprehension	**Post**	29	8.62	0.954	27.95	0.000
	Pre	29	2.47	0.992		
Organizational & Referential Comprehension	**Post**	29	8.47	0.992	21.63	0.000
	Pre	29	3.06	1.254		
Skimming and Scanning Skills	**Post**	29	8.62	0.954	29.21	0.000
	Pre	29	2.53	0.992		
Syntactic and Structural Knowledge	**Post**	29	8.56	0.927	24.25	0.000
	Pre	29	2.47	0.929		
Metacognitive knowledge	**Post**	29	8.09	0.793	24.71	0.000
	Pre	29	2.65	1.041		
Regulating & Integrating Prior Knowledge	**Post**	29	8.35	1.070	25.41	0.000
	Pre	29	2.44	0.894		
Rotating & Reorganizing skills	**Post**	29	13.71	1.142	43.36	0.000
	Pre	29	3.62	0.652		
Academic comprehension	**Post**	29	13.62	1.129	43.77	0.000
	Pre	29	3.68	0.638		
Total	**Post**	29	86.41	3.115	107.45	0.000
	Pre	29	25.09	1.897		

Significant *t*-value

Table 3 illustrates that the CFT-treatment group students exhibited significant improvements in EFL academic reading comprehension across all dimensions when comparing their pre- and post-assessment scores. The mean scores for Academic Vocabulary Knowledge,

Informational/Textual Comprehension, Organizational & Referential Comprehension, and Skimming and Scanning Skills in the post-assessment were 8.53, 8.62, 8.47, and 8.62, respectively, all substantially higher than the corresponding pre-assessment means of 2.38, 2.47, 3.06, and 2.53. Additional dimensions also reflected marked enhancements: Syntactic and Structural Knowledge increased from 2.47 to 8.56, Metacognitive Knowledge rose from 2.65 to 8.09, Regulating & Integrating Prior Knowledge improved from 2.44 to 8.35, Rotating & Reorganizing Skills advanced from 3.62 to 13.71, and Academic Comprehension climbed from 3.68 to 13.62.

The overall mean score for the EFL Academic Reading Comprehension Test rose dramatically, from 25.09 in the pre-assessment to 86.41 in the post-assessment. These differences are statistically significant, as evidenced by the t-values: 23.89 for Academic Vocabulary Knowledge, 27.95 for Informational/Textual Comprehension, 21.63 for Organizational & Referential Comprehension, 29.21 for Skimming and Scanning Skills, 24.25 for Syntactic and Structural Knowledge, 24.71 for Metacognitive Knowledge, 25.41 for Regulating & Integrating Prior Knowledge, 43.36 for Rotating & Reorganizing Skills, and 43.77 for Academic Comprehension. The overall t-value of 107.45 confirms the intervention's efficacy at the 0.01 level of significance. These findings strongly validate the second hypothesis, demonstrating that the CFT-based approach substantially improved the EFL academic reading comprehension of the treatment group students across all assessed dimensions.

Testing Hypothesis Three

It states that “CFT-based instruction is effective in promoting EFL postgraduates' EFL academic reading comprehension (both overall and across its dimensions)”. To verify this hypothesis, Black’s Formula was applied.

Table 4

Gain Ratio of the CFT- Treatment Group in EFL Academic Reading Comprehension

Dimension	Groups	N	Mean	maximum Score	Gain Ratio
Academic Vocabulary Knowledge	**Post**	29	8.53	10	1.42
	Pre	29	2.38	10	
Informational/Textual Comprehension	**Post**	29	8.62	10	1.43
	Pre	29	2.47	10	
Organizational & Referential Comprehension	**Post**	29	8.47	10	1.32
	Pre	29	3.06	10	
Skimming and Scanning Skills	**Post**	29	8.62	10	1.42
	Pre	29	2.53	10	
Syntactic and Structural Knowledge	**Post**	29	8.56	10	1.42
	Pre	29	2.47	10	
Metacognitive knowledge	**Post**	29	8.09	10	1.28
	Pre	29	2.65	10	
Regulating & Integrating Prior Knowledge	**Post**	29	8.35	10	1.37
	Pre	29	2.44	10	
Rotating & Reorganizing skills	**Post**	29	13.71	15	1.56
	Pre	29	3.62	15	
Academic comprehension	**Post**	29	13.62	15	1.54
	Pre	29	3.68	15	
Total	**Post**	29	86.41	100	1.43
	Pre	29	25.09	100	

Gain Ratio from 1 to 2 is *satisfactory*

Table 4 shows that (1.43) is the overall gain ratio, indicating that the CFT-based instruction is highly effective in enhancing EFL postgraduates' EFL academic reading comprehension. Furthermore, the gain ratios for the individual dimensions reflect substantial improvement, with all values falling within the satisfactory range of 1 to 2 as per Black's Formula. The highest gain ratios were observed in Rotating & Reorganizing Skills (1.56) and Academic Comprehension (1.54), demonstrating the intervention's effectiveness in fostering advanced reading abilities. Other

dimensions also showed significant gains, including Informational/Textual Comprehension (1.43), Skimming and Scanning Skills (1.42), and Syntactic and Structural Knowledge (1.42). Notably, Academic Vocabulary Knowledge (1.42) and Regulating & Integrating Prior Knowledge (1.37) displayed strong outcomes, while Organizational & Referential Comprehension (1.32) and Metacognitive Knowledge (1.28) revealed slightly lower but still satisfactory improvements. These results highlight the significant and satisfactory impact of the CFT-based intervention on students' academic reading comprehension, both overall and across its dimensions. Therefore, the third hypothesis is confirmed, validating the effectiveness of CFT intervention in promoting EFL postgraduates' academic reading comprehension; such significant improvements may be attributed to CFT-based instruction.

Testing Hypothesis Four

It states that "There is statistically significant difference between the CFT-treatment group students' mean scores and those of the control group on the post-assessment of the Selective Attention Scale in favor of the CFT-treatment group". In order to test this hypothesis, independent samples *t*-test for was used to find out any significant differences.

Table 5

T-test Results Comparing study groups in the Post-Administration of the Selective Attention Scale

Dimension	Group	N	M.	S.D	*t.* Value	Sig.
Focusing on Relevant Information	**Exp.**	29	23.71	1.142	25.99	0.01
	Cont.	29	11.85	2.401		
Filtering Distractions	**Exp.**	29	23.62	1.129	25.07	0.01
	Cont.	29	12.62	2.296		
Shifting Attention	**Exp.**	29	23.59	1.076	28.91	0.01
	Cont.	29	10.79	2.346		
Maintaining Attention over Time	**Exp.**	29	23.53	1.212	24.38	0.01
	Cont.	29	11.79	2.532		
Attention to Detail	**Exp.**	29	23.56	1.186	23.28	0.01
	Cont.	29	11.32	2.825		
Multitasking and Divided Attention	**Exp.**	29	23.50	1.022	27.16	0.01
	Cont.	29	11.56	2.351		
Response Inhibition	**Exp.**	29	23.62	1.181	29.03	0.01

	Cont.	29	10.97	2.249		
Task Relevance Identification	**Exp.**	29	23.41	1.131	27.43	0.01
	Cont.	29	11.18	2.342		
Total	**Exp.**	29	188.53	2.894	81.97	0.01
	Cont.	29	92.09	6.220		

Significant *t*-value

Table 5 shows the t-test results comparing the study groups on the post-administration of the Selective Attention Scale, revealing significant differences in favor of the students in the experimental group across all dimensions of selective attention. The experimental group consistently outperformed the control group, achieving higher mean scores in each dimension: Focusing on Relevant Information (23.71 vs. 11.85), Filtering Distractions (23.62 vs. 12.62), Shifting Attention (23.59 vs. 10.79), Maintaining Attention Over Time (23.53 vs. 11.79), Attention to Detail (23.56 vs. 11.32), Multitasking and Divided Attention (23.50 vs. 11.56), Response Inhibition (23.62 vs. 10.97), and Task Relevance Identification (23.41 vs. 11.18). The total mean score for the experimental group was 188.53, compared to 92.09 for the control group.

The t-values for each dimension indicate statistically significant differences at the 0.01 level: 25.99 for Focusing on Relevant Information, 25.07 for Filtering Distractions, 28.91 for Shifting Attention, 24.38 for Maintaining Attention over Time, 23.28 for Attention to Detail, 27.16 for Multitasking and Divided Attention, 29.03 for Response Inhibition, and 27.43 for Task Relevance Identification. The *t*-value for the total score was 81.97, further supporting the statistical significance of the results. These findings confirm the fourth hypothesis, demonstrating that the CFT-based instruction significantly enhances the selective attention for the participants.

Testing Hypothesis Five

It states that "There is statistically significant difference between the CFT-treatment group students' mean scores on the pre-post assessments of the Selective Attention Scale in favor of the post-assessment results". In order to test the fourth hypothesis, paired samples *t*-test was applied.

Table 6

T-test results comparing the pre- and post-administrations of the experimental group on the Selective Attention Scale

Dimension		N	M.	S.D	*t*. Value	Sig.
Focusing on Relevant Information	**Post**	29	23.71	1.142	38.10	0.01
	Pre	29	7.85	2.271		
Filtering Distractions	**Post**	29	23.62	1.129	44.02	0.01
	Pre	29	7.97	2.096		
Shifting Attention	**Post**	29	23.59	1.076	34.87	0.01
	Pre	29	8.00	2.335		
Maintaining Attention Over Time	**Post**	29	23.53	1.212	41.35	0.01
	Pre	29	7.91	1.929		
Attention to Detail	**Post**	29	23.56	1.186	39.46	0.01
	Pre	29	8.09	2.006		
Multitasking and Divided Attention	**Post**	29	23.50	1.022	23.34	0.01
	Pre	29	9.12	3.179		
Response Inhibition	**Post**	29	23.62	1.181	45.09	0.01
	Pre	29	8.35	1.704		
Task Relevance Identification	**Post**	29	23.41	1.131	38.18	0.01
	Pre	29	7.68	2.114		
Total	**Post**	29	188.53	2.894	96.16	0.01
	Pre	29	64.97	6.952		

Significant *t*-value

Table 6 shows that experimental group students exhibited significant improvements in selective attention across all dimensions when comparing their pre-assessment and post-assessment scores. The post-assessment mean scores for Focusing on Relevant Information (23.71), Filtering Distractions (23.62), Shifting Attention (23.59), Maintaining Attention Over Time (23.53), Attention to Detail (23.56), Multitasking and Divided Attention (23.50), Response Inhibition (23.62), and Task Relevance Identification (23.41) were all substantially higher than the

corresponding pre-assessment means of 7.85, 7.97, 8.00, 7.91, 8.09, 9.12, 8.35, and 7.68, respectively.

The total mean score increased significantly from 64.97 in the pre-assessment to 188.53 in the post-assessment. These differences were statistically significant, as indicated by the t-values for each dimension: 38.10 for Focusing on Relevant Information, 44.02 for Filtering Distractions, 34.87 for Shifting Attention, 41.35 for Maintaining Attention Over Time, 39.46 for Attention to Detail, 23.34 for Multitasking and Divided Attention, 45.09 for Response Inhibition, and 38.18 for Task Relevance Identification. The overall t-value of 96.16 confirms the effectiveness of the intervention at the 0.01 significance level. Thereby, this hypothesis is verified and such significant improvements possibly resulted from the CFT-based intervention.

Testing Hypothesis Six

It states that "CFT-based instruction is effective in promoting EFL postgraduates' Selective Attention (both overall and across its dimensions)". This hypothesis is tested by calculating Black's Formula.

Table 7
Gain Ratio of the CFT-Treatment Group in Selective Attention and in its Dimensions

Dimension	Groups	N	Mean	maximum Score	Gain Ratio
Focusing on Relevant Information	**Post**	29	23.71	25	1.56
	Pre	29	7.85	25	
Filtering Distractions	**Post**	29	23.62	25	1.54
	Pre	29	7.97	25	
Shifting Attention	**Post**	29	23.59	25	1.54
	Pre	29	8.00	25	
Maintaining Attention Over Time	**Post**	29	23.53	25	1.54
	Pre	29	7.91	25	
Attention to Detail	**Post**	29	23.56	25	1.53
	Pre	29	8.09	25	
Multitasking and Divided Attention	**Post**	29	23.50	25	1.48
	Pre	29	9.12	25	

Response Inhibition	**Post**	29	23.62	25	1.53
	Pre	29	8.35	25	
Task Relevance Identification	**Post**	29	23.41	25	1.54
	Pre	29	7.68	25	
Total	**Post**	29	188.53	200	1.53
	Pre	29	64.97	200	

Satisfactory Gain Ratio

Table 7 shows that the overall gain ratio for the CFT-treatment group in Selective Attention is 1.53, indicating that the intervention effectively enhanced EFL postgraduates' selective attention. Furthermore, the gain ratios for individual dimensions demonstrate substantial improvement, with Focusing on Relevant Information at 1.56, Filtering Distractions at 1.54, Shifting Attention at 1.54, Maintaining Attention Over Time at 1.54, Attention to Detail at 1.53, Multitasking and Divided Attention at 1.48, Response Inhibition at 1.53, and Task Relevance Identification at 1.54 These results highlight the significant and satisfactory impact of the CFT-based intervention on selective attention across all its dimensions. Therefore, this hypothesis is confirmed, validating the effectiveness of CFT intervention in promoting selective attention for EFL postgraduates.

Discussion

Findings of the present study prove the effectiveness of cognitive flexibility theory-based intervention in improving postgraduate English majors' academic reading comprehension and their selective attention, with significant *t*-values and satisfactory gain ratios overally and across dimensions. The CFT-treatment group exhibit significant improvements across all measured dimensions, including overall academic reading comprehension and its sub-skills (beginning with *Academic Vocabulary Knowledge* and *Informational/Textual Knowledge*, and ending with ultimate Academic Reading Comprehension). These improvements were significantly higher than those observed in the pre-assessments and those of the control groups' post-assessments. The results emphasize the potential of CFT-based interventions in fostering academic reading proficiency with its entailed sub-skills. The same applies to the participants' improvements in overall selective attention and its sub-dimensions (beginning with *Focusing on Relevant Information* and Filtering Distractions and terminating with overall Selective Attention. These improvements confirm the promising benefit and contribution of utilizing CFT tenets, principles and strategies in cultivating foreign language competences and some companion cognitive processes and abilities.

The CFT-based intervention presented dynamic adaptable learning settings where students engaged in flexible, non-linear, multi-perspective, multidimensional learning tasks. These tasks required students to integrate information from multiple sources, shift perspectives, and adapt their understanding to different contexts. For instance, students participated in hypermedia-based activities, case-based discussions, and reflective exercises, all of which fostered active engagement and changeable content manipulation. CFT-based instruction implies empowering learners with strategic training to detect situational knowledge, re/build knowledge, re/construct meaning at an advanced level from multiple resources. It enables learners to effectively adapt their responses in accordance with the reading purpose, adjust what is learned in new learning situations, switch between tasks and thoughts, manipulate different learning contents with versatile strategies, accomplish multitasks in reading, receive information from different perspectives, prioritize some information and inferiorize other, depart and impart specific information from and among multiple texts. Furthermore, its strategies help learners represent information in different ways, elicit and integrate contextual information, put it in new positions or arrangements, navigate between alternatives, prepare flexible possibilities for problem-solving during learning tasks. Applying these strategies within each and every reading comprehension academic task, and aligning with the purpose of the present study, CFT-treatment group got their academic reading comprehension enhanced remarkably.

CFT-based trained learners got their *Selective Attention* significantly enhanced also. That's because they effectively applied and sustainable attention perceptual selection, cognitive control, task management of academic material under manipulation. Cognitive flexibility, in the context of learning, is effectively deployed when learners demonstrate a receptive orientation towards diverse knowledge perspectives, sources, thoughts, and opinions during information gathering related to novel learning challenges. This entails not only accessing and integrating diverse informational inputs but also strategically applying this synthesized knowledge to generate and implement alternative solutions across varying task demands, reflecting an adaptive and context-sensitive approach to problem-solving. They, accordingly, got their selective attention enhanced. They could intentionally focus in threads of thought, trace pertinent information, control and sustain attention, control reading task course and progress, disengage irrelevant information, filter out much detail.

These results are consistent with the studies which confirmed the utility of cognitive flexibility in improving academic motivation (Toprak, et al., 2023), academic self-concept, student teachers' awareness of differentiated teaching, self-compatibility and academic self-efficacy (Abdel-Azim; 2018), academic performance (Lin, 2013), communication skills (Ghazanfari & Pourhosein Gilakjani, 2022), and study strategies (Önen & Koçak, 2014).

Furthermore, a great corpus of studies explored the relationship between cognitive flexibility and other domains such as professional competence, academic competence, critical thinking, academic achievement, academic performance (e.g. Ahmed, 2020; Mohamed, 2020; Güner & Gökçe, 2021; Demirtaş et al., 2023; Zheng et al., 2024). These studies predicted positive linear correlation between cognitive flexibility and each of them, recommending integrating CFT principles and strategies to foster these domains and competences among learners across all learning levels.

From other perspectives, significant improvements in academic reading comprehension align with the results of the studies attempted to enhance these skills or other language skills (e.g. Abbott, 2013; AL Zahrani, 2021; Bhatt & Samanhudi, 2022; Ismail & Edi, 2023; Lubis & Sulistyo, 2018; Nergis, 2013) and also align with the recommendations of other studies which favored direct instruction and development for EFL academic reading comprehension (e.g. Dardjito, 2019; Fitriana, 2018; Hasan et al., 2016; Jo, 2021; Nejadghanbar et al., 2022).

The findings of these remarkable improvements in SA are clearly consistent with those of many studies which either examined SA as a strategy to be utilized or as a mental ability to be enhanced. Both perspectives ensured the promising potential of SA and strong positive correlation with listening and reading comprehension, providing beneficial pedagogical implications for EFL

learners (e.g. Prichard, 2014; Prichard & Atkins, 2019; Qiu & Ismail, 2023; Zabihiatergeleh, 2011; Zhang & Wu, 2009).

Recommendations

The following recommendations are proposed, in the light of the obtained findings, for enhancing the EFL academic reading comprehension and selective attention of EFL postgraduate students using CFT tenets, principles and strategies. Curriculum designers should integrate CFT principles into EFL curricula, emphasizing tasks that promote adaptive thinking, multi-perspective learning, and inferential reasoning. Instructional materials should include case-based activities, hypertext learning environments, and contextually rich reading texts that encourage flexible interpretation, meaning construction, assembly of ideas, informative textual reading, and critical analysis of material presented. Educators should employ CFT strategies that foster selective attention, such as scaffolding tasks to focus on key details, discarding distractions, and practicing attention-shifting techniques in reading exercises. Professional development programs should prepare teachers to implement CFT-based approaches, equipping them with the tools and strategies to create dynamic, non-linear learning experiences that build cognitive flexibility and oriented-comprehension skills.

Assessment tools should be redesigned to measure both academic reading comprehension and selective attention across multiple dimensions, ensuring that instructional methods align with students' developmental needs. Schools should adopt more technological resources and multimedia platforms that facilitate adaptive and ubiquitous learning environments, granting students opportunities to interact with varied reading materials in a self-paced manner. Emotional and cognitive support should be prioritized, encouraging learners to explore complex texts without anxiety, fostering confidence, and promoting independent learning. Policymakers should recognize the value of CFT-based approaches, incorporating them into national educational strategies for EFL instruction and allocating the necessary resources for effective implementation and teacher training.

Suggestions for Further Research

In light of the current study findings, some suggestions for further research are proposed

1. Investigating CFT-based interventions on EFL academic reading comprehension and selective attention across different educational levels and student demographics.
2. Investigating the effect of CFT-based interventions on EFL academic writing skills.
3. Examining the effect of CFT on promoting EFL professional competence.

4. Examining the effect of CFT on cultivating EFL language competences, i.e. phonological grammatical, and lexical.
5. Investigating the effect of CFT-based instruction with other psychological variables, i.e. working memory and verbal memory.
6. Examining the impact of integrating CFT principles with other innovative teaching methodologies, such as task-based learning or project-based learning, on EFL learners' reading comprehension.
7. Exploring the potential of multimedia-enhanced CFT frameworks in reducing cognitive load and improving selective attention in other areas of language learning, i.e. listening or speaking, writing skills.
8. Investigating the role of CFT in fostering critical reading skills and metacognitive skills of EFL postgraduates.

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