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The Relationship between Teachers' Neurodidactic Awareness and Content Adaptation in EFL Classrooms

Teachers of English language in Some Algerian Universities

A Dissertation Submitted in Partial Fulfillment for the Requirement of the Master Degree in **Didactics of Foreign Languages**

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Dedication 1

﴿ وَقَالَ رَبِّ أَوْزِعْنِي أَنْ أَشْكُرَ نِعْمَتَكَ الَّتِي أَنْعَمْتَ عَلَيَّ وَعَلَىٰ وَالِدَيَّ وَأَنْ أَعْمَلَ صَالِحًا تَرْضَاهُ وَأَدْخِلْنِي بِرَحْمَتِكَ فِي عِبَادِكَ الصَّالِحِينَ﴾ النمل (19)

First and foremost, all praise and gratitude to Allah for granting me strength, health, patience, and guidance to complete this work.

I dedicate this work for my father and the soul of my mother and my grandmother.

To my brothers Haroun, Nassim, Noureddine, and Ayoub.

To my beloved niece Layan, and to my sister in law Sara.

To my beloved maternal aunts Fatima, Zainab, Halima, Fatiha, and Roukia.

I am grateful for my family and their support throughout this journey.

I am deeply grateful for my partner Wissam for her understanding and patience and encouragement during the completion of this work.

Finally, to myself

Proof that persistence can turn exhaustion into achievement

Rahma

Dedication 2

In the name of Allah, The Most Merciful, The Most Compassionate.

Praise to Allah for his guidance, power, and endless mercy, without his mercy this work would never have been possible.

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Abstract

Enhancing teachers' instructional effectiveness in EFL settings requires both solid understanding of brain-based learning and the ability to tailor instructional content to learners' cognitive and linguistic needs. Due to the growing interest in brain-based learning, neurodidactic has become an essential field that connects neuroscience findings with teaching practices, particularly content adaptation. This study aims to examine the relationship between teachers' neurodidactics awareness and their practical decisions regarding content adaptation in EFL classrooms. Out of the identified research problem three research questions were formulated: what is the level of neurodidactic awareness among EFL teachers? How do EFL teachers adapt instructional content in their classrooms? Is there a statistically significant relationship between teachers' neurodidactic awareness and content adaptation?

Initially, the study adopts a quantitative associational design, using a structured questionnaire as the main data collection instrument. The sample consist of EFL teachers from some Algerian universities, selected to provide relevant insights into instructional practices regarding content adaptation in EFL classrooms. Statistical analysis including Pearson correlation, were conducted to examine the relationship between the two variables. The results generally showed that EFL teachers possess a partial to moderate level of neurodidactic awareness which is appeared in the Pearson correlation results($r=0.506$). The findings further revealed that teachers apply different forms of content adaptation practices, although some practices appeared inconsistently implemented. Therefore, the Pearson correlation analysis revealed a statistically significant relationship between teachers' neurodidactic awareness and content adaptation in EFL classrooms. In addition, the research suggests that increasing teachers' awareness of brain-based learning principles may lead to more effective and meaningful instructional adaptation practices in EFL classrooms.

Key words: content adaptation, EFL, neurodidactic, teachers' awareness.

List of Abbreviations

EFL: English as Foreign Language

TPR: Total Physical Response

TNA: Teachers' Neurodidactic Awareness

CA: Content Adaptation

%: Percentage

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The General Introduction

1. Statement of The Problem

Recent advances in educational neuroscience have highlighted the importance of understanding how the brain learns and how this knowledge can inform effective teaching practices. Neurodidactics, an interdisciplinary field combining neuroscience, psychology, and education, seeks to apply brain-based principles to classroom instruction (Preiß, 1993; Tokuhama-Espinosa, 2010). Key principles such as attention, memory, emotion, and neuroplasticity play a central role in learning and student engagement (Sousa, 2011; Howard-Jones, 2014). Within this framework, teachers' neurodidactic awareness refers to teachers' understanding of how learners process and retain information, rather than formal expertise in neuroscience. Such awareness may influence instructional decisions, including how content is presented, structured, and adapted to reduce cognitive overload and enhance engagement (Tokuhama-Espinosa, 2010; Jensen, 2008).

In English as a Foreign Language (EFL) classrooms, teachers frequently work with learners who differ in proficiency levels, learning needs, and different backgrounds. As a result, standardized materials may not fully address these differences. This has led to increased attention to content adaptation, defined as teachers' deliberate modification of instructional materials to suit learners' linguistic levels, cognitive readiness, and contextual needs (Tomlinson, 2010; Nation, 2001). Content adaptation in EFL instruction commonly involves simplifying texts, adding contextualized examples, reordering tasks, and supplementing materials with visual or auditory resources (McGrath, 2013). Teachers act as key agents in this process, mediating between curriculum requirements and learners' capacities to facilitate effective learning.

Despite the recognized importance of both neurodidactics and content adaptation in education, teaching practices in many EFL classrooms still rely on standardized and uniform

instructional approaches that do not fully consider learners' cognitive and linguistic diversity. In addition, many teachers may not possess sufficient awareness of key neurodidactic principles such as attention span limitations, working memory capacity, and the role of emotions in learning. Consequently, content adaptation practices may not always effectively meet learners' needs in the classroom.

Although both neurodidactics and content adaptation are recognized as important in education, limited research has examined the relationship between teachers' neurodidactic awareness and their practical decisions regarding content adaptation in EFL contexts. This gap in the literature raises questions about whether teachers' understanding of brain-based learning principles is reflected in their instructional decisions when adapting content for diverse learners.

This gap may lead to several educational consequences. In the absence of adequate neurodidactic awareness, teachers may face difficulties in effectively adapting instructional materials, which can negatively affect learners' motivation, comprehension, classroom engagement, and long-term retention. Therefore, examining the relationship between teachers' neurodidactic awareness and their practical decisions regarding content adaptation is essential for improving the quality of EFL instruction and promoting more learner-centred teaching approaches.

2. Aims of The Study

In the light of previously mentioned points, the main purpose of conducting this research is to examine the relationship between teacher's neurodidactic awareness and content adaptation in EFL classrooms; the case study addresses Teachers of English in some Algerian universities. The study is, therefore, aim to measure teachers' neurodidactic awareness (i.e., their understanding of brain-based learning principles such as attention, memory, emotions, motivation, stress, multisensory learning, learning environment, and neuroplasticity) at first place. Then, the study seeks to measure the frequency with which these teachers use content

adaptation practices. Finally, the study aims to determine whether a statistically significant relationship exist between teacher's neurodidactic awareness and their instructional decisions regarding content adaptation in EFL classrooms. This research is likely to increase teachers' awareness of neurodidactic knowledge and its application for successful content adaptation in EFL classrooms, contributing to more effective teaching and learning processes.

3. Research Questions

The present study will seek answers to the following questions**:**

- What is the level of neurodidactic awareness among EFL teachers?
- How do EFL teachers adapt instructional content in their classrooms?
- Is there a statistically significant relationship between teachers' neurodidactic awareness and content adaptation?

4. Research Methodology

In order to answer the aforementioned research questions and fulfill the aim of this study, an associational research design was employed to collect the data needed for the completion of this work. A questionnaire addressed to 36 EFL teachers, and designed to measure the relationship between teachers' neurodidactic awareness and their instructional decisions regarding content adaptation in EFL classrooms.

5. Research Structure

The present study comprises two main chapters, a theoretical and a practical one.

The first chapter entitled "Teachers' Neurodidactic Awareness and content adaptation in EFL classrooms", provides a comprehensive theoretical foundation for the research. It is divided into two main sections. The first section emphasized on teachers' neurodidactic awareness. It begins with a definition and historical overview of neurodidactics, followed by clarification of the differences between neurodidactics, neuroeducation, and neuroscience. It then presents the main principles of neurodidactics including attention, memory, emotion, and motivation, stress and learning multisensory learning, learning environment. This section also discusses neuroplasticity and its relevance to learning, as well as the notion of teachers' neurodidactic awareness. It addresses the importance of instructional decision-making, outlines different types of neurodidactic awareness, and addresses the common neuromyth in education.

The second section focuses on content adaptation in EFL classrooms. It starts with an overview of differentiated instruction and learner variables in differentiation. It then discusses key elements of differentiation and differentiated content, before moving to the transition from differentiated instruction to content adaptation. Moreover, it provides a definition of content adaptation, its techniques, explores its principles, and applications in EFL settings. This section also discusses the benefits and challenges of content adaptation in language teaching. The chapter ends up with a discussion of the relationship between content adaptation, which

represents the core focus of the study. The second chapter, entitled “Associating Teachers’ Neurodidactic Awareness with Content adaptation practices in EFL classroom.: The Field Work”, presents the practical part of the study. It begins by restating the aims, research questions. It then provides a detailed description of the research methodology, including the population and sample of the study. The chapter also includes the analysis, interpretation of data collected through the research instrument. Finally, it addresses the main findings, outlines the limitation of the study, and provides recommendations for future research and teachers.

Chapter One: Teachers' Neurodidactic Awareness and Content Adaptation Related literature review

Introduction

The growing interest in the overlap between brain science and teaching, has led to the emergence of new hybrid fields that seeks to understand how learning occurs. Among these, neurodidactics has become an influential framework that connects findings from brain research with pedagogical practices. By emphasizing how the brain processes, stores, and retrieves information, neurodidactics offers a scientific foundation for designing classroom strategies that respond to learners cognitive and emotional needs. Essentially, this type of awareness is important in guiding teachers' decisions when they adapt and tailor their content to meet the cognitive and emotional needs of diverse learners. In this account, teachers' neurodidactic awareness plays a fundamental role in shaping pedagogical decision-making guiding their classroom practices. Within the realm of EFL instructions, understanding the relationship between teachers' neurodidactic awareness and content adaptation is of great importance; therefore, recognizing how teachers' knowledge of brain-based learning systems is associated with the adaptation of instructional materials is crucial for creating an inclusive and supportive learning environment that aligns with student diversity. This chapter aims to bridge the gap between brain science and content adjustment in English foreign language classrooms. It begins with identifying the origins and foundations of neurodidactics. It then clarifies the distinction between neurodidactics and related fields such as neuroeducation and neuroscience. The chapter goes on to establish the key principles of neurodidactics including attention, , memory, emotion, motivation stress, multisensory learning and learning environments. It explains then the concept of neuroplasticity and its relevance to learning. Moving forward, the chapter discusses the notion of teachers' neurodidactics awareness, providing its types and its importance in teaching and instructional decision- making. Subsequently, the chapter then

introduces differentiated instructions as a theoretical framework supporting content adaptation, followed by a distinction between differentiated content and content adaptation, providing a clear explanation of the latter. Afterwards, the chapter outlines various types and techniques of adaptation, highlights fundamental principles for effective adaptation, identifies the application of content adaptation in EFL classrooms as well as reviews benefits and challenges of content adaptation. Lastly, the chapter concludes by highlighting the relationship between teachers' neurodidactic awareness and content adaptation in EFL classrooms.

Section One: Teachers' Neurodidactic Awareness

1.1.1. *Definition and Origins of Neurodidactics*

In this research and for clearer understanding of the topic, it is essential to define the term "Neurodidactics" and to shed light on its principles. Neurodidactics as the name implies, is an interdisciplinary field that examine how insights from neuroscience can inform teaching practices, particularly in relation to how learners encode, store and recall information. This term was initially introduced by Gerhard Preiß, who highlighted the connection between brain research and didactic theory to enhance pedagogical outcomes (Preiß, 1993). However, early conceptualizations are characterized by a lack of specificity regarding the systematic application of neuroscience to teaching practices, providing little guidance on how such knowledge might be operationalized within authentic classroom settings.

Similarly, Becker (2006) defined neurodidactics as a branch of educational science that explores how brain research can influence teaching methods and instructional practice. In other words, neurodidactics focuses on understanding how the brain learns and on applying this knowledge to create effective and learner- centered instructional strategies. It draws upon several disciplines which are neuroscience, psychology, pedagogy, and education. Becker's definition positions neurodidactics as a multidisciplinary framework aiming to improve teaching effectiveness. Nevertheless, this definition resets on the assumption of a direct

application of neuroscientific findings to classroom practices. This assumption risks oversimplifying the complex nature of real-world teaching.

This perspective is directly relevant to this study. It shifts the focus from knowledge acquisition to knowledge application. It suggests that the effectiveness of neurodidactics relies on teachers' ability to understand cognitive and neural processes and apply them in classroom practice. Neurodidactic awareness plays a crucial role in shaping how teachers adapt learning content to accommodate learners' needs.

In 1980s, a period marked by rapid process in brain-imaging technologies and increasing interest in neurological foundations of learning. During that time, Gerhard Preiß proposed neurodidactics as an autonomous discipline aimed at connecting brain research with pedagogical and didactic theory. His perspective emphasized that learning is inherently rooted in neural processes insisting that teaching practices must be congruent with the learner's cognitive and biological maturation (Preiß,1993). However, the emergence of neurodidactics during this period was largely motivated by scientific enthusiasm, yet it lacked a solid pedagogical foundation.

Simultaneously, in United states, studies conducted by researchers like Leslie Hart, Howard Garner, and Renate and Geoffrey Caine strengthen the movement by linking cognitive research with classroom pedagogy and highlighting the impact of emotional and cognitive conditions on learning outcomes (Elsebumer,2013) . Later, in Europe other contributions added to this field through the concept of Mind, Brain, and Education (MBE) science by Takayama (2010), which positioned neurodidactic as the intersection of neuroscience, psychology, pedagogy, and didactics (Tokuhama-Espinosa ,2010). Consequently, related notions such as neuropedagogy and brain-based learning emerged, aiming to enhance educational effectiveness by aligning instructional strategies with scientific knowledge of brain functions (Hart,1983; Garner 1983; Caine & Caine,1991; Jenson,2008). Neurodidactics can effectively guide

teaching practices when teachers interpret and apply its principles appropriately in specific classroom context. While this approach offers a valuable theoretical framework for teaching, it remains challenging to synthesize and apply knowledge from different fields in real–classroom settings.

1.1.2. *Difference between Neurodidactics, Neuroeducation, Neuroscience*

Neuroscience, neuroeducation and neurodidactics are three fields that are closely related yet distinct; therefore, it is essential to differentiate between them in order to avoid theoretical ambiguity. Neuroscience is a scientific discipline that focuses on the study of the structure and functioning of the nervous system, as well as the interaction among brain components that gives rise to human behavior. It seeks to explain complex processes such as emotion, consciousness, behavior, and thought. In addition, this knowledge remains primarily theoretical and does not provide a direct guidance for classroom implementation, which restrict its immediate relevance to education. Moreover, building on this foundation, neuroeducation represents an interdisciplinary field that seeks to improve teaching and learning processes by integrating insights from cognitive sciences, pedagogy and neurobiology (Tokuhama-Espinosa, 2010). In addition, neuroeducation explores how insights from brain research can inform our understanding of the interaction between the brain and its environment during the process of learning. However, neuroeducation does not offer prescriptive teaching strategies, instead it provides broad frameworks that require interpretation by teachers, thereby, its effectiveness in classroom relies heavily on teacher's capacity to understand and implement its principles (Howard-Jones, 2014). In contrast, neurodidactics refers to the application of knowledge about brain science and neuroeducation to optimize learning by aligning teaching methods with brain's natural functioning. More precisely, neurodidactics emphasizes on the need to adapt instructional strategies to align with learners cognitive and neural processes, such as attention and memory. Thus, neurodidactics represents practice oriented-level, at which theoretical

knowledge is transformed into concrete teaching decisions. In summary, the relationship between the three fields is complementary while neuroscience offers the theoretical and scientific foundations, and neuroeducation translates it into educational frameworks, neurodidactics focuses on translating this knowledge into concrete instructional strategies within the classroom (De Barros & Hernández Fernández,2022).

1.1.3. *Principles of Neurodidactics*

Neurodidactic principles are research-based concepts that explain how learning occurs in the brain and understanding these concepts guides teaching practices. These principles are derived from different research fields; namely neuroscience and cognitive psychology, which offers a framework for understanding how learners process, store, retrieve, and apply information in educational settings. However, the application of these principles within the classroom is not straightforward process; it needs careful and considered interpretation to translate research outcomes into useful teaching methods, rather than literal implementation. In this regard, these principles are essential for this current study, as the foundation for examining whether there is a connection between educators' understanding of brain– based learning and their instructional decisions regarding content adaptation (Jenson,2008).

1.1.3.1. Attention. Attention is crucial phenomenon in human cognition, and understanding it can contribute to improving language learning. Steven and Mangun (2014) defined attention in general as focusing mental processes in which the brain focuses exclusively on one task ignoring others, a process often referred to as concentration. In addition, they categorize attention into two criteria; attention as executive control where concentrating on a single task neglecting others. For instance, the Stroop task illustrates executive control because it requires overriding the automatic response of reading the word to instead perform the less-practiced task of naming its ink color. The interference (e.g., saying "bleu" when the word "red" is printed in bleu) reflects the conflict between two processes, and successfully naming

the color demands attentional control to suppress the dominant reading habit. In other words, a successful attentional control requires suppressing automatic responses in order to focus on less practiced or less dominant task. The second type is selective attention. It basically occurs by selectively focusing on one source of sensory input and neglecting others. A good illustration is visual search task. It requires locating a target object while filtering out interfering and distracting similar objects. Furthermore, attention is a complex process of selecting, controlling and implementing collected sensory input. Therefore, differentiating between attentional control (cognitive regulation) and attentional implementing (immediate performance) is highly important for further understanding of attention processes. Attentional control is responsible for general task commands (find grapes on the picture) and translating them into mental bias for specific features like color, size, and location. Whereas, implementing attention is responsible for processing relevant features ensuring enhanced priority. According to Treisman (2009), attention is limited due to the brain's finite capacity when processing information. She explains this deficiency of the brain as follows; limits occur due to interference of two competing task sharing similar specialized brain systems. For example, performing multiple visual tasks at once causes interference. However, combining different tasks (visual and auditory) facilitates processing. In addition, attention is limited because of general resources; the brain's mental effort has single, limited reservoir, a difficult task consumes this shared resource and reducing it for secondary tasks. This clarify why multitasking causes low performance. Treisman (2009) highlighted that consistent practice reduces limitations of attention, as automatic and familiar tasks require far less attention. In EFL classrooms, attention refers to focusing on specific linguistic features (vocabulary, pronunciation) while suppressing native language interference, different language varieties and irrelevant visual information. It requires conscious effort to control unfamiliar input, such as learning new expression, by managing the brain's limited processing capacity when integrating

multiple tasks (learning sound and spelling of a word). Through consistent practice, attention gradually develops into automaticity. Since attention is limited, teachers should avoid excessive linguistic input by presenting lessons in small chunks with structured, manageable instruction to avoid cognitive load. They may use short instructions, chunks, staging in presenting grammar lesson. Moreover, attention selects relevant stimuli and ignores irrelevant ones. As a result, learners only acquire information that they attended to. Educators should highlight language forms (noun, verb, adjective) using visual, auditory aids applying strategies like color-coding grammar, stress and intonation and gestures. These findings suggest that attention is a fundamental component of language learning and has direct implications for instructional design. In EFL classrooms, teachers may be required to modify content by minimizing extraneous input, structuring information systematically, and applying techniques that shift learners' attention to target linguistic features. Therefore, teachers' neurodidactic awareness may be associated with how they manage attentional demands and adapt instructional content in EFL classrooms.

1.1.3.2. Memory. Memory is an essential gift for human cognition and it is crucial for learning. Without it, all memories, feelings, experiences would be meaningless. Human brain would be unable to connect new information to the past, use it to plan for the future, or grasp deeper meanings. As a result, learning would fail. More precisely memory is a key element in mastering a foreign language. It enables learners acquire, retain and retrieve vocabulary, rules, linguistic forms, and pronunciation patterns, which are central for effective communication (Sousa, 2011). According to Schacter (2009) memory refers to a collection of different abilities and systems in the brain. It is divided into three main processes encoding, storage, and retrieval. Sousa (2022) explained that information (sensory stimuli) enters at first stage in the working memory, where it is held briefly. Then through processes of rehearsal and active engagement, these data are transferred to long-term memory for permanent storage. He classifies long -term

memory into declarative and nondeclarative (explained by Schacter below). To simplify, a new information received by the brain is immediately encoded into learning and acquiring processes. Then, it moves to the storage where information is kept for long time and stabilized. After that, when individuals attempt to use stored information, they retrieve it. Moreover, Schacter (2009) identified distinct memory systems in the brain, each of which operates differently. The system consists of working memory which holds small amount of information in short time (like phone number seen quickly). It has episodic memory that keep personal events, and semantic memory rely on general knowledge (like sky is blue). Procedural memory involves recalling skills and habits enabling to perform tasks (like riding a bike), and priming describes a higher probability of selecting or using certain words, ideas, expressions due to recent exposure. All these types are highly important in maintaining different memories and recalling them. Schacter (2009) noted that memory interacts with other brain functions emotions, cognitive control, and planning. For instance, emotional events are remembered easily, and cognitive control that directs encoding information and retrieval ones needed for planning future events. Research indicates that memories are distributed across different areas in the brain. For instance, visual memories are stored in the occipital lobe, language places in the temporal lobe, and emotions are in the amygdala. Experiences activate multiple neural pathways that are processed and stored separately. During recalling, all these pieces are brought together to form a single meaningful memory, such as birthday memory might include chocolate cake, colors, decorations and warming letters from friends. In addition, memory may fail or be imperfect in different ways, such as forgetting and distorting. Memory errors can involve either a complete loss of information over time or incorrect recalled with distortions.

Furthermore, Jensen (2008) explained that a momentary or brief experience can cause durable neural modification that encodes memory. He argued that learning physically changes the brain, which indicates that memory is both a mental and a biological process. In educational context,

successful recall demonstrates that learning has been achieved by learners. This indicates that teachers should adapt instructions based on students ' natural learning and memory system, by focusing on this capacity by enhancing it rather than only addressing their weaknesses such as forgetting.

In EFL classrooms, educators apply strategies based on memory science that enhance language learning. In vocabulary teaching, they use hints that facilitate the identification of words. For example, the word starts with "Br.." like bird; this activates neural networks and connects the word to related words. Additionally, using rhymes, acronyms and songs helps vocabulary stick deeply in memory. When asking questions or giving instructions, teachers should present them one a time with pauses. This consideration helps students activate the right patterns in the brain by thinking, and reflecting on them. Teachers should encourage analysis. When students create mind maps, storyboards or posters, they organize materials by themselves, which involves fostering different types of memory. Another important strategy is peer teaching. When students discuss their ideas, and concepts by themselves, it improves deeper memory connection, which leads to better recall. In addition, teachers can present interesting content, such as celebration of different cultures, and using visual and auditory aides. This triggers emotions such as enjoyment, and curiosity within learners' brain, which leads to memory development and learning as well. When teachers understand memory processes and apply these strategies, they design content that aligns with how the brain naturally encodes, stores, and retrieves information. These findings indicate that memory is an important element in language, learning especially in designing instruction for EFL classrooms. Thus, teachers who possess this understanding can adapt instruction to promote long-term retention and meaningful learning by organizing content into measurable units, encouraging active retrieval and using emotionally engaging materials that strengthen memory connections.

Therefore, teachers' neurodidactic awareness may be related to how they organize instructional content and implement memory-based strategies during content adaptation in EFL classrooms.

1.1.3.3. Emotion and Motivation. Emotion and motivation are essential components in language learning, and closely interact in shaping learner's engagement and performance. Understanding these concepts are highly important to apply this knowledge by teachers and lesson designers. Firstly, from neuroscientific perspective, emotion is defined as specific neural and physiological shift in a living organism in response to stimuli in the environment (Fossati, 2012). Emotions are not just feelings; they are coordinated responses of the brain and the body to environmental stimuli involving the release of chemicals. For instance, when an individual received good news (e.g. passed important exam), the brain responds by releasing dopamine, while relaxing heart rate and facial muscles due to reward system activation. The emotional reaction is feeling happy and relieve which then motivates and encourages better future academic performance.

Moreover, dopamine plays a central role in motivation, not only as a source of positive emotions, but also because it is linked to the brain's reward system. This neurochemical substance is released due to anticipation of success or curiosity. Learners are more motivated when they expect rewards, not only when they receive them (Lucas-Olivia et all ,2022; Kang et al,2009; Schultz, 1997). Secondly, motivation is always a concept of interest and research, each defines it differently. Schunk (2012) defined motivation as ongoing process by which goal-directed behavior is initiated, sustained, and regulated. This indicates that motivation is not a single event, but a continuous process that initiates action by keep it going, and guides it toward desired goal. For example, a language learner may initially tend to speak English fluently (motivational intention). To achieve this goal, the learner downloads a language-learning application that tracks progress and provides feedback, which helps maintain engagement and persistence (motivational sustenance). After several days, feeling of boredom

and exhaustion may appear; therefore, the learner may switch methods and set new learning plans to maintain engagement (motivational regulation). This example shows that motivation to learn English is ongoing process rather than merely a feeling, as it begins with intention and continues through regulation and management over time.

According to Zull (2006) emotions are the foundation of learning; without strong emotions, learning lacks depth and meaning. Zull explained that learning is strongly influenced by emotional chemistry in the brain. It means that emotions regulate neural activity when brain releases specific neurochemicals such dopamine, serotonin, and adrenaline. These chemicals affect cognitive processing capacity and influence how neurons connect, communicate, and process information. For instance, dopamine is associated with reward and motivation. the greater the release of dopamine, the more the learning experience is reinforced and improved. In contrast, stress and anxiety produce adrenaline, which may disturb neural processing and reduce cognitive functioning. By extension, a state of emotional overload associated with heightened stress responses may occur under conditions of intense stress and elevated cortisol release. This leads to shift in the brain from reflective thinking and metacognition ability to survival mode. This condition can shift the brain from reflective thinking toward a survival-oriented response, which may negatively affect motivation and learning, and motivation. In addition, Jensen (2008) explained that emotions affect learning far beyond the level of brain chemistry. The brain has different areas that process emotional information, which are not isolated. It is a whole network of connection throughout the brain and body systems, which means it affects the individual as a whole allowing emotion to shape overall cognitive performance. The brain prioritizes emotional input, especially from amygdala, which boosts and strengthens attention and memory. For example, hearing bad news or winning a prize often stays longer in memory then neutral event.

Learner's emotional state is shaped by the quality of learning. When negative state occurs; such as fear or excessive stress; it leads to disrupted thinking and impaired working memory. In contrast, a positive emotional state improves focus and engagement, involving feelings like curiosity and anticipation. This positive state activates inner motivation that drives learners to perform well in task based on their interest and desire to learn. This enhances learning through exploration and autonomy. For teachers, emotional states are not fixed, they are temporary and influenced by classroom environment. In order to maintain these states, teachers create a supporting, engaging and emotionally safe classroom, where learners feel secure, involved and actively engaged in the learning process. Jensen (2008) mentioned that learners may experience unmotivated state due to fear, lack of relevance or weak social connection. Therefore, teacher's role is to manage these unmotivated states by working on learner’s environment by supporting, creating suitable conditions for learning.

There are some strategies for classroom implementation such as compelling questions, role modeling, celebrations, physical activity, and personal connection. To simplify, compelling questions engage emotions and lower the affective filter (Krashen) (e.g., the emotional barrier). It shifts from getting grammar right to expressing meaningful ideas. It triggers curiosity that releases dopamine and increases motivation to participate. For example, at the beginning levels a teacher may ask questions about facial expressions using visual, and gestures. The teacher may say, "point to the face and show me the expressions happy, sad, and angry". This task activates different emotional responses that stick in memory and are learned for a long time in role-modeling, teachers demonstrate language learning behavior by showing learners that making mistakes and admitting uncertainty and keeping trying. This encourages them to feel safe and take risks when modeling emotional vocabulary such as "I feel frustrated when I cannot find the right word". This task develops emotional expressivity. This builds learner's confidence which boost them to participate and take risks and engage in learning. Celebration

is another interesting strategy where teachers encourage learners to take risks and reinforce good effort, which emotionally motivate them and develop a belief that they can succeed in learning English. This type of encouragement improves motivation better than external reward. Cultural celebration is an illustration for this strategy. It is when a student teaches the class a word or phrase from their heritage language. Using physical activity reduces anxiety and engages kinesthetic learners with the help of non-verbal communication. For instance, a teacher says: “stand up, turn around, clap your hands”, this task is called the Total Physical Response. It connects brain and body, releasing dopamine, which leads to positive emotional state.

Personal connection is a way of integrating learners’ lives, cultures, and experiences into language learning. This boosts relevance, which is crucial for intrinsic motivation as it makes learners willing to engage in meaningful tasks. More importantly, it provides rich language resources and familiar contexts, where learners feel at ease and reduce cognitive load. Examples include language journals, where students write in English and can use their native language for reflection, and then teacher responds to student's journal and provides feedback. As known, rewords increase motivation by activating brain's pleasure system. However, the brain adapts to repeated rewards, which leads to habituation. At that point, the reward becomes ineffective, so encouragement, feedback, and occasional unexpected reward are considered the solution rather than reliance on external motives (Jenson,2008).

According to the previous points, emotions and motivation serve as essential elements that shape learning experiences and offer meaningful considerations for instructional design in EFL classrooms. Learners' emotional states affect key processes such as attention, memory, participation, and willingness to engage in tasks. Therefore, teachers may need to modify instructional content and classroom activities to reduce stress and facilitate engagement by encouraging positive emotional experiences. This modification may include strategies such as creating emotionally supportive environments, where learners feel safe, valued, and respected;

using relevant and motivational materials; and encouraging active participation via collaborative learner-centered activities. Thus, neurodidactic awareness may correspond to how they address emotional and motivation factors when adapting instructional content to meet learners' cognitive and emotional needs.

1.1.3.4. Stress and Learning. Stress is considered as one of the fundamental factors influencing human cognition, and recognizing that its dual nature can enhance language learning outcomes. Jensen (2008) defined stress as the brain and body's response to environmental demands or pressure. Its impact on learning is not intrinsically negative; rather, it may be either harmful or beneficial depending on its duration, learner's ability to manage it and the level of its intensity. In this regard, stress is commonly categorized as eustress and distress. Eustress is a temporary form of stress that can enhance attention, memory, and retention. For example, a student may experience a limited level of tension during an examination, which can increase concentration and enhance memory retention. In contrast, distress appears when stress is excessive, exceeding the learner's abilities resulting in cognitive and emotional impairment, leading to increased student anxiety and lower performance. From a neurodidactic perspective, stress is linked to the limbic system, in particular the amygdala, which is the center for emotional processing and threat detection. Moreover, it is important to differentiate between acute and chronic stress to better comprehend their effects on learning process. Acute stress is short-term, manageable, and can enhance memory and attention. Whereas, chronic stress is uncontrollable, includes sustained exposure to stressors and activation of cortisol, which affects cognitive processes. According to Jensen (2008), sustained exposure to activated cortisol can harm the hippocampus (a brain structure essential for memory), damage the brain, weaken neural connections, and reduce concentration and the ability to encode and retain information.

Sousa (2011) argues that chronic stress decreases neural plasticity and impairs the formation of long term-memory. In stressful conditions, the brain prioritizes survival-oriented reactions rather than higher-order thinking skills such as analysis and problem solving. This often leads to difficulties in performing complex tasks like oral production and reading comprehension.

Therefore, Sousa (2022) highlighted the significance of a supportive classroom atmosphere in minimizing the impact of stress. This occurs because emotional security helps the brain to shift from survival-oriented state to a learning-oriented state. In EFL classrooms, stress generally occurs in evaluative situations, public speaking activities, and spontaneous language use. Such contexts often demand that students process unfamiliar input while coping with the fear of errors. Nevertheless, continuous exposure to supportive low-pressure communication can progressively foster learner's self-confidence and diminish language anxiety. Since excessive level of stress may affect cognition, especially memory and attention, teachers should create emotionally secure and safe learning environments. Strategies include positive support and reinforcement, consistent classroom routines, and scaffolded speaking activities.

In a nutshell, stress represents a complex factor in language learning that can either facilitate or hinder learning. Although a moderate degree of stress may promote cognitive engagement and enhance motivation, chronic stress can negatively impact academic achievement. Hence, teacher's neurodidactic awareness is essential for identifying stress-related challenges and adapting classroom instructions to better support learners 'cognitive and emotional needs.

1.1.3.5. Multisensory Learning. A core principle within neurodidactic is multisensory learning, which reflects the brain's innate capacity to process information through multiple sensory inputs. It suggests that engaging more than one sense simultaneously; including

kinesthetic, tactile, auditory and visual, during learning enhances the learning process. Engaging multiple sensory modalities enhances comprehension and strengthen memory retention through multisensory integration (Shams & Seitz,2008) Within the framework of neurodidactic, this can be interpreted as an educational application of cognitive science finding, where combining sensory channels allows learners to make strong connections between their existing knowledge and the new information. Similarly, Sousa (2022) emphasized arts, including music, visual arts, and movement, engage multiple sensory systems and foster neural connections. In addition, researchers make a distinction between two related but different approaches: multisensory integration and single-sense instruction. Multisensory integration involves presenting knowledge through multiple senses at once, helping the brain to create stronger and longer memory traces (Shams & Seitz, 2008). To illustrate, a learner may see a picture of a dog (visual), hears the word "dog" pronounced (auditory), and traces the letters with a finger(tactile) (Jensen ,2008). However, single-sense instruction depends on one modality like listening to an audio without reading or movement (Porfyri et al., 2025). Another example which is the traditional vocabulary practices where learners only see written words on a page without engaging physical interaction (Jensen, 2008). In addition, multisensory learning is different from the debunked learning style theory, which assumes that every learner learns best through one dominant sensory preference. In contrast, multisensory integration focuses on combining senses for all learners rather than adapting teaching to just only one supposed preferred style. Understanding the differences between both concepts is crucial for effective instructional practices (Pashler et al., 2008; Shams & Seitz, 2008). Moreover, multisensory integration forms multiple neural connections that strengthen memory recall. When information is processed through several senses, it is encoded in distributed brain networks, which facilitate retrieval and memory storage. In addition, multisensory learning promotes understanding through cognitive reinforcement; each sensory input supports the

others, minimizing ambiguity and enhancing meaning. This explains why learners understand abstract concepts better than concrete ones through multiple senses. In EFL classrooms, multisensory learning is the combination of visual, auditory, kinesthetic, activities to explain new information. Therefore, successful application requires careful lesson planning to ensure that sensory inputs work together rather than causing cognitive overload. Multisensory tasks reinforce learners' engagement, comprehension, and retention (Jensen,2008). Since multisensory learning improves memory and comprehension, teachers may use different sensory activities like Total physical response (TPR), images, choral repetition, word card sorting games (Jensen, 2008). These findings suggest that multisensory learning is essential component of successful language teaching. In EFL settings, this may include adjusting materials by adding visual elements movement-based tasks that strengthen linguistic input. In addition, teachers 'neurodidactic awareness may affect their ability to design and apply multisensory learning experiences in the classroom.

1.1.3.6. Learning environment. The learning environment is a crucial factor that influences how students construct knowledge, and recognizing how physical and sensory conditions affects brain functioning and improve language outcomes. Jensen (2008) explained that the physical and sensory conditions of the classroom environment such as colors, lighting, noise, temperature and space have a significant impact on how the brain works and how students learn. For example, in a noisy classroom student may feel stressed and may cause low concentration. However, a calm classroom is a better environment for students to focus and understand. Furthermore, natural lighting and successfully chosen colors boost student's mood which help students feel motivated, happier, and more engaged. Furthermore Jensen (2008) emphasized that the brain is highly responsive to environmental conditions because it continuously evaluates its surroundings for security and comfort. Supportive environments are responsible for minimizing stress hormones like cortisol, increasing positive neurotransmitters

like dopamine and serotonin, promoting participation and attention. According to Jensen (2008), students in flexible classroom and well- designed atmosphere including opportunities for movement, varied seating, good air quality and suitable temperatures show better behavior and successful learning than students in poor environments. He emphasizes that when the brain feels secure and comfortable, it can dedicate more mental resources to learning rather than survival monitoring.

Moreover, classroom conditions play a crucial role in the learning process as they influence students' emotional state; clean and organized classes improve motivation and increase engagement while poor conditions may result in student disengagement. In EFL classrooms, learning environment requires a careful attention to ensure that the environment reinforces rather than hinders language acquisition. Through providing a consistent supportive learning environment learner experience less anxiety, increased willingness to orally participate. Since learning environment is crucial as it affects cognitive processes, it is essential to avoid stressful conditions such as overcrowding, poor lighting and noise, teachers may use simple strategies involving opening windows for fresh air, allowing students to choose their seating arrangement, displaying student work on walls, using calming colors to create more comfortable atmosphere. These points suggest that learning environment represent a crucial element of successful language teaching. Therefore, supportive environment is inherently inclusive; as it benefits all students, especially those with sensory sensitivities. Teachers' neurodidactic awareness is associated with the way teachers manage environmental conditions and adjust the learning space to better support learning (Jensen,2008).

1.1.4. *Neuroplasticity and Its Relevance to Learning*

Learning has always raised the question for cognitive science: how does the brain develop and become flexible through what is known as neuroplasticity? The neural system is an innate faculty that creates, organizes and adjusts neurons. This system has different abilities

to develop such as neuroplasticity. "Neuroplasticity has been defined as a change (either strengthening or weakening) in synaptic efficacy brought about though experience" (Rose & Rankin, 2001 as cited in Zerilli, p66.). In other words, this capacity is able to modify the strength of neural connections in response to experience. Additionally, neuroplasticity is a broader concept that focuses on neural system modification of both structure and function in response to environmental stimuli (experiences) or compensation for sensory loss (Neville & Bavelier, 2001, as cited in Zerilli,2021, p67). Kolb and Gibb (2011) explained that brain development is closely linked to its ability to change and adapt due to the interaction between genetic factors and environmental experiences that continuously shape learning throughout life. For instance, development occurs when an individual's genes provide the ability to learn language, while the environment determines which specific language is to be learned (English, Spanish, Chinese, etc.), with both factors working together. During this process there are two main mechanisms of neuroplasticity that drive development. Once the brain forms new neural pathways and connections, and keep only the used ones, this process depends on two types of experience: one driven by external environmental stimuli (e.g., light, sound, language), while the other comes from internal, unique and individual autonomous learning. These two experiences indicate that active engagement improves neural circuits, and continuous learning strengthens neural pathways. Gazzaniga (2019) added that brain continuously develops and adapts through experience encountered, which leads to better learning outcomes. This Means that the quality of experience determines the occurrence of learning, adaptive plasticity is a beneficial brain change, such as learning new skill, whereas maladaptive plasticity is due to chronic stress or negative habits that cause harmful change in the brain. All these facts affect learning because it requires specific and appropriate conditions and repeated meaningful input. The conditions include a suitable environment, relevant and comprehensive information for learner, and mindful repetition, which helps the brain wire and strengthen its neural

connections. In the EFL context, repeated exposure to language input and vocabulary use enhances neural connections. The more a learner participates in meaningful language tasks, the more he builds linguistic competence, while less practice leads to weakening those neural pathways or their gradual removal. Neuroplasticity is very helpful concept to be understood and applied in learning and teaching context.

Neuroplasticity supports language learning and teaching, as researchers Lightbown and Spada (2013) confirmed that learning a second language requires repeated exposure to meaningful language input (teacher talk, peer interaction, multimodal practices, and aural /oral input) in order to strengthen linguistic knowledge and power neural connections. Meaningful communication and interaction during tasks deepen meaning and engage learners in learning process. For instance, when learners use language in real-life communication topics like "AI-generated content may reduce human critical thinking," this kind of task improves neural activation as well as learning. In addition, errors are a part of the learning process, with corrective feedback, the brain adjusts and refines the existing linguistic knowledge. Another way of strengthening brain's neural network is by activating specific patterns related to accuracy, which is attention to form (sentence structure, word forms, and pronunciation). This occurs when the teacher highlights specific vocabulary or grammar rule during a communicative task. When teachers take these parameters into consideration by aligning special brain capacities with teaching, it explains and guides effective EFL teaching. In summary, neuroplasticity refers to the brain's ability for neural reorganization, which facilitates and reinforces second language acquisition by engaging learners with meaningful input, real communication, and corrective feedback. This process thereby strengthens neural connections and renders learning effective.

This suggest that learning is not a fixed process; it is a dynamic one that continuously reorganizes neural connections through experience and practice. In the EFL classrooms, this

indicates that instructional design may benefit from adaptive content delivery by offering repeated exposure to the target language, gradual progression, and meaningful practice to reinforce learning over time. Thus, a teacher's neurodidactic awareness may be associated with how instructional content is sequenced, how previously learned material is systematically revised, and how long-term language development is supported through flexible and responsive teaching practices.

1.1.5. *Understanding Teachers' Neurodidactic Awareness*

1.1.5.1. Definition of Awareness in Teaching. Awareness in teaching is the teacher's conscious and reflective understanding of their own teaching practices, including student's needs and the factors that shape learning such as emotional and cognitive factors. It involves the ability to observe, evaluate, and adjust teaching according to classroom situations. This kind of awareness is not only about knowing facts about teaching, it requires active thinking and reflection while teaching is happening. Shön (1983) described this process as" reflection in action." Moreover, he explained that when teachers reflect in this way " they become researchers in the practice context"(Shön, 1983). In other words, the teacher does not apply a fixed plan but continuously learns from the classroom and adjusts their teaching. Teachers' awareness is important since it helps them make successful decisions during the learning experience.

This perspective suggests that teacher awareness is not limited to theoretical knowledge, but also involves continuous reflection and adaptation during classroom instruction. In EFL contexts, such awareness may be related to how teachers respond to learners' needs and adjust their instructional practices accordingly.

1.1.5.2. Definition of Teachers' Neurodidactics Awareness. Neurodidactic awareness refers to teachers' understanding of how human brain processes and shapes learning and how this awareness can be used to improve teaching practices. It involves using findings from

neuroscience to support instructional decisions that enhance student's attention, memory and engagement. In this context, Grospietschand and Mayer (2019) emphasized the importance of developing "neuroscience literacy" among teachers, which helps them interpret scientific insights correctly and use them effectively in the classroom. Neurodidactic awareness enables teachers to critically interpret neuroscience-related information and apply it appropriately in classroom contexts rather than relying on misconceptions or generalized assumptions about learning. This suggests that teachers' neurodidactic awareness extends beyond familiarity with neuroscience concepts to include the ability to relate such knowledge to instructional practices and classroom decision-making.

1.1.6. *Importance of Teaching and Instructional Decision-making*

Neurodidactics awareness plays an essential role in improving teaching and guiding instructional decision-making. By understanding how the brain responds to factors such as, memory, stress and motivation, teachers can design lessons that result in meaningful learning. For instance, knowledge about memory processes enables teachers to structure content that supports retention. Furthermore, neurodidactics awareness helps teachers adjust their instructional strategies to meet learners' diverse needs, and create an inclusive classroom environment. Dubinsky, et all (2022) argued that neuroscience professional development provides teachers with principles that support pedagogical choices, effective lesson design and responsiveness to classroom situations. This view highlights that integrating findings from neuroscience into teaching can improve both learning outcomes and instructional quality. Daugirdienė, et al (2024) clarified that learners' engagement, understanding, and retention are related to teachers' practices in the classroom. In summary, teachers' neurodidactic awareness may be related to how they organize instruction, respond to learners' needs, and make instructional decisions that support effective learning.

1.1.7. *Types of Teachers' Neurodidactic Awareness*

Teacher's neurodidactic awareness is a combination of several interconnected fields of knowledge, not a single isolated competence. First, cognitive knowledge refers to the teacher's understanding of how learners process, store, and retrieve information. This includes awareness about key mental functions as attention, memory, and information processing. Sousa (2011) emphasized that successful learning depends on how the information and successful learning depends on how the information is encoded, organized, and stored in the brain, rather than a presentation of information only. Learners do not acquire passive knowledge but engage in active cognitive process that requires learners to engage and participate. As well as by conditions that support memory, retention, and recall.

Moreover, Borg (2003) emphasized that teacher cognition is essential because it shapes classroom decisions. This includes what teachers know, believe, and think about teaching and learning, which affected their decisions about how they plan and deliver lessons. In addition, cognitive knowledge is teacher's own thinking patterns which guide their pedagogical choices and classroom behavior. Therefore, teacher cognitive knowledge is essential as it is considered as a key element for effective teaching. These perspectives indicate that cognitive knowledge may be related to how teachers organize and present instructional content in ways that support learners' attention, processing, and retention.

Teacher's pedagogical knowledge refers to the understanding that enables educators to create effective teaching and learning environments. Shulman (1987, p. 8) defined it as "general pedagogical knowledge, with special reference to those broad principles and strategies of classroom management and organization that appear to transcend subject matter". This form of knowledge is distinct from the subject matter knowledge and pedagogical content knowledge, which is teachers' ability to transform the content into teachable forms by identifying the aspects of content most germane to its teachability, recently, Toledo et al (2017, p. 80)

conceptualized general pedagogical knowledge as “the specialized knowledge of teachers for creating effective teaching and learning environment for all students independent subject matter". Pedagogical knowledge is considered as a central pillar of the teaching profession because it plays a critical role in teachers’ effectiveness. This suggests that pedagogical knowledge plays an important role in helping teachers select and adapt instructional strategies according to classroom needs.

Teacher's affective knowledge is the professional awareness that learning is not purely a cognitive process, but an emotional experience that shapes students' memory, attention, and engagement. Immordino (2016 argued that " it is literally neurobiologically impossible to build memories, engage in complex thoughts, or make meaningful decisions without emotions," which highlight the idea that emotion is not separate from cognition but its foundation. From this perspective, teachers with affective knowledge understand that students' learning processes are affected by their emotional states. As a result, positive emotions can reinforce learning while negative feelings like stress and anxiety may impair cognitive processing. Zembylas (2007) described this concept through the notion of an “emotional ecology “in teaching, arguing that teacher's pedagogical and subject matter expertise is interrelated to their emotional knowledge. Affective knowledge is embedded within all instructional practices which help teachers read classrooms dynamics, anticipate students’ affective responses and adjust their instructional decisions in ways that support both emotional engagement and cognitive development. In summary, effective teaching requires not only the cognitive and pedagogical skills but also a strong awareness of the emotional conditions that shape learning. This highlight that awareness of learners’ emotional states may be associated with how teachers create supportive learning environments and adjust instructional practices in EFL classrooms. Teacher's critical knowledge is the ability that enables educators to reflect, analyze and question the assumptions, practices that influence teaching and learning. This type of knowledge is

different from cognitive and pedagogical knowledge. Instead, critical knowledge is operating on deeper level of professional awareness, helping teachers examine methods whether they are suitable for learning and learners or not.

In educational theory, critical knowledge is associated with reflective teaching models and transforming instructional practice. Schön (1983) emphasized that critical knowledge is essential for teacher equally as important as facts, experiences and values. This perspective views a teacher as professional and decision-maker who adjusts their approaches according to their learners' needs. Brookfield (2017) argued that critical knowledge can be seen when teachers question whether established knowledge is applied to all learning situations, rather than accepting it without examination.

In neurodidactic, critical knowledge provides teachers with the right approach by applying brain research in real classroom. Instead of following general rules without thinking critically, aware teachers consider learners differences such as emotional states, readiness to learn, individual differences, and prior knowledge. This flexible approach enables teachers to make decisions that are adaptable and responsive to context. In addition, critical knowledge plays a crucial role in continuous evaluation, allowing teachers to assess the effectiveness of content, method, and materials through regular reflection and adjustment.

In conclusion, teachers' critical knowledge enables them to reflect and adapt teaching especially in diverse EFL classrooms supported by pedagogical knowledge, affective knowledge, and cognitive knowledge. Taken together, cognitive, pedagogical, affective, and critical knowledge form interconnected dimensions of teachers' neurodidactic awareness that may be reflected in their instructional decisions and classroom practices.

1.1.8. *Neuromyths*

An essential aspect of neurodidactic awareness is a basic understanding of how the brain learns and adapts. However, this understanding must be accompanied by the ability to

critically evaluate information, as the field of education is often influenced by neuromyths; widely held but scientifically inaccurate beliefs about brain functioning. Common examples include the notion that individuals use only a small percentage of their brain or that learners are strictly "left-brained" or "right-brained." Other pervasive neuromyths include the belief that some students are naturally "born good at languages" while others are not, or that the brain cannot change significantly after childhood, ignoring the well-established concept of neuroplasticity. Studies have shown that even well-intentioned teachers may hold such misconceptions, which can negatively impact their instructional choices. For instance, Dekker et al. (2012) found that teachers who were enthusiastic about applying neuroscience in the classroom believed nearly half of the neuromyths presented to them, with 70% endorsing myths related to commercialized educational programs. Similarly, Grospietsch and Mayer (2019) reported that among pre-service science teachers, 93% believed in the learning styles myth, and more than 50% endorsed ten different neuromyths. Importantly, the authors concluded that neuromyths can persist alongside accurate scientific knowledge and are resistant to formal education. Consequently, genuine neurodidactic awareness requires more than factual knowledge about the brain; it specifically includes the ability to recognize and reject common neuromyths. A teacher who holds such misconceptions; even while knowing some neuroscience facts, may demonstrate limited neurodidactic awareness, as such misconceptions can interfere with informed instructional decision-making.

1.2. Section Two: Content Adaptation in EFL Classrooms

1.2.1. *Differentiated Instruction*

In the context of learning, students are different in terms of their abilities, personalities, and interests, despite being age - matched. Tomlinson (2014) clarified and guided teachers to create a learning environment that addresses diverse classrooms by introducing differentiated instruction as an essential approach to teaching. Differentiated instruction is a teaching

philosophy where teachers primarily and proactively adjust content, process, and product according to learner's readiness, interest, and learning profile (Tomlinson, 2014). In order words, this teaching philosophy requires educators ‘scaffold and adaptation to content (knowledge, and input provided by the teacher), process (transforming input through task), and product (demonstrating learning through multiple forms). These adaptations are in response to the learner's readiness (their current level), interest (their preferences), and learning profile (How they learn best). It aims to help and support students ‘progress by providing the appropriate environment where they challenge and engage in effective tasks, while accepting individual diversity as the norm rather than one size fits for all.

1.2.1.1. *Learner Variables in Differentiation*. According to Tomlinson (2014) differentiated instruction is initially guided by three dimensions: readiness, interest, and learning profile. These dimensions provide the foundation for the three main differentiation elements: content, process, and product, which teachers modify and adjust appropriately. This approach helps learners learn at an appropriate rigor despite their differences, as well as supporting their future academic success. First, differentiation by readiness is an approach to planning instructions; it involves developing challenging tasks that meet each student's current level of skill and understanding. These tasks challenge learners' abilities by encouraging risk-taking behavior and helping them progress further independently with the right scaffolding. Tomlinson offered a practical tool named the "Equalizer." It encompasses eight continuums (e.g., foundational to transformational, concrete to abstract, simple to complex). Rather than adjusting all continuums for each learner, this tool allows teachers to adjust tasks based on students' diverse needs. Not every continuum needs modification, because teachers choose what is relevant to students. Thus, by designing tasks based on student readiness, teachers create a learning environment where all students grow at their own pace. Second, another essential differentiation is by student interest. It prioritizes students'

interests and preferences in designing instruction. This dimension addresses key motivators like voice (opportunity for self-expression), choice (offering options in the learning process), personal meaning (seeking what matters and connects it to their lives), ownership (taking responsibility for their work), and competence (building skills and capability through practice). Engagement increases and learning is enhanced due to the application of interest-based differentiation, especially when all five motivators being addressed. To achieve differentiation by interest, this dimension follows two main goals. Beginning with existing student interest, teachers connect these interests to content, which makes it accessible and satisfying for learners. For instance, if students are interested in anime and manga stories, teachers can use this to create content (texts, videos) which is enjoyable for them. The other goal is creating new interests for learners, by actively introducing novel ideas, concepts, and various topics (e.g., start the unit with a topic about language variation, and then ask them to create a video or simple project about it). To achieve these goals, teachers apply practical strategies for existing interests, like sidebar studies. Sidebar studies engages students in investigation, where they explore a unit based on their interest (e.g., if they like politics, they may study the Arab Spring uprising). They may work individually or in groups, which improves class discussion and deepens it. In addition, specialty terms refer to the use of words specific to subject or field, where students form teams based on genres that interest them, like poetry, music, technology, and economics, each team analyzes the use of language and author ideas. Then teams nominate and defend their favorite concepts and thoughts to the class. Moreover, for expanding interest teachers apply two crucial strategies. Real-life application, where students engage in real communications by interviewing different people like education consultants, and about what their profession involves, what skills are needed to design learning programs. The second strategy is new forms of expression, which involves inviting students to demonstrate different formats like storytelling, photojournalism, drama,

role-play. This challenges students to transform abstract ideas into concrete ones. For example, instead of writing long paragraphs, they create posters with full description and information. Thus, teachers who understand their students' interest help them believe that learning is fulfilling and deeply satisfying. Learning profile differentiation is the adaptation of teaching methods to align with how students learn effectively and appropriately, in order to create an atmosphere where all students can learn and engage in the classroom. Even though, students may have the same culture, they do not necessarily have the same preferences, which are influenced by factors such as cognitive abilities, personal experiences and cultural backgrounds. Additionally, adapting content according to student learning profiles fosters autonomy and flexibility.

1.2.1.2. ***Key Element of Differentiation.*** As previously mentioned, the dimensions that guide differentiation in instructions are readiness, interest, and learning profile which influence the selection and the adaptation of content, process, and product. It is necessary to clarify how these elements of differentiation form instruction. Next, as Tomlinson (2012, p. 72) said: "content is the input of teaching and learning. It is what we teach or what we want students to learn ". In other words, content refers to knowledge, concepts, skills, expected by learners to learn. Instead of being fixed, content changes according to students' level of differences in readiness, interest, and learning profile. In this context, successful content adaptation meets diverse needs and enhances the overall learning process. This adjustment process requires mindful decision–making by teachers to determine which item or concept is suitable. Finally, the modification of content aims to ensure that the input is accessible and comprehensible for all learners, despite their diverse needs.

Furthermore, process refers to the sense-making activities through which students develop and construct knowledge. These activities are highly important because if they are not carried out, the learner may fail to retain the content effectively or experience difficulties in

achieving clear understanding. However, it is essential for teachers to design simple tasks for those who are struggling or confused, and complex tasks for those who have mastered the content rather than letting all students work on the same activity. This ensures all students have equal opportunities to understand and engage. In this way, aligning the process with each student's level helps all students build a solid understanding of the material. In summary, process differentiation includes designing activities that enable students to understand according to their readiness, interest and learning profile for effective learning.

Differentiated product refers to the act of creating summative assignments carried out at the end of units that provide students more freedom and time to demonstrate that they understand the fundamental knowledge, and skills. Moreover, successful application requires clear design process in which teachers first identify what should student learn (knowledge, understanding, and skills), and then define basic quality expectations for content, process, and product. In addition, teachers should select the appropriate scaffolding techniques as well-defined timelines, useful templates and ongoing progress evaluation. Throughout the learning process, teachers should guide students reach the expected level rather than just giving the task at the beginning, then evaluate it without teacher ‘support. In summary, well design and effective support of differentiated tasks enable students to show their understanding in the classroom.

1.2.2. *Differentiated Content*

According to Tomlinson (2017) Content can be differentiated in response to students 'readiness level, interest, and learning profile. First, differentiating content according to readiness level means matching lesson materials to students’ current level, by providing appropriate tasks that neither too easy or too difficult for them. To illustrate, the teacher notices that some students struggle in understanding grade-appropriate reading article, the teacher provides them with a simplified version with simple vocabulary, while the advanced learners

work with the original one. Second, interest involves integrating ideas and concepts, materials within the curriculum that interest students. For example, in an English class a teacher encourages students who are interested in reading poetry to present some verses and discuss it in front of the class. Interest guides the selection and the presentation of content, which leads to improvement of engagement and participation in the classroom. Third, differentiation of content by learning profile refers to modifying linguistic and conceptual input to match students learning styles such as auditory, visual, and kinesthetic. This model ensures that all learners understand and access information easily based on their preferred style. For instance, during class, a teacher uses different tools and techniques to include all learners; visual learners need videos or lesson slides to grasp meaning; using audio or recorded lectures for auditory learners, as for kinesthetic learners using movements, gestures or role–play activities that engage them more in the learning process. Additionally, teachers differentiate content using several ways. Teachers carefully manage the level of complexity and difficulty of materials depending on the learners' level. Educators should regulate both depth and amount of content, avoiding excessive details or overly large quantity of information that are expected by learners. During the learning process, many teachers provide scaffold and support using explanation, simplification, visual aids all to ensure successful delivery of content. In short, combining the three dimensions of differentiation and pedagogical skills in content differentiation make it accessible and satisfying for all learners.

1.2.3. *From Differentiated Content to Content Adaptation*

Differentiated content is the first step in the teaching journey, by adjusting knowledge, concepts, and skills expected to learn based on learners' different abilities, and learning needs. However, this step may not be implemented entirely in its pure form, for this reason teachers enhance their content delivery through content adaptation. It is the modification of instructional materials including texts, tasks, worksheets, and multimedia resources. The purpose of this

adjustment to make content accessible, understandable, and appropriate for all learners despite their differences. While differentiated content sets the direction by changing learning expectations, content adaptation maintains the main learning goals and modifies how the material is presented for learners. Thus, it serves as roadmap that links theory to practice, allowing teachers to support all learners effectively (Tomilson,2017).

1.2.4. *Definition of Content Adaptation*

In many teaching situations, teachers face a common reality that language materials may not fully align with students' diverse needs. Thus, educators often find it necessary to adjust, a process known material adaptation. According to Saraceni (2014), material adaptation is an inevitable process of modifying, supplementing, or simplifying course content, tasks, and objectives to fit learners' needs and context. She emphasized that materials are seen as flexible resources rather than fixed ones. For materials to become effective, they require competent teachers who successfully adjust them in real practice, because published materials are designed for a broad audience, rather than corresponding to the diversity found in the classroom. Among the key aspects of materials adaptation, content adaptation involves adjusting the linguistic and conceptual input delivered to learners. This conceptual adaptation refers to the modification of the knowledge, concepts and skills within materials to reach the learner's readiness level, interest, and learning profile. Therefore, teachers adapt the content to make it accessible, appropriate and relevant to all students.

In this context, content adaptation is the practical side of differentiated instructions in which it takes the actual theory and transforms it into actual practice in the classroom. In addition, content adaptation is distinct from both related concepts which are materials selection and design. Selection involves choosing to appreciate resources, while design is creating new material. On the other hand, Tomlinson (2014) clarified that adaptation is the modification of existing resources to address specific learners needs, in this way, adaptation enhances learners'

understanding and promotes teaching and language learning. This perspective suggests that content adaptation is not merely a technical adjustment of instructional materials, but a pedagogical process that requires teachers to make informed decisions based on learners' needs and classroom contexts.

1.2.4.1. *Techniques of Content Adaptation*. In English language teaching, published materials are not entirely effective. This is why teachers proceed with adaptation in order to meet the classroom realities. According to McDonough, Shaw, and Masuhara (2013) adaptation involves a principled process that enables teachers to adjust materials to suit learners' needs, guided by the notion of "congruence", which means the materials should match the learner's needs, context, and learning objectives as well. Congruence can be achieved through personalization (increasing relevance to learners' interest), individualization (addressing different learning styles) and localization (adapting content to specific cultural and educational settings).

Teachers apply five specific adaptation techniques. Adding is the process of supplementing existing instructional materials to enhance learning opportunities. Deleting consist of removing unnecessary, complex or misaligned material to create a more manageable learning experience. Modifying refers to changing the form or structure of content while maintaining its core meaning. Simplifying involves reducing the complexity of instructional content to match learners' proficiency level. Reordering involves organizing content in a sequence that facilitates understanding and learning progression. To conclude, the application of these techniques provides teachers with structured framework that transforms published materials into responsive and effective resources that align with learners needs and the dynamic classroom realties. These techniques suggest that content adaptation is not a rigid process, but a flexible practice; it requires that teachers select appropriate strategies according to learners' needs and instructional objectives.

1.2.4.2. *Principles of Effective Content Adaptation*. Successful content adaptation in language teaching is constrained by core principles designed to ensure changes rather than weaken the lesson (Tomlinson,2011). First, it is essential to maintain the original learning objectives; the adaptation of content should remain aligned with the intended goals of the lesson. Tomlinson argued that the modification should support clearly defined outcomes. In addition, preserving meaning and authenticity, which it is another important principle, since authentic materials expose students to real-life language use and successful communication. According to Richards (2006), authenticity is essential for developing communicative competence, and it is essential to neither distort the original message nor diminish the natural flow of the language while adapting content. Moreover, ensuring comprehensibility, which is supported by Krashen who argued that language acquisition occurs when students are exposed to understandable input (Krashen, 1982). The content should be modified in various ways that make them accessible while preserving an appropriate level of challenge. This is closely related to matching materials to learners' levels; effective adaptation must consider cognitive abilities, prior knowledge, and learner's proficiency. Content should be tailored to learners needs in order to facilitate learning and boost engagement, because complex inputs may hinder understanding, whereas those that are too simple limit improvement (Tomlinson, 2011). Lastly, although simplification is a common adaptation strategy, oversimplification should be avoided. Minimizing linguistic complexity too much can remove essential language features. As Tomlinson (2011) noted, successful adaptation requires clear balance clarity with authenticity, ensuring learners to receive meaningful, rich and challenging input. These principles highlight that content adaptation requires careful instructional judgment to ensure that materials are aligned with learners' abilities and instructional objectives.

1.2.4.3. *Content Adaptation in EFL Classrooms*. The diversity of EFL classrooms and different language levels make the strategic adaptation of content fundamental. One of the

prominent challenges is mixed-abilities settings, where students differ in their readiness, interests, and individual learning profile. To meet this challenge, content must be tailored to different strategies that vary in terms of support and task difficulty levels, as highlighted by Tomlinson (2017) and supported by the practical classroom guidance from Ur (1996). Furthermore, teachers must contend with language proficiency levels, ensuring that input is appropriate to learners' level. According to Krashen (1985), learners require input that is just beyond their current level (i+1) to promote acquisition. In addition, vocabulary load is essential in adaptation; too many unfamiliar words will block understanding. According to Nation (2001), learners need a sufficient number of familiar words in order to comprehend a text. Schmitt (2000) argued that controlling vocabulary difficulty is essential to support learning. Therefore, balancing linguistic difficulty, learner needs, and objectives is essential for meaningful learning and effective content adaptation in EFL classrooms. This suggests that content adaptation in EFL classrooms requires teachers to make flexible instructional decisions based on learners' language proficiency, vocabulary knowledge, and diverse classroom needs.

1.2.4.4. Benefits of Content Adaptation. Content adaptation is a pedagogical process, which enables teachers to adjust and reshape learning materials to suit learners' needs, abilities, and the specific classroom context (Tomlinson, 2014). It offers several pedagogical advantages by which it enhances language learning in four key ways: comprehension, cognitive load, engagement, and inclusion. Content adaptation improves comprehension by enabling teachers to present input, which is accessible and meaningful for all learners. According to Krashen (1985) language acquisition requires that learners are exposed to comprehensible input that is slightly above their level (I +1). Tomlinson (2014) supported this view, by clearly stating that material should be understandable, and clear rather than creating confusion for learners. Second, effective content adaptation minimizes cognitive load by facilitating and simplifying instructions and structuring tasks, selecting appropriate vocabulary. This reduces mental effort,

as Sweller's cognitive load theory explains that learning is enhanced when extraneous cognitive demands are reduced or eliminated. This guarantees meaningful knowledge construction by allowing learners to focus on their mental resources on understanding information rather than being overwhelmed by unnecessary difficulties. Third, adapted content promotes engagement in the classroom, as Keller's ARCS (2010) (attention, relevance, confidence, satisfaction) model highlights the conditions a teacher should apply. When materials are modified and connected to learners' needs and interests, they become relevant, and this leads to active engagement and participation in the classroom. Finally,

in mixed-ability classroom, adjusting instructions to meet diverse students' needs, allowing them to take part in the learning process. As Tomlinson (2017) proposed the framework of differentiated instruction as a way to achieve inclusion. In short, content adaptation supports language learning through four beneficial strategies.

Those strategies suggest that content adaptation can enhance the effectiveness of instruction when it is appropriately aligned with learners' needs.

1.2.4.5. ***Challenges and Limitations of Content Adaptation*****.** Despite its advantages, Content adaptation has several challenges in educational settings that may affect its implication. A primary challenge is the time, adapting materials requires analysis, planning and revision in order to produce effective and ready- to- use materials. Both Tomlinson (2014) and McGrath (2013) acknowledged that this process is time –consuming and requires teachers' expertise. Second challenge is oversimplification. When content reduced excessively, it leads to the elimination of essential linguistic elements and weakening cognitive dept. In addition, Tomlinson recommends avoiding the elimination of too much complexity, Ellis (2003) advocated that learners acquires appropriate challenge to develop language skills. Another challenge is loss of authenticity due to heavy modification of materials, which diminishes the communicative value of real–world text (Tomlinson, 2014; Richard ,2001). Finally, there is an

issue of inadequate teacher training in material design, as many educators lack the necessary preparation to adapt content effectively, which affect the quality of instructions. In summary, content adaptation is only effective with teacher's expertise, available time, and balanced approach to simplification and authenticity. These challenges indicate that content adaptation is a complex process that requires both pedagogical knowledge and practical classroom management.

Taken together, the literature indicates that content adaptation in EFL classrooms involves a set of instructional decisions related to the selection, modification, and organization of learning materials according to learners' linguistic needs, proficiency levels, and classroom diversity. In mixed-ability EFL contexts, teachers are required to balance instructional objectives with learners' readiness, comprehension levels, and vocabulary knowledge while also managing practical classroom constraints. The reviewed studies further suggest that effective adaptation depends on providing accessible input and appropriate support that facilitate comprehension and engagement. Accordingly, teachers' neurodidactic awareness may be associated with how they make instructional decisions when adapting instructional content in EFL classrooms.

1.3. The Relationship Between Teachers' Neurodidactic Awareness and Content Adaptation

The connection between teachers 'neurodidactic awareness and content adaptation in EFL classrooms represents the bridge between teachers' understanding of brain-based learning and their practical choices about selecting and modifying content in the classroom. Teachers who are aware of neurodidactics successfully implement content that aligns with learners' cognitive and affective needs. This awareness serves as an interpretive tool. It enables teachers to understand how learners handle and process language, which help them decide which

adjustments are required to support learners' comprehension, retention, and engagement in second language learning.

Attention is one key principle of this relationship. From a neurodidactic perspective, attention is selective and limited in capacity. This is the reason why learners cannot process all the language input they are exposed to. Teachers who acknowledge this adapt content by dividing long reading passages, texts and articles into short sections, highlighting main ideas using visual aids or colors that grab learners' attention and improve focus.

Memory is another key concept in this relationship. Learning occurs through encoding, storage, and retrieval of information. However, working memory has limited capacity that holds memories only for a short time. This requires careful management and presentation of content by teachers especially complex one. When teachers are neurodidacticlly aware, they reduce the content presented by organizing vocabulary into meaningful groups to facilitate remembering, rather than requiring learners to memorize single words in isolation. Spaced repetition further supports long-time retention. For instance, teachers may present a smaller set of connected and thematically related words, instead of introducing long list of vocabulary items. This set of words can be retrieved through speaking and writing tasks. These practices promote deeper processing and lead to higher retention.

In addition, emotion and motivation have significant role in shaping how learners' engagement with instructional content. Neurodidactics awareness indicates that emotional states influence both attention and memory. In other words, when learners are interested and emotionally connected to the material presented, they will successes in learning. Therefore, educators adapt content through the selection of topics that are relevant and meaningful to learners' own experiences. They design communicative tasks that facilitate self-expression and collaborative interaction in the classroom. This strategy reduces anxiety and promotes students'

willingness to participate. This perspective aligns with Krashen's work, that highlights the role of comprehensible input and the affective factors in language acquisition.

Attention, memory, emotion, and motivation are not separate processes. They are interdependent forces that interact during the learning process. When learners sustain attention, they encode information into memory effectively. Positive emotional states enhance and strengthen both attention and retention, which motivates learners to engage in the classroom. Neurodidactics awareness enables teachers to recognize these connections. As a result, teachers adapt content in response to these principles: attention, memory, emotion and motivation. Therefore, adaptation becomes an integrated process that combines cognitive processing and emotional engagement simultaneously, rather than functioning as a set of disconnected technical adjustments.

In a nutshell, the relationship between teachers' neurodidactics awareness and content adaptation is founded on four principles attention, memory, emotion and motivation. Neurodidactics awareness facilitates teachers understanding of these processes. Content adaptation enables them to translate their understanding into practice. Neurodidacticlly informed teachers make thoughtful decisions regarding content modification to support learners' limited attention, reduce memory load, and promote positive emotional engagement. Thus, content adaptation becomes a brain-informed teaching strategy that enhances comprehension, retention, and active engagement in the EFL classroom (Jensen,2005; Schacter,2009; Fossati,2012; Lucas-Olivia et al, 2022; Zull, 2006; Sousa, 2011; Sousa, 2022; Tomilson,2017).

Conclusion

This chapter provides a comprehensive literature review of the research exploring the relationship between teachers' neurodidactics awareness and content adaptation in EFL classrooms. The undeniable impact of brain-based learning principles on instructional decision

making is widely acknowledged. Notably, teachers' neurodidactics awareness contributes to essential variations in their pedagogical practices, with significant emphasis on their capacity to adjust and tailor instructional content, which plays a central role in teaching and learning. Variations in this awareness therefore naturally lead to differences in how teachers adapt and adjust the content. It is advisable to regard teachers' neurodidactics awareness as a core element in both teachers' preparation and ongoing professional support. This emphasis promotes an inclusive and supportive learning environment where learners' cognitive and emotional needs are taken into consideration. To achieve this goal, it is necessary to align teacher's neurodidactics awareness with content adaptation practices, ensuring their integration whenever instructional materials are used in EFL classrooms.

Chapter Two: Associating Teacher's Neurodidactic Awareness and Content Adaptation in EFL Classrooms: The Field Work

Introduction

Unlike the initial chapter, which addresses the theoretical background and views of the research topic, the present chapter is devoted to the practical part of the present study. It represents the fieldwork conducted to collect the required information to answer the research questions and reach the study aims. Furthermore, the chapter is divided into two sections: namely research methodology, participants, the data collection tool, administration and description of the questionnaire. The second section includes detailed analysis and interpretation of the obtained findings, that is followed by a discussion. Finally, it ends up with some recommendations (for teachers and future research) and limitation of the study.

Section One: Research Methodology and Design

2.1. Research Methodology

The study adopts a quantitative associational research design which is appropriate for identifying the relationship between teachers' neurodidactic awareness and content adaptation in EFL classrooms. Therefore, quantitative associational approach is appropriate because it allows the researcher to collect numerical data and statistically analyze the relationship between the variables. Finally, quantitative associational design is used to help the researcher reach the previous aims and answer the research questions.

2.2. Population and Sampling

The population of this study comprises EFL teachers from some Algerian universities, during the academic year 2025-2026. The sample consists of 36 teachers who were chosen to participate based on their relevance to EFL teaching and their ability to offer information relevant to the research. The participants were selected due to their accessibility and availability during data collection process.

2.3. Data Collection Tool

To achieve the aforementioned aims, one questionnaire was used as a data collection tool administered to 36 EFL teachers, which seems appropriate for quantitative research. The questionnaire included closed-ended questions in the form of Likert scale, frequencies, and only one open-ended question.

2.3.1. *Teachers' Questionnaire*

2.3.1.1. Description of The Questionnaire. The teacher questionnaire is made up of four sections and 60 close-ended questions mainly in the form of Likert scale and frequency-based Likert scale, organized from general to specific, and only one open-ended question. It is designed to measure the relationship between teacher's neurodidactic awareness and content adaptation in EFL classroom. The present questionnaire opens with an introductory paragraph that informs the participants about the study aim. The respondents were also informed that filling in the questionnaire remains anonymous, voluntary, and will be used for academic research purposes. In addition, a definition of key term "Neurodidactic" is provided to ensure a clear understanding of the concept. The first section attempts to shed light on teacher's background information in term of their teaching experiences and their academic qualification. The second section is concerned with teacher's neurodidactic awareness which describes key ideas about brain functioning and learning. It consists of 30 statements using a 5-point Likert scale statements (Strongly agree, Disagree, Neutral, Agree, strongly agree). The third section focuses on teachers practices regarding content adaptation in EFL classroom. The statements describe specific classroom actions related to adapting content for university EFL students. It consists 20 questions using a 5-point frequency-based Likert scale statements (Never, Rarely, Sometimes, Often, Always). The fourth section is devoted to linking teacher's neurodidactic awareness and content adaptation in EFL classroom. It describes specific classroom practices related to neurodidactic awareness on teacher's adaptation of instructional content. This section

contains 8 statements using a 5-point Likert scale statements (Strongly agree, Disagree, Neutral, Agree, strongly agree). In addition, an open-ended question is included to give respondents the opportunity to express further opinions and additional comments related to the study.

2.3.1.2. ***Administration of The Questionnaire.*** The present questionnaire is designed to measure the relationship between teachers' neurodidactic awareness and content adaptation in EFL classrooms. The questionnaire administered to 36 teachers from some Algerian universities. It was distributed via printed papers and Google forms. The participants have taken sufficient time to provide valid and reliable responses.

2.3.1.3. ***Analysis of The Questionnaire.*** The collected questionnaire data are analyzed quantitatively using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics including means, and frequencies are used to analyzed participant's answers. In addition, a Pearson correlational statistical analysis is employed to examine the relationship between teacher's neurodidactic awareness and content adaptation in EFL classroom.

Table 1

Background Information

Item 1: Years of Teaching	Frequency	Percent %	Item 2: Academic qualification	Frequency	Percentage %
1–5 years	16	44.4%	Bachelor's degree	1	2.8%
6–10 years	9	25.0%	Master's degree	15	41.7%
11–15 years	5	13.9%	Doctorate (PhD)	18	50%
More than 15 years	6	16.7%	Other (please specify)	2	5.6%
Total	36	100%		36	100%

Item 1

The table above represents years of teaching experience. It is noticed that almost half of the participants (44.4%) have taught English from one to five years. In addition, a quarter of the informants (25%) have been English teachers for less than ten years. In addition, a small proportion of teachers (13.9%) has taught English from 11 to 15 years while 16.7% respondents have taught more than 15 years. Thus, the data mentioned above indicate that questioned participants is predominantly composed of early-career teachers who possess varying level of professional experience in teaching English.

Item 2

As shown in the table, it is observed that teacher's academic qualifications vary between those who hold a bachelor degree, a master degree, and doctorate (PhD). 2.8% of them have a bachelor degree, 41.7% hold a master degree, 50% are qualified with a doctorate degree while 5.6% were post doctor, PhD candidate, and PhD student. Hence, these finding suggest that the majority of the participants are highly academically qualified which allow them to provide us with more accurate responses.

Table 1

Teachers' Neurodidactic Awareness statements

Statements	**Mean**
1- Most individuals use only approximately 10% of their total brain capacity.	3.22
2-Differences between left-brain and right-brain dominance explain individual learning differences.	3.97
3-Language learning ability is largely determined by innate, fixed talent rather than environmental factors.	2.78
4-Brain development becomes much more limited after early childhood.	3.14

5-I recognize that the majority of students are able to maintain their attention throughout the entire lesson.	2.44
6-I am aware that learners can fully concentrate on multiple activities presented simultaneously, as attention is not a limited resource.	2.81
7-I understand that the ability to focus can be enhanced through the implementation of multisensory (five senses) input.	3.53
8-I recognize that some learners can retain new information effectively without frequent repetition.	3.53
9-I am aware that working memory processes information more effectively when it is presented in small, manageable chunks rather than large amounts at once.	4.00
10-I understand that memory is a single, unified process of encoding that is not affected by different instructional conditions.	2.56
11-I am aware that knowing which brain areas (occipital lobe, temporal lobe, amygdala) support memory functions adds no practical value for teachers.	2.83
12-I am aware that strategies such as rhymes, acronyms, and songs are ineffective for long term memory retention.	2.83
13-I am aware that understanding how the memory system works is of little practical importance for teachers because it is largely abstract.	2.69
14-I understand that successful recall of information may indicate that learning has physically changed the brain.	3.44
15-I recognize that emotions have little or no effect on how deeply learners understand new material.	2.25
16-I am aware that negative emotions disturb neural processing and impair working memory.	3.97

17-I understand that emotional states trigger neurochemical changes (e.g., dopamine, cortisol) that can either enhance or impair attention and memory.	4.03
18-I recognize that motivation is regulated by the brain's reward system, which releases dopamine when learners anticipate success or feel curious.	3.97
19-I understand that external rewards (like grades) remain effective even when used repeatedly over time.	3.69
20-I recognize that stress may sometimes improve attention and performance during learning.	3.42
21-I am aware that the effects of excessive stress on learning and memory are often exaggerated.	3.06
22-I recognize that engaging multiple senses (visual, auditory, kinesthetic, tactile) simultaneously creates stronger and longer-lasting memory traces and enhances comprehension and retention.	3.78
23-I am aware that multisensory learning may activate multiple neural pathways and encode information in distributed brain networks, which could facilitate retrieval and memory storage.	3.63
24-I understand that multisensory learning benefits learners regardless of their preferred sensory modality, unlike approaches based on fixed learning style preferences.	3.53
25-I recognize that physical conditions such as lightning, colors, noise, and seating affect how students' brain function.	3.78
26-I am aware that factors such as natural lighting and classroom colors may contribute, to some extent, to students' mood, motivation, and engagement.	3.94
27-I understand that classroom environment plays only a limited role in reducing student stress and supporting learning.	2.86

28-I recognize that the brain changes its neural connections when a person learns a new language.	3.81
29-I am aware that repeated, meaningful exposure to language input and corrective feedback are not necessary for the brain to strengthen neural pathways.	2.64
30-I understand that learning may involve neural reorganization, which might allow many students to improve their language ability with sustained practice, though outcomes can vary.	3.72

Item 1 aims to examine teachers' beliefs regarding the common neuromyth claiming that individuals use only approximately 10% of their total brain capacity. The obtained mean score was (M = 3.22), which falls within the neutral range according to the adopted Likert scale. This indicates that the participants neither agreed nor disagreed with the statement, suggesting uncertainty or limited awareness concerning this neuromyth related to brain functioning.

Statement 2 aims to measure teachers' knowledge regarding the idea that differences in left-brain and right brain dominance explain individual differences. The table shows mean score of 3.97. This demonstrates that most respondents selected the agreement range according to the Likert scale. This indicates that a considerable portion of the participants agreed with the widespread neuromyth related to the idea that left-brain and right- brain have different functions in learning.

Statement 3 aims to examine teachers' awareness concerning learning ability that is largely determined by innate fixed talent rather than environmental factors or effort. The recorded mean score was 2.78 shows that the respondents neither agreed nor disagreed because the mean score inclines towards neutrality. This suggests that participants are uncertain about the notion regarding the role of innate ability, efforts, and environmental factors in learning.

From the table above, item 4 aims to examine teachers' awareness of brain development and its limitation after early childhood. The obtained mean score was (M=3.14) which suggests that participants neither agree or disagree with the statement, and indicates neutral position. This leads to the conclusion that teachers are not sure about the notion of brain development and its limitations after early childhood.

Item 5 aims to measure whether teachers believe that the majority of learners are able to maintain their attention throughout the whole lesson. The obtained mean score was 2.44, which corresponds the disagreement range. This shows that the participants do not believe or agree that the students are able or maintain their attention for the whole duration.

Statement 6 aims to determine respondents' awareness concerning the belief that learners can fully concentrate on multiple activities simultaneously, as attention is not a limited resource. The mean score yielded for this item was (M=2.81), which demonstrate neutrality towards the statement. Denoting that most participant neither agreed nor disagreed, suggesting that they are unsure about the validity of this item. The conclusion that could be drawn from data mentioned is that teachers shows uncertainty regarding the limitation of attention and multitasking in learning setting.

Item 7 tends to examine teacher's knowledge concerning the positive role multisensory input has in promoting learner's ability to focus. The statement scores a mean of 3.53 which reflect agreement with the statement. This indicates that teachers agree on the fact that multisensory stimulation has a positive effect on learning process.

Including item 8 in teacher's questionnaire seeks to address teacher's believes towards learner's ability to retain new input effectively without frequent repetition. A mean score of 3.53 was obtained for this item corresponding to the agreement scale. This leads to the conclusion that most participants tended to agree with statement, suggesting a tendency to

believe that learners are able to retain new information without the need for regular repetition; demonstrating a misconception regarding memory retention.

The purpose behind item 9 is to examine respondents' awareness regarding the effectiveness of working memory when the input is presented in small steps rather than in large amounts at once. The statement scored a mean of 4.00 which shows agreement according to Likert scale. Thus, the data obtained indicates that the participants recognize the importance of chunking information in enhancing working memory processing and learning

The aim behind statement 10 is to examine whether participants understand the idea that memory functions as a single, unified encoding process unaffected by different instructional conditions. The data above shows a score of (M=2.56) which inclines within the disagreement range denoting that teachers generally did not support the statement. This indicates that the participants understand memory as process that involves more than encoding alone that can be influenced by other instructional conditions.

Statement 11 aims to identify teacher's awareness concerning the practical value of recognizing the brain areas responsible for memory functions. The item scored a mean of 2.83, demonstrating neutrality regarding the statement. The data above give a hint that the participants were unsure regarding the practical relevance of neuroscience knowledge for memory-related learning processes.

Item 12 tends to know teachers believes towards the effectiveness of strategies including songs, rhymes, and acronyms in enhancing long term-memory retention. The mean score yielded for this item was 2.83, which lies within the neutral range according to Likert scale. This leads to the conclusion that the respondents are neither agreed nor disagreed with the validity of this notion, reflecting ambiguity in teacher's beliefs towards the role of mnemonic strategies reinforcing long-term memory retention.

The aim behind item13 is to examine the practical importance of understanding how memory system functions in learning. A mean score of 2.69 was obtained for this statement which shows that participants are neither agreed nor disagreed because the mean score falls within neutrality range. Indicating ambiguity regarding the practical value about memory processes in teaching.

The aim behind item 14 is to examine teachers' awareness regarding neuroplasticity and its relation to learning and memory recall, and physical change in the brain. The obtained mean score was(M=3.44), falls within neutral range. This indicates that participants neither agreed nor disagreed. This leads to the conclusion that teachers are not certain regarding the notion of neuroplasticity and its relation to learning and memory recall.

The purpose behind including statement 15 is to examine teachers' understanding of the relationship between emotional state and the depth of learning and comprehension. As shown in the table above, the mean score was (M=2.25) indicates that the participants disagree with the statement, suggesting that teachers do not acknowledge the relationship between emotional state and the depth of learning.

The aim behind item 16 is to address teachers' awareness about how negative emotions disturb neural processing and impair working memory. As the table above shows the score mean was (M=3.97), which suggests that respondents agreed with the statement. This indicates that teachers recognize disruptive effect of negative emotions on brain functioning and cognitive capacity.

Statement 17 aims to examine whether teachers recognize that the emotional state trigger neurochemical changes (e.g., dopamine, cortisol) that can either enhance or impair attention and memory. From the table, the mean score was (M=4.03) suggests that respondents showed a high level of agreement with the statement according to the Likert scale. This

indicates that teachers understand the neurobiological link between emotions and cognitive processes.

From the table above, this item 18 seeks to examine whether teachers understand that motivation is rooted in the brain reward system and depends on dopamine release during anticipation and curiosity. The obtained mean score was (M=3.97) , which suggests a moderate tendency toward agreement among participants. This indicates that teachers acknowledge the notion of motivation and its relation to the brain reward system.

The purpose behind including statement 19 is to address whether teachers recognize that the external rewards lose their effectiveness when used repeatedly. The statement scored a mean of 3.69, which suggests that respondents agreed with the statement. This indicates that teachers do not recognize the habituation effect in the brain's reward system.

Including item 20 in the questionnaire seeks to examine whether teachers recognize that stress can enhance attention and performance. The obtained mean score was 3.42, which suggests that respondents neither agreed nor disagreed with the statement and showed uncertainty. This indicates that teachers do not recognize the notion of stress and its effect on attention and performance.

Statement 21 aims to examine whether teachers understand that excessive stress harms learning and memory, and these facts are exaggerated. This item scored a mean of 3.06, which suggests that participants neither agreed nor disagreed. This indicates that teachers do not clearly acknowledge whether excessive stress harms learning and memory, and whether the harmful effects are often exaggerated.

The purpose behind item 22 is to examine whether teachers recognize that multisensory engagement (visual, auditory, kinesthetic) strengthens memory traces and improves comprehension and retention. From the table above, the mean score was 3.78, which suggests

that participants agreed with the statement. This indicates that teachers recognize the link between multisensory input and enhanced memory formation and comprehension.

From the table above, statement 23 seeks to examine whether teachers understand that multisensory learning involves the activation of different neural pathways and distributed brain networks, supporting memory retrieval and storage. The statement scored a mean of 3.63, which suggests that most respondents agreed with it. This indicates that teachers recognize the neural basis of multisensory learning and its role in memory retrieval.

The aim of item 24 is to examine whether teachers understand that multisensory learning benefits all learners equally, and that should not be confused with the notion of fixed learning styles. From the table above, the mean score was 3.53 which suggests that participants neither agreed nor disagreed with the statement. This leads to the conclusion that teachers have not formed a clear opinion about the distinction between multisensory learning and fixed learning styles

Item 25 seeks to examine the participants' awareness regarding the effect of physical classroom conditions on student's brain functioning. The statement scored a mean of 3.78, showing agreement with statement. This indicates that teachers generally agreed with the fact that physical classroom conditions effects how the brain functions and influences cognitive processing.

Statement 26 tends to examine teacher's knowledge concerning the impact of classroom environmental conditions on student's mood, motivation, and engagement. A mean score of 3.94 was obtained for this item corresponding to the agreement scale. This leads to the conclusion that most participants tended to agree with statement, suggesting that they are aware about the role of positive classroom conditions on enhancing motivational states.

Item 27 tends to examine whether teachers believe that the classroom environment has only a minor impact on student's stress and learning, or whether they recognize its significant

role. This item scored 2.86, which indicates a clear disagreement by the respondents. This leads to the conclusion that teachers acknowledge the effectiveness of the classroom environment in reducing stress and support learning.

The aim behind including statement 28 in the teachers' questionnaire is to examine whether participants understand that learning a new language physically reshape the brain's neural pathways (a core concept of neuroplasticity). The obtained mean score was 3.81, which suggests high level of agreement by the respondents. This indicates that teachers understand the notion of neuroplasticity.

The purpose behind item 29 is to address teachers' understanding of whether repeated language input and corrective feedback is essential for neural change. The statement scored a mean of 2.64, which suggests that participants showed disagreement with it; This leads to the conclusion that teachers rejected the claim that repeated input and corrective feedback are unnecessary. Therefore, they recognize that these elements are indeed essential for neural change and language learning.

Including item 30 in the teacher’s questionnaire seeks to address whether teachers understand the role of neural reorganization in improving language ability through sustained practice. A mean score of 3.53 was obtained for this item corresponding to the agreement scale. This indicates that most participants tended to agree with statement, suggesting that they acknowledge the potential of sustained practice and neural adaptability in reinforcing language learning development, although outcomes can vary among learners.

Content Adaptation

Table 2

Content Adaptation Statements

Statement 1	**Never**	**Rarely**	**Sometimes**	**Often**	**Aways**	**Total**
Frequency	7	5	16	6	2	36

%	19.4 %	13.9%	44.4%	16.7%	5.6%	100%
Statement 2	**Never**	**rarely**	**sometimes**	**Often**	**Aways**	**Total**
Frequency	2	4	12	9	9	36
%	5.6%	11.1%	33.3%	25%	25%	100%
Statement 3	**Never**	**rarely**	**sometimes**	**Often**	**Aways**	**Total**
Frequency	9	7	10	8	2	36
%	25%	19.4%	27.8%	22.2%	5.6%	100%
Statement 4	**Never**	**rarely**	**sometimes**	**Often**	**Aways**	**Total**
Frequency	4	11	7	8	6	36
%	11.1%	30.6%	19.4%	22.2%	16.7%	100%
Statement 5	**Never**	**rarely**	**sometimes**	**Often**	**Aways**	**Total**
Frequency	1	5	7	10	13	36
%	2.8%	13.9%	19.4%	27.8%	36.1%	100%
Statement 6	**Never**	**rarely**	**sometimes**	**Often**	**Aways**	**Total**
Frequency	0	3	7	6	20	36
%	0	8.3%	19.4%	16.7%	55.6%	100%
Statement 7	**Never**	**rarely**	**sometimes**	**Often**	**Aways**	**Total**
Frequency	15	7	9	4	1	36
%	41.7%	19.4%	25%	11.1%	2.8%	100%
Statement 8	**Never**	**rarely**	**sometimes**	**Often**	**Aways**	**Total**
Frequency	2	8	10	8	8	36
%	5.6%	22.2%	27.8%	22.2%	22.2%	100%
Statement 9	**Never**	**rarely**	**sometimes**	**Often**	**Aways**	**Total**
Frequency	0	7	9	10	10	36

%	0	19.4%	25%	27.8%	27.8%	100%
Statement 10	**Never**	**rarely**	**sometimes**	**Often**	**Aways**	**Total**
Frequency	18	9	5	2	2	36
%	50%	25%	13.9%	5.6%	5.6%	100%
Statement 11	**Never**	**rarely**	**sometimes**	**Often**	**Aways**	**Total**
Frequency	0	3	8	8	17	36
%	0	8.3%	22.2%	22.2%	47.2%	100%
Statement 12	**Never**	**rarely**	**sometimes**	**Often**	**Aways**	**Total**
Frequency	3	4	11	15	3	36
%	8.3%	11.1%	30.6%	41.7%	8.3%	100%
Statement 13	**Never**	**rarely**	**sometimes**	**Often**	**Aways**	**Total**
Frequency	2	6	9	9	10	36
%	5.6%	16.7%	25%	25%	27.8%	100%
Statement 14	**Never**	**rarely**	**sometimes**	**Often**	**Aways**	**Total**
Frequency	3	6	6	14	7	36
%	8.3%	16.7%	16.7%	38.6%	19.4%	100%
Statement 15	**Never**	**rarely**	**sometimes**	**Often**	**Aways**	**Total**
Frequency	3	2	11	12	8	36
%	8.3%	5.6%	30.6%	33.3%	22.2%	100%
Statement 16	**Never**	**rarely**	**sometimes**	**Often**	**Aways**	**Total**
Frequency	2	1	10	15	8	36
%	5.6%	2.8%	27.8%	41.7%	22.2%	100%
Statement 17	**Never**	**rarely**	**sometimes**	**Often**	**Aways**	**Total**

Frequency	0	4	10	14	8	36
%	0	11.1%	27.8%	38.9%	22.2%	100%
Statement 18	**Never**	**rarely**	**sometimes**	**Often**	**Aways**	**Total**
Frequency	13	6	8	6	3	36
%	36.1%	16.7%	22.2%	16.7%	8.3%	100%
Statement 19	**Never**	**rarely**	**sometimes**	**Often**	**Aways**	**Total**
Frequency	11	1	10	9	5	36
%	30.6%	2.8%	27.8%	25%	13.9%	100%
Statement 20	**Never**	**Rarely**	**Sometimes**	**Often**	**Aways**	**Total**
Frequency	2	6	10	12	6	36
%	5.6%	16.7%	27.8%	33.3%	16.7%	100%

The statement 1 seeks to examine the extent to which educators assign the same classroom activities despite differences in their readiness levels. The result reveal varying instructional practices among teachers. The largest proportion of respondents (44.4%) claimed that they sometimes provide identical classroom activities to learners with different readiness level, while (16.7%) reported that they often do so. Additionally, (5.6%) indicated that they always assign the same task, regardless of learner's readiness. Conversely, (19.4%) said that they never use the same task to students with varying readiness level. A smaller proportion (13.9%) noted they rarely implement this practice. Evidently, the distribution of the participants' answers leads to the conclusion that despite the fact that some educators differentiate instructions according student's readiness level, a considerable proportion still rely on identical classroom for across all learners.

The purpose behind item 2 is to examine the degree to which participants adjust lesson topics that align with students interests only when they correspond to the required curriculum. The data above reveals a positive tendency towards incorporating learner's interest in lesson planning. Specifically, the highest frequently reported response category fell within "sometimes" range, accounting for (33.3%) of participants. Additionally, (25%) reported that they often adapt their instruction in this manner, similarly, (25%) stated that they always do this practice. However, a minority of respondents opted for "rarely" (11.1%) and never (5.6%). Overall, the data shows that the majority of respondents tend to incorporate student's interests into their lesson design yet, this integration is compatible with the curriculum requirement.

Including item 3 in the teacher's questionnaire seeks to assess teacher's tendency regarding teacher's reliance on the use of single format (visual, auditory, hands- on) when presenting new input. The data obtained demonstrates a considerable variation in teacher's instructional practices. More than a quarter of respondents (27.8%) stated that they occasionally use one format, whereas (25%) of teachers indicated never doing so. Additionally, (22.2%) reported that they often use one single modality while (19.4%) claimed that they rarely adopt this practice. In contrast, a small minority representing (5.6%) indicate that they rely in teaching using a single modality. Apparently, these findings reveal mixed practices regarding the use of one single format when delivering content.

Statement 4 tends to know whether teachers design different activities for stronger and weaker learners when sufficient time is available. The data above reveal variation in teachers' responses. The highest proportion of participants (30.6%) selected "rarely" indicating that they rarely adapt this practice. Suggesting a limited use of planning time as a condition for differentiation. This followed by 22.2% who affirmed that they often differentiate activities for students when time allows. Meanwhile, 19.4% sometimes do so. A further 16.7% claimed that they always tailor content to students' level whereas, (11.1%) asserted the opposite. Based on

the data, this shows a lack of consensus among teachers, with the majority indicating they never design activities based on students' level and planning time available.

The statement 5 examines whether teachers allow students to demonstrate learning through different formats including presentations, written work depending on task requirement. The majority of participants (36.1%) who selected "always" indicate that they consistently permit students to use different format for learning. This was closely followed by 27.8% of teachers who selected often doing so. Additionally, a smaller percentage 19.4% claimed that they sometimes adopt this practice. However, 13.9% stated that they rarely allow such flexibility. Furthermore, only a minimal minority (2.8%) of participants claimed that they never do so. Notably, the data show a strong tendency toward offering a multiple demonstration for learning formats, as a large proportion of respondents who reported that they adapted this practice.

As shown in the table, item 6 aims to examine how far teachers provide additional examples or practice activities when they find a lesson challenging. The results indicate that there is a positive orientation towards this practice. More than half of the informants (55.6%) opted for "always" indicating that they systematically add extra support for difficult lessons parts. A subsequent proportion of the sample (16.7%) stated that they often employ this strategy. Meanwhile, 19.4% reported that they sometimes rely on this practice. Moreover, a small minority (8.3%) indicated that they rarely do so. Notably, no respondents selected "never". The data above reflect teachers' responsiveness to perceived lesson difficulty through extra examples or activities.

Statement 7 seeks to identify whether teachers present lesson content without removing any parts, even when certain sections were difficult for students. A considerable proportion of teachers (41.7%) selected "never", claiming that they tended not to maintain all content parts when certain sections were challenging for students. Additionally, 19.4% indicated that they

“rarely” do this practice. In contrast, 25.0% stated that they sometimes maintain the all content. Further, 11.1% indicate that they often do so while, only a marginal proportion who affirmed that they always deliver the complete lesson without excluding any parts. Evidently, these findings show that the majority of participants were inclined to simplify challenging lesson parts instead of delivering it entirely, reflecting teacher’s responsiveness to learner’s needs.

Including item 8 in the teacher’s questionnaire seeks to address the degree to which educators modify tasks while maintaining the original learning objectives, even though such adjustment results in changes in the objectives. The response distribution reveals considerable spread across the scale. The highest frequently reported response category fell within” sometimes” representing 27.8% of the sample showing occasional experience of this practice. Equal percentages (22.2%) reported for each of” rarely”, “often”, and “always”. However, small minority (5.6%) said that they never engaged with this practice. Suggesting that while the plurality of teachers sometimes experienced few changes regarding learning objectives after modifying task while many frequent or occasional changes, showing differences in task alignment with the original objectives.

The purpose behind item 9 is to examine the extent to which teachers shortened or rephrase sentences to improve readability, only when learners have difficulty with the original version. Equal proportion of participants selecting “often” and “always” (27.8%) , indicating that a majority of teachers consistently adapt texts when students find it challenging. A further, 25.0% reported that they sometimes do so, while19.4% indicated that they rarely adapt this strategy. However, none of the respondents selected never. The finding obtained suggest that most respondents recognize the significance of modifying text to better support learners facing difficulties.

Statement 10 aims to examine how teachers often stick to the original order of activities, when it proves ineffective for their students. The data reveals a clear preference of adaptable

approaches, rather than strictly following a fixed plan. Half of respondents (50%) reported that they never follow the original sequence, when it does not suit their learners. One a quarter of the respondents (25%) stated that they rarely do so. Additionally, a small group (13.9%) indicated that they sometimes follow the sequence. A small minority of respondents (5.6%) responded that they often follow the original sequence of classroom activities. Similarly, 5.6% endorsed that they do so. From these data, most teachers prefer to adjust their teaching practices rather than following the original order of activities that is not suitable for learners.

The purpose behind including statement 11 is to determine how often teachers verify adapted materials to serve the learning objectives, when they have sufficient preparation time. The results show that the majority of teachers frequently verify the adapted materials that serve the main learning objectives, it is noticed that no participant selected never. In addition, a small minority (8.3%) reported that they rarely verify adapted materials. Similar small proportions (22.2%) stated that sometimes or often (22.2%) verify. Almost half of participants (47.2%) indicated that they always verify. These findings demonstrate that teachers verify the adapted materials serve the learning objectives, especially when the preparation time is sufficient.

Item 12 seeks to examine the extent to which teachers oversimplify due to time pressure and wide ability gap, despite their intention to avoid oversimplification to maintain challenge in the classroom. The obtained results show that most teachers do oversimplify under these pressures. A small group (8.3%) stated that they never oversimplify, and another 11.1% reported that they rarely do so. In addition, nearly the third (30.6%) of the participants indicated that they sometimes oversimplify due to time pressure. The largest group of respondents (41.7%) selected that they often oversimplify content, and a further (8.3%) marked they always do so. This leads to the conclusion that the majority of teachers often oversimplify content when facing time constraints and mix-ability classroom, even though they recognize the value of maintaining challenge in the classroom.

Statement 13 aims to determine how commonly teachers preserve original meaning and natural phrasing when simplifying a text, even if the simplified version remain challenging for students. From the data above, results reveal that a majority of teachers follow this practice. A small minority (5.6%) indicated they never follow this practice (e.g., keeping meaning and natural phrasing), a 16.7% reported that they rarely do. One quarter (25%) selected sometimes, and another quarter (25%) chose often. The largest group, 27.8% stated that they always keep the original meaning and natural phrasing. This implies that the majority teachers always prioritize preserving original meaning and natural flow when simplifying a text, even if some students find the text challenging.

The aim of item 14 is to examine how frequently teachers offer temporarily supports like sentence starters, word banks, or model examples for challenging assignments, and gradually remove them to prevent dependence. The results show that a clear majority of teachers adopt this practice. A small minority (8.9%) reported that they never do this type of support. Another 16% of participants indicated that they rarely follow this scaffold then fading strategy. Similarly, 16% stated that they sometimes do so. In addition, 38.9% responded that they often provide and remove supports, while approximately 19.4% said that they always do so. This leads to the conclusion that the majority of teachers often use temporarily supports and fade it over time to encourage learners' independence.

Item 15 seeks to determine how often teachers deliver mutli-step instructions one step at a time and allowing students to finish each step before proceeding to the next. From the obtained data, results reveal that the majority of teachers follow this sequential approach. A small minority of participants (8.3%) indicated that they never deliver multi step instructions, and 5.6% reported that they rarely do. In addition, nearly a third (30.6%) of respondents selected sometimes. The largest group, 33.3% stated that they often deliver instructions sequentially. Nearly a quarter (22.2%) said they always do so. This implies that most teachers

prefer to use multi-step instructions allowing students to complete each step before moving to the next.

Statement 16 seeks to identify the frequency with which teachers review vocabulary and key structure form previous lessons across several weeks, while focusing on items students struggle with rather than reviewing everything. From the table above, the data collected show the results of the vast majority of teachers follow this selective review practice. A very small minority (5.6%) indicated that they never review vocabulary, and only 2.8% reported that they rarely do. More than a quarter (27.8%) selected sometimes. Most respondents 41.7% stated that they often prioritize reviewing difficult vocabulary and structures over reviewing all previous material. 22.2% said that they always do so. These findings indicate that the majority of teachers choose to focus on difficult content when reviewing, rather than adopting a comprehensive review of all previous content across several weeks.

The purpose behind including statement 17 is to examine the extent to which teachers combine multiple sensory input during language presentation, while avoiding two inputs at once to prevent overload. From the result shown in the table, it is clearly indicating that most teachers follow this balanced approach. It is noticed that no participant selected never to the statement. A small minority (11.1%) reported that they rarely combine multiple sensory input in language presentation, more than a quarter (27.8%) indicates that they sometimes do so. The largest group (38.9%) stated they often combine multiple sensory input, while avoiding two-input at once. More than one in a five (22.2%) said they always do so. This leads to the conclusion that most teachers intentionally blend visual, auditory and written input, but limiting the number of simultaneous inputs to prevent cognitive load.

The aim of item 18 is to identify the frequency with which teachers believe that providing encouragement after every successful response is not necessary for learning. The results show that most teachers rejected this view. More than third (36.1%) of teachers selected

never, meaning that they do consider encouragement necessary. A small proportion (16.7%) reported that they rarely hold the belief that it is unnecessary. In addition, 22% of the respondents chose sometimes. Similar proportion (16.7%) stated that they often believe that encouragement is not necessary, and 8.3% indicated that they always believe that. Overall, this implies that the majority of teachers value providing encouragement after successful responses, and it is beneficial for learning.

Statement 19 seeks to determine how often teachers modify classroom environment (e.g., changing seating or reduce noise), after noticing a clear drop in concentration. The obtained results reveal that teachers are divided in responses. Nearly a third (30.6%) of participants indicated that they never modify classroom environment, when concentration is lost. A small proportion (2.8%) stated that they rarely take this action. More than a quarter (27.8%) selected sometimes. Another quarter reported that they often change seating or reduce noise under these conditions, and 13.9% said that they always do so. This Leads to the conclusion that teachers are split between those who intervene proactively, and those who overlook clear signs of disengagement.

Including item20 in the teacher's questionnaire seeks to determine whether teachers adapt the same core content regardless of student's level while preserving the essential objectives. The data above show that largest proportion of the participants (33.3%) selected "often ", indicating frequent engagement in this practice. In addition, 27.8% stated that they sometimes adapt content in this manner. While (16.7%) reported that they always do so. A small proportion (16.7%) indicated that they rarely adopted this practice. Moreover, only (5.6%) claim that they never do so. Overall, the obtained data indicates that most teachers adapt the core content regardless of students' level.

The Relationship between Teachers' Neurodidactic Awareness and Content Adaptation

Table 3 *Statements about the Relationship between the Two Variables*

	Mean
1 Variations in learners' attention during a lesson may be related to the way instructional content and directions are presented.	3.50
2 Previously encountered vocabulary and language structures tend to be revisited in the same ways across lessons.	2.81
3 Learners' emotional reactions during classroom activities are often associated with the type of explanations or tasks provided.	3.64
4 The selection and modification of classroom activities are not usually associated with learners' level of engagement	2.56
5 Adjustments in classroom tasks are generally unrelated to learners' levels of stress or cognitive load.	2.67
6 The use of combined visual, spoken, and written input during language presentation is not associated with the same learning outcomes for all learners.	3.39
7 Interaction patterns, seating arrangements, and instructional delivery are not always linked to variations in students' classroom participation and overall learning conditions.	2.81
8 Repeated language exposure, feedback, and learners' progress are associated with one another in different ways across classroom contexts.	3.75

Item 1 seeks to examine whether teachers understand that changes in students ' attention during a lesson can be linked to how educators present content and provide instructions. From the table above, the item scored a mean of 3.50, which suggests a moderate tendency toward agreement among participants. This leads to the conclusion that teachers acknowledge a link

between variation in learners' attention and how content and instructions are directed and presented.

The purpose behind including statement 2 is to determine whether teachers perceive that previously encountered vocabulary and language structure tend to be revisited in repetitive ways across different lessons. The obtained mean score was 2.81, which suggests that participants disagree with the statement. This indicates that teachers perceive the view of prior vocabulary and language structures as being varied rather than being repetitive across lessons.

The aim of item 3 is to examine teachers' perceptions whether learners' emotional reactions are associated with the type of explanation or the task provided. From the table above, the item scored a mean of 3.54 suggesting tendency toward agreement among participants. This reflects that teachers perceive a link between instructional task design and learners' emotional responses in the classroom.

From the table above, statement 4 seeks to examine teachers' perceptions of whether the selection and modification of classroom activities are not usually related with learners' level of engagement. This statement scored a mean of 2.56, which suggests disagreement among respondents. This leads to the conclusion that how teachers select and modify activities is indeed associated with learners' level of engagement.

Item 5 aims to determine whether teachers perceive task adjustments are unrelated to learners' stress or cognitive load. The obtained mean score was 2.67, which indicates a high level of disagreement among participants. This implies that teachers perceive a meaningful association between adjustments in the classroom tasks and learner's level of stress or cognitive load.

The aim of statement 6 is to examine teachers' perceptions regarding whether the use of combined visual, spoken, and written input during language presentation is related to equal learning outcomes to each learner. The data collected score a mean of 3.39 suggesting that

participants neither agreed nor disagreed with the statement. This leads to the conclusion that teachers did not express a clear perception either for or against the idea that multimodal input leads to varied learning outcomes for different learners.

The purpose behind including statement 7 is to identify teachers' perceptions regarding whether interaction patterns, seating arrangement and instructional delivery are linked to variation in classroom participants and learning conditions. The obtained mean score was 2.81 suggesting disagreement among respondents. This implies that teachers perceive a meaningful association between these classroom organization factors and variation in learner participants and learning conditions.

The aim of item 8 is to examine teachers' perceptions regarding whether repeated language exposure, feedback, and learner progress differ across classroom settings. From the data shown above, a mean score was 3.75, which indicates a high level of tendency toward agreement by the participants. This leads to the conclusion that teachers perceive the relationship among language exposure, feedback, and learner progress as shaped by context, meaning, and these connections vary depending on the classroom settings.

Section D: Further Suggestions

The purpose behind this open-ended question is to ask teachers to share any comments, or suggestions concerning the research topic. It was not answered by all the participants. However, the data obtained from this question amount notable of valuable recommendations was given by some teachers as the following:

- A recurring idea among participants indicating that the brain’s ability to reshape its neural connections through repetition, active practice, and attention. The respondents emphasize that learning becomes more effective when the input is delivered in organized, interactive, and personalized ways that suit learners’ cognitive needs.

- Some teachers underscored the significance of active recall, spaced repetition, and intensive practice in enhancing long-term memory retention. Other claimed that successful learning occurs when it is connected to prior knowledge through appropriate scaffolding, and supported multisensory and multimodal instruction. They emphasize on using different techniques, including brainstorming, questioning, collaborative group activities.
- Another point was raised by the participants regarding the role of motivation, emotions, and classroom environment in the learning process. They stated that supportive relationship between teachers and their students, meaningful examples, and culturally relevant content increases participation and reinforce understanding.
- One participant claimed that adapting content examples to learner's cultural background and daily life experiences helps learners engage and understand effectively.
- Another teacher highlighted the importance of considering individual differences in relation to how teachers adapt their teaching.
- Another recurring idea was raised by another teacher who recommended incorporating warm-up activities and interesting tasks to maintain learner's attention.
- The brain does not merely store information; rather, it constructs meaning through patterns, connections, and repeated exposure. Prior knowledge is fundamental to this process, as new input is continuously interpreted in light of existing cognitive frameworks. Moreover, attention, emotion, and perceived relevance play a crucial role in retention, given that learners engage more effectively when content is meaningful and when cognitive load is carefully regulated. From this standpoint, instructional practice should privilege depth over superficial coverage. Emphasis is placed on fostering conceptual connections, promoting retrieval practice, and reinforcing learning through spaced repetition, thereby supporting durable and transferable knowledge.

- Overall, teacher's suggestions reflect their understanding of how learning occurs indicating that learning is enhanced through repetition, emotional engagement, and successful teaching process.

2.3.2. *Description and Interpretation of The Correlation*

Table 4 *Pearson Correlation of the Two Variables (TNA and C A)*

		Section B TNA	Section C C A
Section B TNA	Pearson Correlation	1	0.506
	Sig. (2-tailed)		0.002
Section C C A	Pearson Correlation	0.506	1
	Sig. (2-tailed)	0.002	

Correlation is significant at the 0.01 level (2-tailed).

The result of the Person correlation analysis revealed that there is a moderate positive correlation between teachers' neurodidactic awareness (TNA) and content adaptation (CA) (r=0.506, p=0.002). This implies that teachers with higher neurodidactic awareness tended to make appropriate instructional decisions regarding content adaptation. Furthermore, the correlation is statistically significant at the 0.01, suggesting that the relationship between the two variables was meaningful rather than coincidental.

2.4. Discussion of Results

The data was conducted through a questionnaire survey which elicited quantitative responses from 36 teachers. The current research aims to measure the relationship between teachers' neurodidactic awareness and content adaptation in EFL classroom.

The data obtained from the questionnaire reveals that the sample is mainly composed of early-career and early educators, as the majority stated having between one to five years of teaching experience. However, a smaller proportion indicates that they have longer teaching experience, which provides the study with diverse professional perspectives concerning

neurodidactic awareness and instructional practices. In addition, the findings reveal that most participants held postgraduate degrees mainly master and doctorate qualification. The sample possesses a high academic background, which may have contributed with deeper understanding of educational and cognitive aspects addressed in this questionnaire. The inclusion of highly qualified respondents enhances the credibility and reliability of this survey.

The outcomes revealed that teachers exhibit various responses regarding neuromyths statement. This indicates that teachers demonstrate only partial to moderate familiarity with neuromyths, the responses were accompanied by multiple neutral answers reflecting uncertainty. This suggests that teachers possess partial to moderate level of awareness of neurodidactic, rather than fully developed understanding. This partial awareness could be attributed to teachers limited exposure to brain-based learning research. Although, some neurodidactic principles appear recognizable by teachers, they struggle with complex and controversial ideas. These results align with earlier studies. Dekker et al (2012) reported that neuroscience intersection teachers still held neuromyths, while Grospietsch and Mayer (2019) concluded that these misconceptions remain resilient, even among knowledgeable and formally trained teachers. For the present study, limited awareness of neuromyths may lead teachers to adjust content based on incorrect believes about learning and the brain, thereby undermining the quality of instructional adaptation.

The data obtained from the questionnaire regarding attention indicates that participants possess a partial understanding of attentional processes in language learning. It suggests that respondents are aware of certain basic aspects of attention mainly its limitations and its role in maintaining concentration during instructional practices. This reflects general understanding among teachers about the idea that attention is not fixed and that students cannot maintain their attention completely throughout the entire lesson. In addition, this is consistent with Treisman's (2009) who argued that attention is limited due to the brain's finite capacity when processing

information. Nevertheless, the results show uncertainty concerning learners' capacity to focus on multiple tasks. Therefore, this indicates that some educators may not understand carefully the limitations of attention and multitasking in learning. Such result is strongly related to the framework presented by Treisman (2009), who clarified that performing two competing tasks at once may create interference and reduce performance because attention relies on a limited reservoir of mental efforts. Moreover, the findings indicate that participants have positive position towards multisensory strategies, suggesting a clear understanding concerning the significance of applying multiple sensory input in reinforcing learner's concentration and engagement Attention involves selecting relevant stimuli while ignoring others (Steven and Mangun (2014). Teachers can guide learners' attention through visual and auditory strategies like gestures, color-coding, and intonation which may help teachers reinforce learning and reduce cognitive overload. Overall, the finding suggest that the majority of participants possess partial awareness of the role, limitations, and strategies that support attention throughout the learning process. However, the presence of uncertainty regarding certain aspects of attention indicates that their neurodidactic awareness remains incomplete.

The results reveal that teachers accurately understand memory concepts, including chunking and the usefulness of mnemonics. However, they were uncertain whether repetition is necessary for long-term memory. This reflects high but partial neurodidactic awareness, with a specific limitation regarding active repetition. Such uncertainty is due to teachers' observation that student often remember emotional or supervising information without repeated review, although the literature review by Jensen (2008) confirmed that repetition and active engagement are essential for strengthening neural pathways and lasting learning (Lightbown & Spare, 2013). For the present study, while teachers' understanding of memory chunking and mnemonics supports content adaptation through manageable input and retrieval aids. However, teachers' uncertainty of the role of repetition may lead them to neglect systematic revision.

Addressing this issue would reinforce the relationship between neurodidactic awareness and long -term language retention in EFL classrooms.

The outcomes show that teachers exhibit a positive yet diverse answers regarding how emotions and motivation affect the learning process. This suggests that teachers have a moderate level of neurodidactic awareness towards the link between emotional state, motivation, and cognitive performance. However, some responses reflected partial misunderstanding about long-term effectiveness of external rewards. The current study indicates that the majority of teachers acknowledge the impact of emotions on learning, memory, and attention. They also seem aware that negative emotional states as stress and anxiety can disturb neural processing and may hinder working memory. These results align with Zull's (2006) explanation that emotions regulate neural activity through neurochemical changes which directly affect cognitive functioning. Similarly, most educators are aware of the role of dopamine and the brain's reward system in enhancing learner motivation through curiosity and anticipation of success. This is consistent with Lucas-Olivia et al (2022) who pointed out that learners become more motivated when they expect positive outcomes and rewards. Nevertheless, the findings indicate that some teachers struggle with more complex aspects related to motivational regulation, especially habituation effect related with external rewards. This contradicts Zull's (2006) clarification about the notion that the brain gradually adapts to recurring rewards, minimizing their motivational effect over time. Consequently, relying on continuous external rewards may not successfully maintain learner motivation in the classroom. Finally, the findings suggested demonstrate a partial to moderate neurodidactic awareness of how motivation affects learning.

The results reveal that teachers demonstrate a neutral view regarding the concept of stress. It can sometimes enhance attention and performance, and its negative effects on learning are often exaggerated. This indicates unclear neurodidactic awareness regarding stress, with

teachers either endorsing nor rejecting these claims. Such neutrality may arise from observing that some students perform well under pressure while others struggle, revealing how complex stress truly is. Yet the literature differentiates eustress (beneficial, moderate stress) from distress (harmful, chronic stress) (Jensen,2008; Sousa, 2011). In relation to present study, neutral awareness about stress may prevent teachers from distinguishing beneficial stress and harmful stress, causing them to either avoid all stress or ignore chronic stress. Therefore, clearer neurodidactic awareness of this concept would support a balance between cognitive challenge and emotional safety in EFL classrooms.

The obtained results indicate that teachers show high level of agreement toward the concept of multisensory learning, which strengthens memory, activate distributed neural network, and benefits all learners. This reflects high and accurate understanding of brain-based teaching that is clearly distinct from learning styles theory. According to the literature disused by Jensen (2008) and Shams et all (2008), this strong awareness may stem from practical and successful classroom activities such as The Total Physical Response, songs with movement or combined images with words. This integration of multisensory input forms multiple neural pathways and connections that strengthen memory recall, encodes information in distributed areas of the brain (occipital for visual, temporal for auditory, motor cortex for kinesthetic), and is fundamentally different from the discredited learning styles approach, which assumes fixed sensory preferences (Plusher et all, 2008). For the present research, this awareness suggests teachers will adapt EFL content by integrating visual, auditory, and kinesthetic elements simultaneously, supporting comprehension, retention, and engagement.

The research data shows a positive tendency concerning the significance of classroom environments in reinforcing learning and brain functioning. Suggesting that the majority of teachers show a moderate level of awareness regarding the effect of physical conditions and student’s classroom conditions on learner’s cognitive emotional processes. The findings show

that the majority understand that classroom conditions such as lighting, colors, noise influence how the brain process information. Jensen (2008) stated that physical and sensory conditions affect concentration, emotions, and cognitive processing. The agreement of participants may indicate that supportive classroom conditions can enhance attention and learning outcomes, yet stressful classrooms may hinder concentration and engagement. Moreover, the respondents reflect crucial awareness concerning the role of natural lighting and classroom colors on students' mood, motivation, and participation. As Jensen (2008) explained that positive classroom environment increases neurochemical responses related to motivation and attention. Reflecting teachers' awareness regarding the relationship between classroom atmosphere and learner's emotional readiness to engage in learning. In addition, the results show that teachers reject the idea that classroom has only a limited role in reducing stress and reinforcing learning. This indicates that the participants recognize the significance of creating comfortable learning that diminishes anxiety and improves engagement which is explained by Jensen (2008) that supportive environment continuously evaluates environmental conditions for comfort and safety and that supportive environment minimizes stress responses while helping learners to direct more cognitive resources to learning. In nutshell, the findings show a positive neurodidactic awareness of the crucial role of classroom conditions in learning as well as their consciousness of how these conditions may affect cognitive processes, engagement, and their emotional state.

The results reveal that teachers correctly agreed that learning a new language changes neural connection, while disagreed that meaningful repeated exposure and corrective feedback are unnecessary. Additionally, they agreed on the idea that sustained practice enables neural reorganization. These indicates that teachers possess high and accurate neurodidactic awareness regarding neuroplasticity and its implication for language learning. This strong awareness may reflect teachers' observation that practice improves learning, while lack of

practice leads to struggle, aligning with the core principle that brain continuously reorganizes in response to experience. This supported by the literature, according to Rose and Rankin (2001) neuroplasticity involves strengthening or weakening of synaptic connections through experience, and second language acquisition requires repeated meaningful input and corrective feedback to strengthen neural connections (Lightbown & Spare; 2013). In addition, active engagement improves neural circuits while continuous learning strengthens neural pathways (Gazzaniga, 2019; Kolb& Gibb, 2011). In relation to the present study, high neurodidactic awareness suggests that teachers will adapt EFL content using repeated exposure, sequence materials, and corrective feedback as reinforcement. They recognize that active, sustained practice (not passive exposure) promotes neural reorganization. Thus, this alignment between awareness and content adaptation supports long-term language development. Turning from readiness differentiation to interest-based differentiation, the obtained data indicates that teacher select similarly patterns of adaptation.

The findings related to content adaptation practices reveal how teachers adapt instructional content in their EFL classrooms. Regarding differentiated content by readiness, a noticeable number of teachers noted they occasionally assign uniform tasks to all learners despite their differences. This indicates that uniform tasks persist to some extent, a practice that only partially follows Tomlinson's principle that teaching should be proactively adjusted by learner’s readiness. Turning from readiness differentiation to interest-based differentiation, the obtained data indicates that teacher select similar patterns of adaptation. In adaptation process, teachers choose topics of interest for their students when it is suitable within the curriculum, reflecting limited rather than systematic use of interest-based differentiation. While Tomlinson (2014). asserted that differentiation by readiness is essential for student engagement. With regrade to learning profiles, some teachers reported relying on single sensory mode (visual or auditory). This practice only partly follows the multisensory learning principle, according to

which combining multiple sensory input enhances retention and comprehension (Jenson, 2008; Shams & Seitz, 2008). Regarding process and product differentiation, data obtained reveals that some teachers regularly designed different tasks for stronger and weaker learners, but only when time permitted. This reflects process differentiation, though it is limited by planning constraints (Tomlinson,2014; McGrath,2013). Conversely, the use of multiple demonstration formats (posters, videos, and written work) is widely practiced indicating full product differentiation (Tomlinson, 2012). For techniques of content adaptation, the data collected reveal that not all adaptation techniques were employed with equal consistency. For instance, teachers rarely added extra examples or practice when facing a challenging lesson. This is contradicted with McDonough, Shaw, and Masuhara (2013) adding strategy. In some instances, presenting content without removal of difficult and unnecessary elements reflects inconsistent use of the "deleting" technique that reduces cognitive load. Notably, a large number of teachers regularly adjusted tasks without alerting the intended learning objectives, demonstrating a good alignment with Tomlinson's (2011) principle. They did not typically wait until becoming severe before shortening or rephrasing sentences; this indicates that simplification was carried out proactively (McDonough et all., 2013). Following the original sequence of activities even when it is not effective, this reflects incorrect use of reordering technique. Another revealed results, a noticeable number of teachers checked whether their adapted materials serve learning objectives. Although, this practice required adequate preparation time. Teachers frequently acknowledged that pressure from limited time and disparities in learner ability led them to oversimplifying content, highlighting the difficulty of maintaining cognitive depth while managing real classroom conditions (Tomlinson, 2011; Ellis ,2003). In addition, authenticity was consistently maintained by the majority of teachers, who preserved meaning and natural phrasing when simplifying, which aligned with Richards view (2006). Teachers regularly employed a scaffolding and fading strategy by providing sentence

starters, word banks, or model answers, and gradually remove them over time, demonstrating effective scaffolding and fading (Tomlinson, 2014). Providing multi step instructions one at a time, allowing students to complete each step before moving to the next, which teachers commonly used practice reflecting correct understanding of working memory limits (Jensen, 2008; Treisman,2009). Furthermore, many teachers reviewed vocabulary and key structure over several weeks, focusing on items that students found difficult. This practice is aligned with Lightbrown and Spare (2013) ideas that spaced repetition and retrieval strengthen neural connections. From the obtained data teachers generally, valued encouragement following correct student responses, as few considered as unnecessary; this practice align with positive reinforcement theory (Zull, 2006; Jensen,2008). Concerning concentration, teachers did not wait until students showed a prolonged loss of concentration before rearranging seating or lowering noise level. This suggests they managed learning environment proactively (Jensen,2008). Finally, many teachers modified the core content allowing all learners to participate without changing the learning objectives. This practice reflects Tomlinson's (2017) definition of content adaptation, which consists of modifying of how a material is delivered while keeping learning objectives intact to foster inclusive participation. Overall, the findings indicate that teachers engage in various forms of content adaptation in their classrooms. In this study, these adaptation practices are referred to as practical decisions regarding content adaptation

The analysis of the data obtained shows a supportive tendency toward the relationship between teacher's neurodidactic awareness and content adaptation in EFL classrooms. The participants answers reflect a moderate level of awareness concerning how attention, memory, stress, multisensory, learning environment and neuroplasticity interact directly with how content adaptation and instructional decisions.

The data indicates that the majority of teachers are aware that variation in learner's attention are related to the way they adjust and modify instructional content. As Steven and Mangun (2014) explained that attention includes mental processes on specific tasks, while ignoring irrelevant one. Treisman (2009) assumed that attention is selective and limited in capacity which requires teachers to organize their instructional content in order to maintain learners' attention and diminish their cognitive load. In addition, the majority of teachers seem to understand the significant of varying vocabulary review and language practice across lessons rather than repeating them in the same way. Sousa (2010) clarified that memory depends on encoding, storage, and retrieval processes, meanwhile repeated meaningful practice enhances long-term retention. In the same context, Schacter (2009) focused on the notion that memory becomes stronger when information is organized and recalled through diverse meaningful experiences rather than isolated repetition. Moreover, the findings suggest that the majority of teachers recognize the connection between instructional task design and learners' emotional responses during classroom tasks.

This result aligns with Fossati's view (2012) who explained that emotions involve neural and physiological reactions that affect learning processes. Likewise, Zull (2006) argued that emotions are essential for successful learning because emotional state regulates neural activities and cognitive processing. Jensen (2008) further explained that emotional input reinforces attention and memory which may explain why emotionally meaningful tasks improve learners' participation. However, most teachers reject the notion that choosing activities or modifying tasks are unrelated to learner engagement and cognitive load. This outcome support Treisman (2009) who pointed out that excessive input and competing tasks may overload learner's attentional capacity. It also aligns with Sousa's (2011) argument that stress and cognitive overload impair memory formation and higher order thinking processes. In addition, adapting tasks that correspond to learner's needs may facilitate

understanding and learning. Therefore, the findings show a level of uncertainty regarding whether combining visual, spoken and written input leads to differentiated learning outcomes among students. This may reflect partial understanding of multisensory learning. According to Shams and Seitz (2008), multisensory integration strengthens learning input processed through various senses which creates stronger neural connections and improves memory retention. Similarly, Jensen (2008) and Sousa (2022) highlighted the importance of combining visual, auditory, and movement-based activities to improve understanding and participation. In addition, the majority of teachers seem aware that classroom conditions such as seating arrangement, and instructional delivery affect engagement and learning process. This align with Jensen (2008) explanation that supportive classroom atmosphere enhances attention, emotional state and motivation and participation by minimizing stress and creating positive learning environment. Also, the findings indicate that most participants recognize the connection between repeated language exposure, feedback, and learners progress across classroom settings, which support the concept discussed by Kolb Gibb (2011), who explained that learning strengthens neural pathways through continuous experience and practice. Therefore, Gazzaniga (2019) assumed that the brain continuously recognizes itself through meaningful experience.

In EFL context, Lightbown and Spada (2013) confirmed that repeated exposure to meaningful input and corrective feedback reinforces linguistics knowledge and support language development. Overall, the results of the present study suggest that teachers demonstrate positive tendency toward neurodidactic awareness and content adaptation in EFL classrooms. They reflect a partial understanding of how teachers adapt instructional content and classroom activities to strengthen learner's attention, memory, motivation, emotions and engagement.

The findings indicate that a positive relationship existed between teachers' neurodidactic awareness and their practical decisions regarding content adaptation. Teachers with higher neurodidactic awareness (brain-based learning principles) tended to adapt instructional decisions to meet learners' emotional and cognitive needs. This connection may be arised because teachers neurodidactic awareness deepens teachers understanding regarding attention limits (Teirsman, 2009), memory processes (Schacter,2009; Jensen,2008), emotional influence on learning (Zull,2006) , and the dual nature of stress in learning (Jensen, 2008; Sousa,2011). In addition, multisensory and its integration in learning (Shams& Seitz, 2008), along with the notion of learning environment and its importance (Jensen, 2008). These insights of brain-based learning inform teachers instructional decisions regarding content adaptation. For the present study, this positive relationship between teachers' neurodidactic awareness and their practical decisions regarding content adaptation suggests that teachers who acknowledge how learners process, store information, focus attention, and manage emotional reactions are better able to adapt content more effectively.

The section represents the core of the present study, where the data collected through the questionnaire were interpreted and discussed in relation to the research objectives and theoretical framework. The findings crucially demonstrate that EFL teachers possess a partial to moderate level of neurodidactic awareness and varying practices concerning content adaptation in EFL classroom setting. The major findings are summarized as follows:

Teachers demonstrated partial to moderate familiarity with brain-based learning principles, (r=0.506) (from the Pearson correlation results) as reflected through their responses to neurodidactic concepts such us attention, memory, stress, motivation, classroom environment, multisensory learning and neuroplasticity. Despite the fact that they recognize various essential principles, yet many responses reveal uncertainty regarding more complex concepts and neuromyths such as stress regulation, divided attention, long term effects of

external rewards indicating that teachers understanding remain incomplete and partial. In addition, the study shows that teacher apply various forms of content adaptation practices in EFL classrooms. Teachers reported that adapting instructional content based on learners' level of readiness, understanding difficulties attention and engagement needs. Teachers frequently simplify explanation by breaking input into smaller steps, review vocabulary repeatedly, scaffolding and modify activities while preserving the learning objectives.

The finding indicated that teachers attempt to minimize cognitive load by presenting input gradually and progressively. Teachers frequently provide learners with feedback, repetition, using multisensory techniques to facilitate learning. However, some adaptive practices remained inconsistent. A number of teachers sometimes rely on identical tasks, single sensory modes or fixed sequencing without accounting learner's differences. Time limitations, curriculum demand further appeared to have remarkable effect on adaptation consistency. Hence, the findings therefore indicate that teachers exhibit moderate and varied application of content adaptation strategies rather than systematic practices.

The results suggest that awareness of attention, memory emotional states multisensory and neuroplasticity may positively and crucially affect the way teachers adapt their instructional content, because they are aware of how learners process information which enable them to modify and adjust explanation classroom activities appropriately. The Pearson correlation analysis showed a statistically significant relationship between teachers neurodidactic awareness and content adaptation in EFL classroom, which demonstrated that teachers with high level of neurodidactic awareness were more likely to adjust lesson content that align with learner's cognitive and emotional needs. The results indicate that a moderate association exist between neurodidactic and content adaptation reinforcing the idea that neuroscience informed understanding may contribute to flexible and adaptive instructional practices.

2.5. Recommendation and limitation

2.5.1. *Recommendation for teachers*

The findings of this study lead to several suggestions for EFL Teachers. Firstly, educators should develop their neurodidactic knowledge, a step that supports smarter decisions about modifying instructional content to meet learners' needs. It is crucial for teachers to recognize that learners exhibit substantial variation in cognitive abilities, attention span, prior knowledge, motivational levels, and rate of progression. Due to these differences, modifying instructional content requires careful and thoughtful decisions regarding their teaching tools, classroom activities, managing learning environment, reducing stress, and integrating multiple sensory inputs based on the specific requirements of each learner. Secondly, educators are encouraged to employ flexible instructional approaches that foster active, meaningful learning by simplifying complex content, varying classroom activities, and connecting lessons to real-life experiences, adjustment that can improve students' ability to process information and maintain concentration throughout the lesson. Thirdly, it is essential for teachers to take part in organized professional learning focused on neurodidactic concepts and content adaptation. They engage in training opportunities such as formal classes, workshops peer-learning, which equip them with essential strategies for designing brain-compatible lessons and making sound instructional decisions. This deepens teachers understanding of how the brain learns and helps them foster EFL classrooms, through supportive, inclusive, and engaging learning environment. Finally, it is necessary to establish an open two-way communication between teachers and students. Educators should invite students to share their learning challenges, personal preferences, and evaluation of classroom materials and tasks. This exchange allows teachers to evaluate their instructional effectiveness and modify content to enhance learners' comprehension and participation.

2.5.2. *Recommendation for Future Research*

The findings of the present research call for additional inquiry to advance knowledge in this area. For future research should include diverse participants to make the findings widely applicable. Studies should examine how factors such as teaching experience, educational level, and training influence teachers understanding of neurodidactic and their ability to adjust instructional content. Researchers should conduct researches about how content adaptation affects students results, academic performance, motivation and participation in EFL classrooms through using different types if research such as qualitative research, using observation and interviews. For later studies, they may focus on specific neurodidactic principles such as attention, memory or emotions and how these elements affect teachers' classroom decisions. This deepens understanding regarding the concept of neurodidactic and its application in educational context especially in language teaching.

2.5.3. *Limitations of the study*

Despite the efforts to produce a complete dissertation, the study by no means~~, it~~ inevitably contains limitations and shorts coming which should be acknowledged. The prominent difficulties include the following:

- The limited availability of previous studies related to research topic constituted one of the main limitations of the present study. Since neurodidactic remains relatively emerging field within educational research particularly in the context of EFL instruction.
- Time limitation and the limited availability of teachers, and the small sample constituted another challenge during the competition of the present study. Due to teacher's professional responsibilities, some teachers were uncapable to dedicate time to answer the questionnaire which affected the data collection process.

Conclusion

The chapter is dedicated to the practical part of the study, basically designed to answer the research questions through measuring the relationship between teachers neurodidactic awareness and content adaptation in EFL classroom. The analysis of the questionnaire revealed that EFL teachers possess a partial to moderate level of neurodidactic awareness which was reflected in their instructional practices. Furthermore, the Pearson correlation analysis demonstrate a statistically significant positive relationship between teacher's neurodidactic awareness and their practical decisions regarding content adaptation in EFL classroom. In addition, the researchers supported the study with some recommendations for EFL teachers as well as for future researcher as well as limitations of the study.

General conclusion

The current research work is undertaken with an attempt to examine the relationship between teacher's neurodidactic awareness and content adaptation in EFL classroom. This research includes two main chapters. The first chapter was devoted for the theoretical background of the research related to teacher's neurodidactic awareness, and content adaptation practices in EFL classrooms. Although neurodidactic has been gained an increasing interest within educational research, limited attention was given to how teacher's neurodidactic awareness shape their practical decisions regarding content adaptation. Dealing with teacher's neurodidactic awareness and content adaptation practices, this study adopted quantitative associational research design to identify the relationship between teacher's neurodidactic awareness and content adaptation in EFL classroom. The data were collected through a questionnaire administrated for EFL teachers to some Algerian universities. The collected data were analyzed and interpreted in order to answer the research questions and reach the aim of the study. The results indicated that teachers have a partial to moderate level of neurodidactic awareness regarding attention, memory, motivation and emotion, stress, multisensory learning, classroom environment, and neuroplasticity. The results also showed that teachers employ different forms of content adaptation strategies, involving modification, simplification, scaffolding and adjustment of content that correspond to learner's cognitive and emotional needs. Nevertheless, some uncertainty remained concerning more complex concepts related to neurodidactic and certain adaptation practices appeared inconsistently applied because of classroom conditions and teaching limits.

In addition, the findings demonstrated a statistically significant relationship between teacher's neurodidactics awareness and content adaptation in EFL classrooms. This implies that teachers who possess higher understanding of neurodidactic principles tend to implement more adaptive instructional decisions in EFL classrooms. Moreover, improving

teachers neurodidactic awareness may lead to effective, successful teaching, and suitable content adaptation strategies.

The proposed recommendations are designed to support teachers, curriculum design, and future researchers regarding incorporating neurodidactic principles into EFL teaching. However, the research acknowledged several limitations particularly the limited sample size, and time limitations. Consequently, the limited scope of this study may encourage further research on neurodidactic and instructional practices in order to enhance more understanding of brain-based learning.

References

Becker, N. (2006). *Die neurowissenschaftliche Herausforderung der Pädagogik* [The neuroscientific challenge of pedagogy]. Julius Klinkhardt.

Borg, S. (2003). Teacher cognition in language teaching: A review of research on what language teachers think, know, and do. *Language Teaching, 36*(2), 81–109.

Caine, R. N., & Caine, G. (1991). *Making connections: Teaching and the human brain*. ASCD.

Daugirdienė, A., Česnavičienė, J., & Brandišauskienė, A. (2024). Insights from the active use of neuroscience findings in teaching and learning. *Behavioral Sciences, 14*(8), 639. https://doi.org/10.3390/bs14080639

De Barros, C., & Hernández Fernández, A. (2022). Neuroscience, neuroeducation, and technology. *Texto Livre, 15*, e41235. https://doi.org/10.35699/1983-

Dekker, S., Lee, N. C., Howard-Jones, P., & Jolles, J. (2012). Neuromyths in education: Prevalence and predictors of misconceptions among teachers. *Frontiers in Psychology, 3*, 429. https://doi.org/10.3389/fpsyg.2012.00429

Dubinsky, J. M., Roehrig, G., & Varma, S. (2022). A place for neuroscience in teacher knowledge and education. *Mind, Brain, and Education, 16*(4), 267–276. https://doi.org/10.1111/mbe.12334

Ellis, R. (2003). *Task-based language learning and teaching*. Oxford University Press.

Elsenbaumer, S. M. (2013). *Neurodidactics in practice: A practical approach to introducing informatics into a primary school in a brain-based way* (Unpublished diploma thesis). Alpen-Adria-University Klagenfurt, Faculty of Technical Studies.

Fossati, P. (2012). *The neural bases of emotion*. Foundation.

Gardner, H. (1983). *Frames of mind: The theory of multiple intelligences*. Basic Books.

Gazzaniga, M. S., Ivry, R. B., & Mangun, G. R. (2019). *Cognitive neuroscience: The biology of the mind* (5th ed.). W. W. Norton & Company.

Grospietsch, F., & Mayer, J. (2019). Pre-service science teachers' neuroscience literacy: Neuromyths and a professional understanding of learning and memory. *Frontiers in Human Neuroscience, 13*, 20. https://doi.org/10.3389/fnhum.2019.00020

Guerriero, S. (Ed.). (2017). *Pedagogical knowledge and the changing nature of the teaching profession*. OECD Publishing. https://doi.org/10.1787/9789264270695-en

Hart, L. A. (1983). Human Brain and Human Learning. New York, NY: Longman.

Howard-Jones, P. A. (2014). Neuroscience and education: A review of educational interventions and approaches informed by neuroscience. Education Endowment Foundation.

Immordino-Yang, M. H. (2016). *Emotions, learning, and the brain: Exploring the educational implications of affective neuroscience*. W. W. Norton & Company.

Jensen, E. (2008). *Teaching with the brain in mind* (2nd ed.). ASCD.

Jolles, J., & Jolles, D. D. (2021). On neuroeducation: Why and how to improve neuroscientific literacy in educational professionals. *Frontiers in Psychology, 12*, Article 411.

Kang, M. J., et al. (2009). The wick in the candle of learning: Epistemic curiosity activates reward circuitry and enhances memory. *Psychological Science*.

Keller, J. M. (2010). *Motivational design for learning and performance: The ARCS model approach*. Springer. https://link.springer.com/book/10.1007/978-1-4419-1250-3

Kim, S. (2013). Neuroscientific model of motivational process. *Frontiers in Psychology, 4*, 98. https://doi.org/10.3389/fpsyg.2013.00098

Kolb, B., & Gibb, R. (2011). Brain plasticity and behaviour in the developing brain. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3181999/

Krashen, S. D. (1985). *The input hypothesis: Issues and implications*. Longman.

Lightbown, P. M., & Spada, N. (2013). *How languages are learned* (4th ed.). Oxford University Press.

McDonough, J., Shaw, C., & Masuhara, H. (2013). *Materials and methods in ELT: A teacher's guide* (3rd ed.). Wiley-Blackwell.

McGrath, I. (2013). *Materials evaluation and design for language teaching*. Edinburgh University Press.

Nation, I. S. P. (2001). *Learning vocabulary in another language*. Cambridge University Press.

Pashler, H., McDaniel, M., Rohrer, D., & Bjork, R. (2008). Learning styles: Concepts and evidence. *Psychological Science in the Public Interest, 9*(3), 105–119.

Porfyri, I., Paraskevopoulos, E., Anagnostopoulou, A., Styliadis, C., & Bamidis, P. D. (2025). Multisensory vs. unisensory learning: How they shape effective connectivity networks. *Frontiers in Neuroscience*.

Preiß, G. (1993). *Neurodidaktik: Ein notwendiger Beitrag zur Didaktik des Jahres 2000* [Neurodidactics: A necessary contribution to the didactics of the year 2000]. *Lehren & Lernen, 19*(6), 40–45.

Richards, J. C. (2001). *Curriculum development in language teaching*. Cambridge University Press.

Saraceni, C. (2013). Adapting courses: A personal view. In B. Tomlinson (Ed.), *Developing materials for language teaching* (2nd ed., pp. 51–53). Bloomsbury.

Schacter, D. L. (2009). Memory and reality. *Nature Neuroscience, 12*, 367. https://doi.org/10.1038/nn0409-367

Schmitt, N. (2000). *Vocabulary in language teaching*. Cambridge University Press.

Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. Basic Books.

Schultz, W. (1997). Dopamine neurons and their role in reward mechanisms. *Annual Review of Neuroscience, 20*, 513–563. https://doi.org/10.1146/annurev.neuro.20.1.513

Schunk, D. H. (2012). *Learning theories: An educational perspective* (6th ed.). Pearson.

Shams, L., & Seitz, A. R. (2008). Benefits of multisensory learning. *Trends in Cognitive Sciences*.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. Harvard Educational Review, 57(1), 1–22.

Sousa, D. A. (2011). *How the brain learns* (4th ed.). Corwin.

Sousa, D. A. (2022). *How the brain learns* (6th ed.). Corwin.

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science, 12*(2), 257–285.

Tokuhama-Espinosa, T. (2010). *Mind, brain, and education science: A comprehensive guide to the new brain-based teaching*. W. W. Norton & Company.

Toledo, D., Révai, N., & Guerriero, S. (2017). Teacher professionalism and knowledge in qualifications frameworks and professional standards. In S. Guerriero (Ed.), *Pedagogical knowledge and the changing nature of the teaching profession* (pp. 73–95). OECD Publishing. https://doi.org/10.1787/9789264270695-en

Tomlinson, B. (Ed.). (2013). *Developing materials for language teaching* (2nd ed.). Bloomsbury.

Tomlinson, C. A. (2001). *How to differentiate instruction in mixed-ability classrooms* (2nd ed.). ASCD.

Tomlinson, C. A. (2011). *Leading and managing a differentiated classroom*. ASCD.

Tomlinson, C. A. (2014). *The differentiated classroom: Responding to the needs of all learners* (2nd ed.). ASCD.

Tomlinson, C. A. (2017). *How to differentiate instruction in academically diverse classrooms* (2nd ed.). ASCD.

Vygotsky, L. S. (1978). *Mind in society*. Harvard University Press.

Zembylas, M. (2007). Emotional ecology: The intersection of emotional knowledge and pedagogical content knowledge in teaching. *Teaching and Teacher Education, 23*(4), 355–367. https://doi.org/10.1016/j.tate.2006.12.002

Zerilli, J. (2021). *The adaptable mind: What neuroplasticity and neural reuse tells us about language and cognition*. Oxford University Press. https://doi.org/10.1093/oso/9780190067885.001.0001

Zull, J. E. (2006). Key aspects of how the brain learns. In K. P. Taylor & C. Marienau (Eds.), *The neuroscience of adult learning* (pp. 3–9).

Appendices

Teacher Questionnaire

Dear EFL teacher,
This questionnaire is part of a Master's dissertation entitled "The Relationship between Teachers' Neurodidactic Awareness and Content Adaptation in EFL Classrooms."
The aim of this study is to examine whether there is a significant relationship between teachers' neurodidactic awareness and their instructional decisions regarding content adaptation in EFL classrooms.

Your participation is entirely voluntary. All responses will remain anonymous and confidential and will be used exclusively for academic research purposes.
By completing this questionnaire, you are giving your informed consent to participate in this study.
Thank you for your time and valuable contribution to this research.

Key term: Neurodidactics is interdisciplinary field that draws upon several disciplines (neuroscience, psychology, pedagogy and education) that examine how insights from neuroscience can inform teaching practices.

Section A: Background Information

1. How many years have you taught English at the university level (EFL)?
☐ 1–5 years
☐ 6–10 years
☐ 11–15 years
☐ More than 15 years

2. What is your highest academic qualification?
☐Bachelor's degree
☐Master's degree
☐ Doctorate (PhD)
☐ Other (please specify): .....

Section B: Teachers' Neurodidactic Awareness

The following statements describe key ideas about brain functioning and learning

Please indicate your level of agreement with each statement using the scale below:
Strongly Disagree – Disagree – Neutral – Agree – Strongly Agree

1. Most individuals use only approximately 10% of their total brain capacity.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

2. Differences between left-brain and right-brain dominance explain individual learning differences.

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

3. Language learning ability is largely determined by innate, fixed talent rather than environmental factors or effort.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

4. Brain development becomes much more limited after early childhood.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

5.I recognize that the majority of students are able to maintain their attention throughout the entire lesson.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

6. I am aware that learners can fully concentrate on multiple activities presented simultaneously, as attention is not a limited resource.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

7.I understand that the ability to focus can be enhanced through the implementation of multisensory (five senses) input.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

8.I recognize that some learners can retain new information effectively without frequent repetition.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

9.I am aware that working memory processes information more effectively when it is presented in small, manageable chunks rather than large amounts at once.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

10. I understand that memory is a single, unified process of encoding that is not affected by different instructional conditions.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

11. I am aware that knowing which brain areas (occipital lobe, temporal lobe, amygdala) support memory functions adds no practical value for teachers.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

12. I am aware that strategies such as rhymes, acronyms, and songs are ineffective for long-term memory retention.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

13. I am aware that understanding how the memory system works is of little practical importance for teachers because it is largely abstract.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

14. I understand that successful recall of information may indicate that learning has physically changed the brain.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

15. I recognize that emotions have little or no effect on how deeply learners understand new material.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

16.I am aware that negative emotions disturb neural processing and impair working memory.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

17. I understand that emotional states trigger neurochemical changes (e.g., dopamine, cortisol) that can either enhance or impair attention and memory.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

18. I recognize that motivation is regulated by the brain's reward system, which releases dopamine when learners anticipate success or feel curious.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

19. I understand that external rewards (like grades) remain effective even when used repeatedly over time.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

20. I recognize that stress may sometimes improve attention and performance during learning.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

21. I am aware that the effects of excessive stress on learning and memory are often exaggerated.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

22. I recognize that engaging multiple senses (visual, auditory, kinesthetic, tactile) simultaneously creates stronger and longer-lasting memory traces and enhances comprehension and retention.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

23. I am aware that multisensory learning may activate multiple neural pathways and encode information in distributed brain networks, which could facilitate retrieval and memory storage.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

24. I understand that multisensory learning benefits learners regardless of their preferred sensory modality, unlike approaches based on fixed learning style preferences.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

25.I recognize that physical conditions such as lightning, colors, noise, and seating affect how students' brain function.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

26. I am aware that factors such as natural lighting and classroom colors may contribute, to some extent, to students' mood, motivation, and engagement.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

27. I understand that classroom environment plays only a limited role in reducing student stress and supporting learning.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

28.I recognize that the brain changes its neural connections when a person learns a new language.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

29.I am aware that repeated, meaningful exposure to language input and corrective feedback are not necessary for the brain to strengthen neural pathways.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

30. I understand that learning may involve neural reorganization, which might allow many students to improve their language ability with sustained practice, though outcomes can vary.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

Section C: **Content Adaptation**

The following statements describe specific classroom actions related to adapting content for university EFL students

Please indicate how often you perform each of the following actions in your EFL classroom**.**
Never / Rarely /Sometimes /Often / Always

1. I assign the same classroom tasks to students despite differences in their readiness levels.
Never ☐ Rarely ☐Sometimes ☐Often ☐ Always ☐

2. I adapt lesson topics to reflect students' interests only when they fit into the required curriculum.
Never ☐ Rarely ☐Sometimes ☐Often ☐ Always ☐

3. I use only one learning format (visual, auditory, or hands-on) when presenting new content.
Never ☐ Rarely ☐Sometimes ☐Often ☐ Always ☐

4. I design different activities for stronger and weaker students only when I have enough planning time.
Never ☐ Rarely ☐Sometimes ☐Often ☐ Always ☐

5. I allow students to demonstrate their learning through different formats such as posters, presentations, videos, or written work, depending on the task requirements.
Never ☐ Rarely ☐Sometimes ☐Often ☐ Always ☐

6. I add extra examples or practice activities when I consider a lesson to be challenging for students.
Never ☐ Rarely ☐Sometimes ☐Often ☐ Always ☐

7. I **present** lesson content without removing any parts, even when some sections are difficult for learners.

Never ☐ Rarely ☐Sometimes ☐Often ☐ Always ☐

8. I modify tasks while maintaining the original learning objective, but the objective sometimes changes slightly as a result of the modifications I make.
Never ☐ Rarely ☐Sometimes ☐Often ☐ Always ☐

9. I shorten or rephrase sentences to make a text easier to read only when students have significant difficulty with the original version.
Never ☐ Rarely ☐Sometimes ☐Often ☐ Always ☐

10. I follow the original sequence of activities even when it does not work well for my students.
Never ☐ Rarely ☐Sometimes ☐Often ☐ Always ☐

11. I verify that adapted materials still serve the main learning objective, especially when I have sufficient preparation time.
Never ☐ Rarely ☐Sometimes ☐Often ☐ Always ☐

12. I avoid oversimplifying content to maintain challenge, though time pressure and wide ability gaps lead me to oversimplify.
Never ☐ Rarely ☐Sometimes ☐Often ☐ Always ☐

13. When I simplify a text, I keep the original meaning and natural phrasing, even if the text remains somewhat challenging for some students.
Never ☐ Rarely ☐Sometimes ☐Often ☐ Always ☐

14. I provide sentence starters, word banks, or model answers for difficult tasks, then remove them over time to avoid dependence.
Never ☐ Rarely ☐Sometimes ☐Often ☐ Always ☐

15. I deliver multi-step instructions sequentially, allowing students to complete each step before moving to the next.
Never ☐ Rarely ☐Sometimes ☐Often ☐ Always ☐

16. I review vocabulary and key structures from previous lessons across several weeks, but I prioritize items that students have struggled with rather than reviewing everything.
Never ☐ Rarely ☐Sometimes ☐Often ☐ Always ☐

17. I combine images, spoken words, and written text when presenting new language, but I avoid using more than two sensory inputs at once to prevent cognitive overload.
Never ☐ Rarely ☐Sometimes ☐Often ☐ Always ☐

18. I do not consider providing encouragement after every successful response necessary for learning.
Never ☐ Rarely ☐Sometimes ☐Often ☐ Always ☐
19. I change seating or reduce noise only when I observe a clear and sustained drop in concentration across most of the class.
Never ☐ Rarely ☐Sometimes ☐Often ☐ Always ☐

20. I adapt the same core content so that all students, regardless of level, can participate without changing the essential learning goal.
Never ☐ Rarely ☐Sometimes ☐Often ☐ Always ☐

Section D: The Relationship between Teachers' Neurodidactic Awareness and content Adaptation

Please indicate your level of agreement with each statement using the scale below:
Strongly Disagree – Disagree – Neutral – Agree – Strongly Agree

1. Variations in learners' attention during a lesson may be related to the way instructional content and directions are presented.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

2. Previously encountered vocabulary and language structures tend to be revisited in the same ways across lessons.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

3. Learners' emotional reactions during classroom activities are often associated with the type of explanations or tasks provided.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

4. The selection and modification of classroom activities are not usually associated with learners' level of engagement.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

5.Adjustments in classroom tasks are generally unrelated to learners' levels of stress or cognitive load.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

6. The use of combined visual, spoken, and written input during language presentation is not associated with the same learning outcomes for all learners.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

7. Interaction patterns, seating arrangements, and instructional delivery are not linked with variations in classroom participation and learning conditions.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

8. Repeated language exposure, feedback, and learners' progress are associated with one another in different ways across classroom contexts.
☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

Section E: Further Suggestions

Please share any further thoughts regarding your understanding of how the brain learns, or any content adaptation practices you use, that were not addressed in this questionnaire.

Résumé

Pour améliorer l'efficacité pédagogique des enseignants dans le cadre de l'enseignement de l'anglais langue étrangère (EFL), il est nécessaire de disposer à la fois d'une solide compréhension de l'apprentissage fondé sur le fonctionnement du cerveau et de la capacité à adapter le contenu pédagogique aux besoins cognitifs et linguistiques des apprenants. En raison de l'intérêt croissant pour l'apprentissage fondé sur le fonctionnement du cerveau, la neurodidactique est devenue un domaine essentiel qui relie les découvertes des neurosciences aux pratiques pédagogiques, en particulier à l'adaptation des contenus. Cette étude vise à examiner la relation entre la connaissance qu'ont les enseignants de la neurodidactique et leurs décisions pratiques concernant l'adaptation des contenus dans les classes d'EFL. À partir du problème de recherche identifié, trois questions de recherche ont été formulées : quel est le niveau de connaissance de la neurodidactique chez les enseignants d'anglais langue étrangère ? ; Comment les enseignants d'anglais langue étrangère adaptent-ils les contenus pédagogiques dans leurs classes ? ; Existe-t-il une relation statistiquement significative entre la connaissance de la neurodidactique chez les enseignants et l'adaptation des contenus ?

Dans un premier temps, l'étude adopte une approche quantitative associative, en utilisant un questionnaire structuré comme principal outil de collecte de données. L'échantillon est composé d'enseignants d'anglais langue étrangère (EFL), sélectionnés pour apporter un éclairage pertinent sur les pratiques pédagogiques en classe en matière d'adaptation des contenus. Des analyses statistiques, notamment la corrélation de Pearson, ont été menées afin d'examiner la relation entre les deux variables. Les résultats ont globalement montré que les enseignants d'EFL possèdent un niveau de sensibilisation à la neurodidactique allant de partiel à modéré. Les résultats ont en outre révélé que les enseignants appliquent différentes formes de pratiques d'adaptation du contenu, bien que certaines pratiques semblent mises en œuvre de manière incohérente. Par conséquent, l'analyse de corrélation de Pearson a révélé une relation

statistiquement significative entre la conscience neurodidactique des enseignants et l'adaptation du contenu dans les classes d'anglais langue étrangère. De plus, la recherche suggère que le fait de sensibiliser davantage les enseignants aux principes d'apprentissage fondés sur le fonctionnement du cerveau pourrait conduire à des pratiques d'adaptation pédagogique plus efficaces et plus pertinentes dans les classes d'anglais langue étrangère.

Mots-clés : adaptation du contenu, anglais langue étrangère, neurodidactique, sensibilisation des enseignants.

الملخص

يتطلب تعزيز فعالية المعلمين التعليمية في بيئات تدريس اللغة الإنجليزية كلغة أجنبية فهمًا راسخًا للتعلم القائم على علم الدماغ، إلى جانب القدرة على تكييف المحتوى التعليمي بما يتناسب مع الاحتياجات المعرفية واللغوية للمتعلمين. ونظرًا للاهتمام المتزايد بالتعلم القائم على علم الدماغ، أصبح علم التعليم العصبي مجالًا أساسيًا يربط بين نتائج علم الأعصاب والممارسات التعليمية، ولا سيما تكييف المحتوى. تهدف هذه الدراسة إلى فحص العلاقة بين وعي المعلمين بعلم التعليم العصبي وقراراتهم العملية فيما يتعلق بتكييف المحتوى في فصول تدريس اللغة الإنجليزية كلغة أجنبية. من بين المشكلة البحثية المحددة، تمت صياغة ثلاثة أسئلة بحثية: ما هو مستوى الوعي بعلم التعليم العصبي بين معلمي اللغة الإنجليزية كلغة أجنبية؟ كيف يقوم معلمو اللغة الإنجليزية كلغة أجنبية بتكييف المحتوى التعليمي في فصولهم الدراسية؟ هل هناك علاقة ذات دلالة إحصائية بين وعي المعلمين بعلم التعليم العصبي وتكييف المحتوى؟

في البداية، تتبنى الدراسة تصميمًا ارتباطيًا كميًا، باستخدام استبيان منظم كأداة رئيسية لجمع البيانات. وتتألف العينة من معلمي اللغة الإنجليزية كلغة أجنبية، الذين تم اختيارهم لتقديم رؤى ذات صلة بالممارسات التعليمية في الفصول الدراسية فيما يتعلق بتكييف المحتوى. وأُجريت تحليلات إحصائية، بما في ذلك معامل ارتباط بيرسون، لفحص العلاقة بين المتغيرين. وأظهرت النتائج بشكل عام أن معلمي اللغة الإنجليزية كلغة أجنبية يتمتعون بمستوى وعي عصبي تعليمي يتراوح بين جزئي ومعتدل. كما كشفت النتائج أن المعلمين يطبقون أشكالاً مختلفة من ممارسات تكييف المحتوى، على الرغم من أن بعض الممارسات بدت غير متسقة في التنفيذ. لذلك، كشف تحليل ارتباط بيرسون عن وجود علاقة ذات دلالة إحصائية بين وعي المعلمين بالعلم العصبي التربوي وتكييف المحتوى في فصول اللغة الإنجليزية كلغة أجنبية. بالإضافة إلى ذلك، تشير الدراسة إلى أن زيادة وعي المعلمين بمبادئ التعلم القائم على الدماغ قد تؤدي إلى ممارسات تكييف تعليمية أكثر فعالية وذات مغزى في فصول اللغة الإنجليزية كلغة أجنبية .

المصطلحات الرئيسية: تكييف المحتوى، اللغة الإنجليزية كلغة أجنبية، علم التعليم العصبي، وعي المعلمين.