PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA

MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

MOHAMED KHEIDER UNIVERSITY – BISKRA

FACULTY OF LETTERS AND FOREIGN LANGUAGES

DEPARTMENT OF ENGLISH LANGUAGE AND LITERATURE

Investigating the Correlation between Verbal Working Memory Capacity and L2 Reading Comprehension:

The Case of Undergraduate Students of English at Biskra University

Dissertation submitted in partial fulfillment of the requirements for a

Master Degree in Sciences of Language

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Academic Year: 2022/2023

Declaration

I, Zakaria M. ATHMANI, do hereby declare that this MA dissertation is my original work and is the byproduct of my own efforts. Excluding where references have been cited, all of the words present in this work are mine and has not been published or written by another person. This work has not been submitted to any other university or institution for the completion of a degree or whatsoever.

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Date:

Dedication

To my parents and anyone who offered any kind of safety during this process. They'll recognize

themselves.

Special dedication to: M.C, M.S, S.H, A.B, M.D²ˢ

Acknowledgements

First and foremost, praise and gratitude to Allah for granting me the patience, the capacity, and ability necessary for the completion of this work.

I, also, express my deepest gratitude to my teacher and supervisor Prof. Ahmed Chaouki HOADJLI for his academic commitment, endless support and patience, and unconditional guidance before and throughout the entire research process.

I would like to express my honest appreciation for the Board of Examiners: Dr. Manel **TRIKI** , Mr. Bilal **ZENNOU,** and Ms. Nadjette **MOUSSAOUI** for devoting their precious time and honest efforts in correcting and providing insightful feedback.

I am especially thankful and indebt to the students whose devotion and commitment were decisive in the progress and completion of this work. Thanks to the participants who, despite their busy schedules, never hesitated to offer a helpful hand when needed. Lastly, special thanks to Mr. Alaa **HARZALLAH** and Ms. Hanine **GRIRA** for the unconditional effort, consistent help, and genuine concern in maintaining the progress of this study.

I am sincerely grateful for the four teachers whom agreed on sitting for the interviews. Though their identities are kept anonymous obeying the signed consent papers, their responses and insights were of great help.

I am deeply grateful as well for the collaboration of Mr. Tayeb **BOUHITEM** and Dr. Chahira **NASRI** as regards to their consent on the use of empty classrooms.

Abstract

Reading is perceived as a cornerstone which improvement and development are necessary for the achievement of higher language proficiency levels. EFL learners, however, are required to hold an adequate mastery on reading comprehension. The latter have been observed to cause repeated worries for the majority of EFL students at Biskra University. In an attempt to isolate one of the possible factors revolving around the issue, the present study investigated a possible correlation between verbal working memory capacity and reading comprehension of 30 students, who were selected following the convenient sampling technique. On the methodological terms, the study rested on a Mixed-methods approach wherein a case study design as well as a convergent parallel design allowing for the interpretation of both data simultaneously. In order to collected the necessary data, a verbal working memory test and a reading comprehension test were administered in addition to a questionnaire and interviews with four teachers of Reading. While thematic analysis, conducted through MAXQDA 2022, was used in qualitative analysis, quantitative analysis was analyzed through measures of frequencies and Spearman correlation. Ultimately, the findings revealed a moderate positive correlation between the verbal working memory capacity of the selected sample and their reading comprehension. The correlation was equally reflected in the results of the interviews and the questionnaires. The results also indicated a limited awareness on the influence of cognitive factors on reading comprehension as, generally, teachers failed to prove otherwise. Lastly, the students' admitted facing further difficulties in questions where the role of their working memory was more pronounced. Essentially, the results were holistically in favour of the found positive correlation.

Keywords: Cognitive factors, reading comprehension, reading comprehension difficulties, working memory, working memory capacity

List of Acronyms

WM: Working Memory

WMC: Working Memory Capacity

VWMC: Verbal Working Memory Capacity

RC: Reading Comprehension

EFL: English as a Foreign Language

FLL: Foreign Language Learning

STM: Short Term Memory

LTM: Long Term Memory

SM: Sensory Memory

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General Introduction

English as foreign language (Henceforth, EFL) learners are expected to hold an adequate level in the fundamental language components. Whether they are capable of developing a native-like understanding of the target language is still a matter of controversy; what it is safe to assume is a decent proficiency in the four language skills is mandatory for their academic accomplishment. Reading, specifically, is constantly advocated and shed-light upon. In this sense, reading practice is continuously urged by EFL teachers.

Still, an adequate portion of EFL learners meets difficulties during the reading process. Meticulously, they show a degree of deficiency in reading comprehension (Henceforth, RC). Those problems would eventually apprehend their academic progress causing, probably, learners' to endure academic failure. This can be justified by the permanent presence of RC in the various phases of the learners' learning journey: examinations, assignments, and provided documents are typically written rather than audiotaped or videotaped, and are usually joined with questions on comprehension.

Indeed, the implications of those hitches should be cured. However, it is only logical that the identification of factors, which are causing those difficulties, comes prior to their remedy. Following this vein, while a set of factors can be more explicitly overcome, others are more persistent and arguably more delicate to deal with. The latter refer the unconscious cognitive functions and processes that are, for the most part, uncontrollable. They cannot be solved or modified by learners. In fact, these learners are sometimes not even aware of which cognitive faculties may affect their RC.

Through a closer examination, EFL learners may complain of RC questions, which call for a relatively high degree of cognitive processing. Among the latter, the working memory (Henceforth, WM) is considered to be responsible for processing, as well as storage of information. It is advocated that it allows the linkage between novel data and prior knowledge so as to achieve comprehension. Therefore, it becomes intriguing to inspect whether working memory capacity (Henceforth, WMC) and RC are significantly related.

1. Statement of the problem

It is evident that the field of Foreign Language Teaching (Henceforth, FLA) is an amalgam of disciplines, comprising requirements deriving from in-depth, consistent research, and which validity of findings is often stalled by differences in context and setting. Nonetheless, it is, also, evident that the five language skills are reckoned a cornerstone for EFL learners; They are a chief criterion, essential for the continuance of their language-learning journey. Conjointly, reading is considered of paramount importance. The accessibility of information and knowledge granted by the reading skill cannot be neglected. Arguably, reading counts for most of the comprehensible input needed for the development of EFL learners for it permits the extension of knowledge .

From a narrowed lens, the expectations and demands regarding EFL learners' reading skill proficiency exceed the sheer limits of the ability to read fluently. EFL learners are rather expected to develop their RC. Simply put, RC encompasses the ability to exploit the concealed twists of texts, to infer abstract meaning, to deduce and draw logical conclusions and relations. In this regard, EFL learners exploit various assets in order to successfully answer the reading comprehension section. Accordingly, a deficit in any of the means triggers difficulties in RC. The latter, then, are a matter of concern for EFL learners, as they obstruct the development of their language proficiency. In this respect, the difficulties encountered by EFL learners in RC vary,and

it is difficult to account for all of them in a single research work. Based on the researcher's observation, experience, and their review of literature, the cognitive processes responsible for RC are understudied at the Department of English Language and Literature in Biskra University. Furthermore, the role of WM in RC has not been yet inspected. The selection of WM was not arbitrary; we have observed that EFL students still display noticeable difficulties in RC regardless of the adopted diction in the text, the complexity of the material, or even the time allocated for reading. Adjacent to the latter, some of the researchers' peers complained about issues in the processing and retention of information. It is important to note that although abundant research has been conducted on reading comprehension difficulties in our department, research on, generally, cognitive processes and, specifically, on WM is scarce.

Therefore, the present study aims at investigating a correlation between WMC and RC. We hope to adopt a Mixed-methods approach so as a collection of teachers' perceptions of students' reading comprehension difficulties, and a quantification of the students' WMC crossed with their RC is permissible. Our findings can be considered as a ground-basis upon which further investigations using more sophisticated measures and thorough calculations can be achieved. Further, we seek to highlight the impact of the cognitive abilities of EFL learners on their academic accomplishment (though in our case it is restricted to RC). Lastly, we aim to promote the consideration of WMC in the teaching of the Reading subject.

2. Research Questions

This research seeks to answer the following research questions:

RQ1: How aware are teachers of Reading regarding the role of cognitive factors in shaping reading comprehension?

RQ2: To what extent do students encounter problems in reading comprehension sections which are more cognitively taxing?

RQ3: Is there any significant relationship between the verbal working memory capacity and L2 reading comprehension?

3. Research Hypotheses

Based on the proposed research questions for this study, we suggest the following research hypotheses:

RH1: We hypothesize that teachers have limited awareness on the role of cognitive abilities in L2 reading comprehension.

RH2: We hypothesize that undergraduate EFL learners at Biskra University experience more difficulties in questions which require further cognitive effort.

Concerning the third research question, we assume the null hypothesis

H$_0$: We hypothesize that there is no significant relationship between Undergraduate EFL learners' verbal working memory capacity and reading comprehension.

4. Aims of the study

The general aim of this study is to investigate a possible association between verbal working memory capacity and reading comprehension of undergraduate students at Biskra University.

More precisely, this work also aims to:

- raise the awareness of teachers on the role of cognitive abilities in reading comprehension;

- shed light on the notion of working memory and its possible influence on reading comprehension;

- determine the relationship of undergraduate students at Biskra University between verbal working memory capacity and reading comprehension; and

- identify the patches where students encounter most difficulty in reading comprehension.

5. The Research Methodology for this Study

Supporting the current research nature and purposes, the researcher considered positiniong the present work under a Mixed-methods approach. The pragmatic nature of the said approach allows the quantification of results and the exploration of teachers' perceptions of the role of working memory in reading comprehension. While tests emerge quantitative data, teachers' perceptions were treated through interviews. Both of latter can only be combined in a mixed-approach based research.

Given the correlational nature of the study, it becomes inappropriate to associate the current study with an experimental design. Conversely, the qualitative and quantitative data were

collected simultaneously, with no specific conditions in integration or time sequence. Accordingly, the convergent parallel design paves fittingly the course of the present study. As stated by Cohen et al., (2018),

> Their convergent parallel design has both quantitative and qualitative data which are collected independently and in parallel with each other, and then they converge, yielding triangulation of data and offering complementary data on the question, problem, issue or topic in question. Quantitative and qualitative data are collected and analysed separately and then put together, for example they may be compared and contrasted, looking for similarity, difference and complementarity. The overall, combined or integrated results are reported (p.39)

Thus, the selection of this research design was not arbitrary; it flows evenly with the main purpose of the study

Regarding the data collection instruments used to gather the relevant data, the correlation was measured through two independent, different tests. Reading comprehension was assessed using NDRT Form E, which is considered as a standardized reading comprehension test that is suitable for the students' level. The latter was confirmed through a previously held TOEFL-like reading proficiency test that permitted the assignment of the proper passages in the NDRT Form E. Concerning the verbal working memory, the RST was selected as a proper measure for two reasons. First, it targets both the processing and the storage faculties of the working memory as determined by Daneman and Carpenter (1980). Second, the RST revolves around only the linguistic knowledge of participants in contrast to certain other measures as the Operational Span Task, which incorporates mathematical equations.

On the data analysis terms, the presence of, first, the two different kinds of data and, second, multiple data collection instruments entailed the devotion of varying data analysis procedures. The qualitative facet of the gathered data was described thematically using MAXQDA 2022 as a transcription and coding platform. The quantitative data, however, employed more than a single data analysis method. The structured questionnaires' analysis was limited to the measures of frequencies (mainly percentages) as those were sufficient enough for the research aims. In order to measure and display the correlation, the Spearman statistical test of correlation was conducted as it fits the criteria of this study.

6. Population and Sampling

The current study's population is the undergraduate students of English at Biskra University. Though it primarily it was intended to target only second year students of the same major, the encountered incapability of reaching a satisfactory number of participants (n=30) imposed, to an extent, the addition of students of the first year level. It is worth mentioning that the two chosen levels are to a great extent compatible regarding the set criteria for selection. The latter could be summarized in the academic enrollment in Reading class as well as a close age range. Then, the 30 students were conveniently chosen. Additionally, four teachers of Reading, two actual teachers and two ex-teachers, were approached as a source of qualitative data.

7. Significance of the study

The present study aids in gaining further knowledge on the association of working memory and reading comprehension. Besides, it may help in raising the teachers' awareness on the cognitive processes and abilities, precisely the working memory, and their relation to reading comprehension. By doing so, it might induce the instructors into developing their literacy on the

matter. The absence of similar research at the level of the Department of English Language and Literature at Biskra University reflects a neglect vis-à-vis the said concepts. In addition, given the scarcity of similar research in our department, the current work could possibly be deemed as a starting point and inspiration for further investigations. The latter can be conducted either on the same variables, or it is possible to extend the research's scope so as to generate more in-depth results possibly through dissociating reading comprehension into smaller variables as to realize the exact point of correlation, if any.

8.   The Referencing Style for this Dissertation

The referencing style applied throughout the entirety of this work is the APA (American Psychological Association) 7th edition. The choice was not arbitrary; The APA referencing style is deemed the most appropriate for educational research. However, as a result to discussions with the supervisor of this work, an exception regarding the "justify" function was proposed. While the APA 7th disregards the use of the "justify" option, the supervisor and the researcher viewed that it would be more fit for the lines to be equally aligned.

9.   Delimitations of the study

The feasibility and progress of arguably any research work depends heavily on clear delimitations of the study's scope. Hence:

- The researcher could only target undergraduate students of second and first year given the allocated time for the completion of the current work. A large sample may eventually prove problematic because of short time. Besides, owing to their Reading subject, undergraduate students seem to be the proper fit.

- The correlation of working memory and reading comprehension were not studied in-depth

as the latter requires sophisticated measures (EEG, MRIs, etc...) able to indicate precisely which parts of the brain are activated during reading comprehension. The researchers look only for a potential relationship through statistical analysis.

10. Structure of the dissertation

The following outline describes the structure to which the dissertation adheres:

Chapter One directs the spotlight on exclusively the working memory. It discusses working memory, its components, and the different proposed models, which will be discussed somehow thoroughly. Besides, it sheds light on the working memory capacity as it is the aspect of working memory to be measured. Lastly, it presents an account on the relation between working memory and learning

Chapter Two of this dissertation offers a comprehensive examination of the reading skill, delving into its nuanced definitions, diverse typologies, theoretical models, and overarching objectives. It specifically focuses on elucidating the distinction between reading and reading comprehension, while also exploring the intricacies of reading comprehension components, and cognitive mechanisms involved

Chapter Three aims to elucidate the methodological aspects that underpin the current inquiry, providing a comprehensive portrayal of the research design and procedures employed. It outlines the approach taken for implementing the treatment and elucidates the methodologies utilized for data collection**.**

Chapter Four endeavors to present, describe, and categorize the extensive corpus of collected data, while simultaneously conducting an in-depth analysis and interpretation of both quantitative and qualitative findings. Besides, it aims to draw meaningful inferences, derive

insightful conclusions, and contribute to the overall understanding of the research topic. It presents

the implications and the recommendations deduced from the results.

Chapter one: Working Memory

Introduction

The present chapter provides a holistic view on the working memory (henceforth, WM), working memory capacity (henceforth, WMC), and its relationship to learning. The chapter first adopts a retrospective view through displaying the emergence of the notion of WM, and discussing the most prominent suggested models, revealing their strengths, as well as their shortcomings. Given the long debate on the different between short-term memory (henceforth, STM), and WM, and their overlapping history, it comes in convenient to present the different views on the matter.

1.1 **Historical background of the working memory**

Tracing back the emergence of the concept of WM to its point of origin may prove delicate. Although presently the notion of WM holds a wide consensus of mental faculty supervising processing and temporary storage (Baddeley, 2000), a glimpse into its origins would reveal multiple definition associated with the said term. The latter is due to the term being adopted in different fields of research with distinct background and needs, which evoked numerous meanings attributed to it (Shah & Miyake, 1999; Baddeley 2010). In this sense, Honig's model of WM (1978) could be perceived as a landmark in the development of the WM namely after its adoption by Olton in the following year (Becker & Morris, 1999; Baddeley, 2010). Honig's model was developed depending on data extracted from his experiments on pigeons. Accordingly, he advocated for two main components: the Spatial Working Memory, and the Reference Memory.

Aligning with his studies on pigeons, both of the concepts were mainly connected to the animals' ability in remembering locations and space (thus the name Spatial Working Memory). To clarify, the Working Memory, according to Honig, served as a one-way ticket for the animal: a piece of information that is only valid for one trial, which is to be forgotten in order to avoid interference (Becker & Morris, 1999). On the other hand, the Reference Memory allows for a

storage of all of the needed spatial information (Becker & Morris, 1999). As aforementioned, this was eventually adopted by Olton (1979), and constituted the basis of his Olton Maze.

The discussion of Honig's model lights a distinct path for tracking the emergence of WM: The existence of multiple advocated models attempting both to unveil the nature of WM and to suggest a practical, definite framework for it. Accordingly, in order to understand the actual status of WM and its development, it may be practical to scrutinize, at least partially, those models, which slowly sculpted its present definition.

1.1.1 **The Modal Model**

In 1968, Atkinson and Shiffrin proposed a theoretical framework attempting to explain the flow of information from the environment, the exterior input, to the memory. Their model adopted senses as a starting point, and shed its main focus on the transfer of information from one faculty to another, as they explained,

> The flow of information among the three systems is to a large degree under the control of the subject. Note that by information flow and transfer between stores we refer to the same process: the copying of selected information from one store into the next (1968, p.94).

The influence of Atkinson and Shiffrin's model was paramount, shaping it as, perhaps, the most important milestone in WM models' development. In fact, it would be later on known as the Modal model as most following models would revolve around it. Baddeley, in his interview with the GoCognitive, confirms the impact of the Modal Model (1968) on the WM research, " ... most influential of those which was a model by Atkinson and Shiffrin, which became known as the Modal Model because it was kind of in the middle and like all the others approximated to" (personal communication, November 3rd, 2010)

It should be emphasised that the Modal model (1968) was not entirely dedicated for explaining the WM. It was an attempt to offer a holistic framework on the faculty of memory. In this respect, the Modal model is composed of three storage systems, each of which features their own system of encoding, the maximum capacity of possible items withheld at a time, and the duration up to which items are maintained (Atkinson & Shiffrin, 1968; Shah & Miyake, 1999). Depending on those systems and their features, Atkinson and Shiffrin argued a linear sequencing of information flow, as the incoming data travels from one storage entity to another in order a clear, systematic order.

1.1.1.1 Sensory register. As its name suggests, the sensory register is exclusively dependent on senses. From Atkinson and Shiffrin's (1968) perspective, external input is only captured through the human senses. Therefore, aligning with the basic premise of this framework, information should be maintained as to be transferred to the next system (Alsaeed, 2017). The fact that humans possess five senses, all equally capable of transferring information, poses a number of questions regarding whether sensory register, or sensory memory, is somehow altered in accordance with which of the five senses was used or not (Atkinson & Shiffrin, 1968).

In spite of their equity in catching information, the difference lies in the duration of maintaining that information (Foster, 2008). For instance, iconic memory, which stems from the sense of sight, is only able to hold information for a maximum of three seconds while echoic memory, that of hearing, can extend until 10 seconds of information maintenance. The latter is what allows humans to delay answering questions for few seconds. Haptic memory, at last, may be the shortest of them all, with only two seconds of maximum duration. Given that the environment is continually analysed through senses, selective attention allows to direct and focus

on the needed information (Miyake & Shah, 1999). Concurrently, a loss of attention or a distraction may ultimately result in the loss of information.

1.1.1.2 Short term memory. The Modal model's (1968) defending a division in STM and long-term memory (henceforth, LTM) paved the way for a debate on the unitary or non-unitary nature of memory. The STM, in Atkinson and Shiffrin's view, acts as a mediator to the last system. To clarify, after receiving information from the Sensory Memory, STM maintained the information for long enough to be possibly permanently stored in the LTM. In this part specifically, the influence of the Modal model could possibly be best perceived. First, Atkinson and Shiffrin (1968) labeled the STM as WM, "The second basic component of our system is the short-term store. This store may be regarded as the subject's 'working memory.' "(p.92). It could be inferred that the term WM, at this point, was merely synonymous to the STM; Essentially, STM functioned as a processing room as well as a temporary storage faculty (Baddeley, 1992). Although for a different purpose, the association of the term WM to STM launched further research investigating the two mental faculties with an aim to draw a clear line between the two.

Second, the claimed division between STM and LTM ran against the usual memory clockwork back then. Put simply, up to the introduction of the Modal model, there was a large, yet hypothetical, agreement that the memory was a single unit, clear of any divisions. Hence, a division in the core memory systems shed considerable light on the Modal model. It should be understood that a partition of STM and LTM indirectly calls for a revision of all of the adopted knowledge and frameworks aligning with view of memory as a single mental block.

Third, Atkinson and Shiffrin (1968) introduced through their memory model 'the control processes'. Simply, the control processes are a set of actions conducted by the individual in order

to manipulate the information s/he has in mind (Walczyk, 2000). One may use a memory palace

to permit the retention of a long list of items, for example. Similarly, the STM, in the Modal model,

makes-use of the control process of rehearsal. The basic premise was through repeating

information, it becomes possible to maintain the information for longer, which guarantees a higher

chance of transfer into the LTM (Baddeley, 2010). Even further, a greater rehearsal was set to

promise a better learning (Baddeley, 2010). The same premise for which it will later on be

criticized. Additionally, the control processes in the said model are only restricted to memorization

strategies and techniques (Shah and Miyake, 1999).

Figure 1

Sketch of the Modal Model
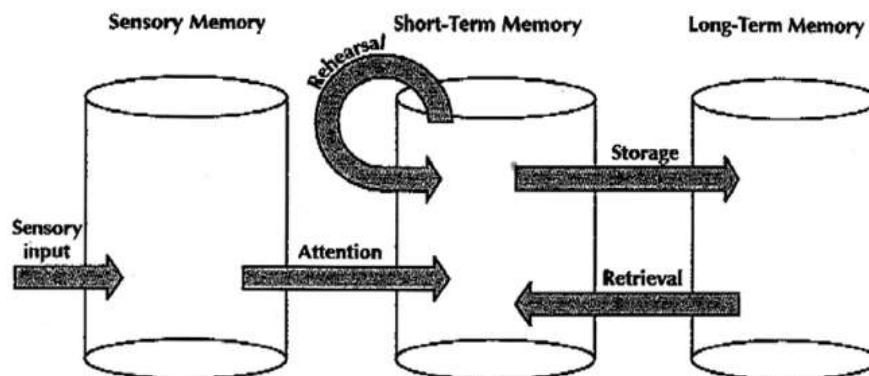
Note. From Alsaeed,N,H. (2017), p.522

1.1.1.3 Long Term Memory. The LTM could be seen as the least controversial bit of

the Modal model as it was felt in the academic settings that memory does factually contain a

permanent storage. LTM is the last component of the three stores component, and it is different

from its counterpart, the STM, in its ability to retain information without being susceptible to

decay. It should be noted that despite its unlimited capacity and undefined duration, sometimes

information might still be irretrievable as upcoming data may cause a disruption (Miyake &

Shah, 1999).

Atkinson and Shiffrin's (1968) work had an irrefutable influence on the future research of

WM. However, it came short as researchers begun to question the linear transfer advocated by the

model, especially with neuropsychological data stating otherwise. On one hand, the said

neuropsychological evidence defended the dichotomous structure of memory claimed by Atkinson

and Shiffrin (Baddeley, 1992). On the other hand, the same studies highlighted a critical flaw in

the model. The criticism stemmed from an examination of two patients. The first patient, H.M,

studied by Brenda Milner (1938) had a normal STM, or as she called it immediate memory, but a

disrupted LTM.

Patient H.M did not pinpoint any shortcomings as he, following the model, could only

maintain information for a short period. More importantly was the second subject who was studied

by Shallice and Warrington (1970). He displayed an opposite case: a disrupted STM but a normal

LTM. In theory, the second patient should not be able to retain information as the latter is only

transferred to the LTM if the STM is fully functional, which was not the case. The second patient

could perfectly use his LTM, but struggled only with his STM capacity, reflecting a non-linear

nature of memory. Furthermore, as STM was considered as also a working faculty supervising the

processes needed for the completion of a given task, Shallice and Warrington's patient should have

exhibited clear deficits in cognitive processes as reasoning and problem solving (Baddeley &

Hitch, 1974).

Upon proven somehow unpractical, further attempts were conducted in proposing a

comprehensive framework of, generally, memory and, specifically, WM. Though the notion of

WM was present in the Modal model, it was used as another term for STM; Atkinson and Shiffrin

believed that STM was equally responsible for processing, which was later on proved incorrect by the aforementioned neuropsychological studies. Consequently, models targeting primarily the WM arose as the notion gained more population in the 1970s.

1.1.2 Baddeley and Hitch's Model (1978)

In contrast to the first discussed model, the Modal model (1968), Baddeley and Hitch's work (1978) was devoted directly to the WM. They proposed a framework explaining the constituting parts of the WM with a thorough account of each of those components. Baddeley and Hitch shadowed the non-unitary view of Atkinson and Shiffrin, but argued a separation between WM and STM. They stated, in this respect, "The most devastating evidence against the hypothesis that STM serves as a crucially important working memory comes from the neuropsychological work of Shallice and Warrington" (1974, p.48). As an initial step, Baddeley and Hitch (1974) employed what will later on be known as the dual task method. Their subjects of study had to complete cognitive processes as comprehension or reasoning while remembering strings of numbers (Baddeley, 1992). The results reflected a positive correlation: the more strings are to be remembered, the more time is spent in accomplishing the given task.

In addition to confirming the function of the WM, that is processing and storage, the data revealed an almost straight line for the percentage of errors. As Baddeley expressed in his interview with the Annual Review of Psychology in 2013, "Even more striking is the error rate ... clearly the system we were filling up was involved in the working memory but it was by no means the whole story". Accordingly, Baddeley and Hitch proposed their Multi-components Model as a reaction to, first, the Modal model and, second, to the findings of their experiment, as they noted that WM is made-up of more than just a singularity of representations (Baddeley, 1986; Cowan, 2008).

The multi-components model (1974) was initially comprised of three main components. Pezzulo (2007) provided a clear definition on the matter , "Here working memory is not described as a unitary system, but as multicomponent: it includes a central component, the central executive, and three sub-systems: the phonological loop, and visuospatial sketch pad, and the episodic buffer." (p.1).

Figure 2

The Multi-components Model of Baddeley and Hitch
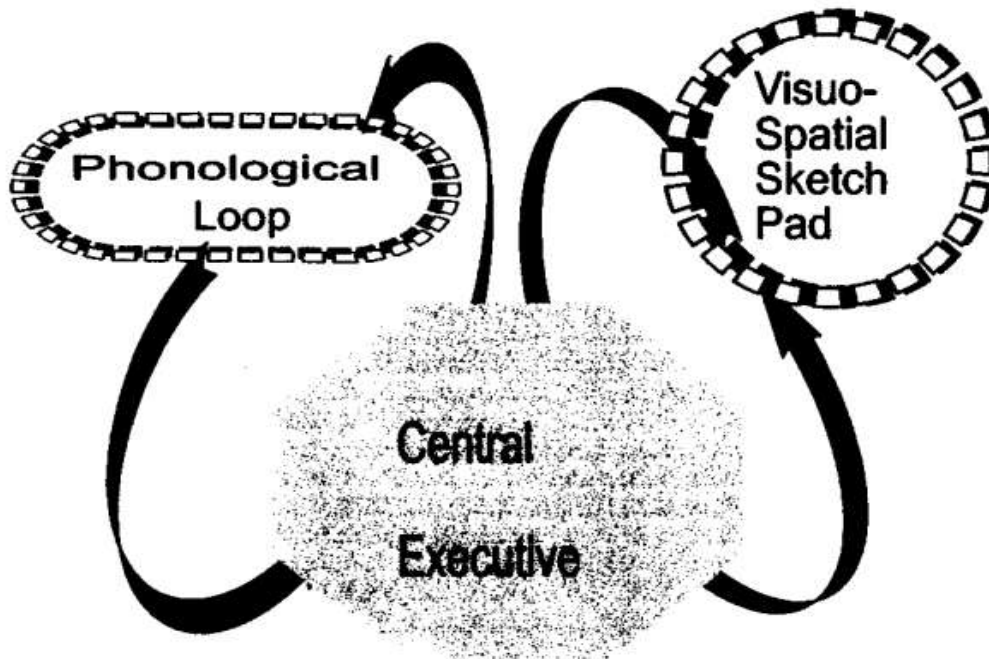
Note. From Miyake, A., & Shah, P. (Eds.). (1999)

1.1.2.1 The Central Executive. The Multi-component model (1974) revolved around a main component: the central executive (henceforth, CE). The CE functions as a supervisory system involved in certain executive functions as attention switching and memory manipulation while ensuring coordination between the two slave sub-systems (the phonological loop and the visuospatial sketchpad). The CE promises the control and regulation of the system of WM, yet

the exact functions of the CE have been the reasons of a long journey of scrutiny. The image of

CE as sketched by Baddeley and Hitch in 1974 did not remain static; Revisions were repeatedly

put forward as an attempt to provide a comprehensive account for the functions of the CE

(Baddeley & Hitch, 2001).

In fact, the questioning of the CE preceded any empirical evidence as the issue laid with

the definition itself. CE, in its initial state, was largely described as a "homunculus", analogically

referring to its undefined nature (Baddeley, 1996). The comparison was only reinforced as

Baddeley (1986) (as cited in Baddeley & Logie, 1999) acknowledged the incomplete explanation

given to the CE in his model (Baddeley & Hitch, 2001). The question, then, was to frame clearly

the functions of the CE. Regarding this issue, Baddeley noted that an eventual let down of a

supplementary storage capacity for the CE was mandatory for the progress of research on the

matter (Miyake & Shah, 1999).

1.1.2.2 The Visuospatial Sketchpad. Following their suggested division of the WM, the

visuospatial sketchpad (henceforth VSSP) refers to one of the two slave systems seen responsible

for the accomplishment of various cognitive tasks as planning and perception. Accordingly, the

VSSP is in charge of holding and manipulating information that has a visual or spatial

component, such as images, shapes, and locations. In this sense, the VSSP has also been

connected to spatial engineering and movement (Baddeley, 1992). In effect, the VSSP holds a

pivotal role in daily lives as remembering recent visual, possibly dynamic images is crucial for

the accomplishment of plain activities. Initially, the VSSP constituted a single entity, but it was

eventually rendered twofold (Logie, 1995).

For a clearer understanding of the division, it, first, should be noted that the act of rehearsal as means of temporary maintaining of information was openly emphasized in the Multi-components Model (Baddeley & Hitch, 1974; Baddeley, 1992; Baddeley & Logie, 1999). The fraction of the VSSP draws a line between a passive retention faculty labeled as the visual cache, which is accountable for image generation and visual patterns, and an inner scribe thought to process sequences of movements and spatial engineering (Baddeley & Logie, 1999). Similar to Atkinson and Shiffrin's case, dividing a previously-perceived singular entity to multiple fragments would in-turn raise the question of capacity distribution. Put simpler, dividing the VSSP into two sub-systems calls for an empirical justification on the proportions of retaining and processing capacities, which has not been covered. It should be mentioned, however, that less importance was attributed to the active rehearsal in comparison to the initial activation (the visual / spatial coding), for its importance varies with the situation wherein communication happens.

1.1.2.3 The Phonological Loop. The second domain-specific slave system advanced by Baddeley and Hitch (1974) is the Phonological Loop. As external input could also come in form of speech, Baddeley and Hitch's model (1974) designates a specific mental faculty for the decoding and processing of speech-coded information, as they state

> We, therefore, appear to have at least tentative evidence for the existence of a phonemic buffer, together with techniques such as articulatory suppression and the manipulation of word length which hopefully will provide tools for investigating this component in greater depth. (p.79)

With a closer examination, it can be noticed that a change in names occurred as the phonological loop was originally called the phonemic buffer, yet the functions remained the same

(Andrade, 2001). The shift of labeling from phonemic buffer (Baddeley & Hitch, 1974), throughout articulatory loop (Baddeley, 1986) and to, finally, phonological loop (Baddeley, 1990) was justified by Baddeley as a an attempt of displaying the similar importance of the processing and storage functions of the Phonological Loop. Additionally, the above-mentioned quote shows clearly a superficial understanding of the phonological loop as Baddeley and Hitch (1974) label it as "tentative" while inviting further research to be conducted on the matter.

Similar to the VSSP, the phonological loop was fractioned into a dichotomy flowing in the same logical division, as it comprises of a temporary store and a rehearsal mechanism. The phonological store, as its name evokes, refers to a passive faculty designed for maintaining verbal information whereas the active rehearsal denotes the act of repeating the verbal code as means of extending the temporary maintenance (Baddeley & Hitch, 1999; Baddeley, 1992). Further clarification on the active rehearsal was provided as overt and covert vocalisation are thought to be of equal effect in maintaining the memory traces. The importance of both systems shadows, to an extent, that of the VSSP; the active rehearsal may not always be obligatory as it only serves to preserve the information from fading away (Baddeley & Hitch, 1999; Baddeley & Hitch, 2019).

Given the aims and methodology of our study, it becomes paramount to highlight distinctively the phonological loop's ability to transform the nonverbal stimuli as written language and describable pictures to phonological code (Baddeley, 1992). This is particularly important in our context as the verbal capacity will be measured throughout nonverbal stimuli. Additional confirmation was provided by Baddeley and Hitch (2019) as they emphasised the phonological stores' capacity in decoding visual data through conversion,

One basic question concerning the loop is the nature of its storage code. Conrad (1964) referred to it as an acoustic store, although this could presumably not be literally the case

since it can be fed either auditorily or visually, through the covert naming of letters or words (p.9).

Aligning with the criticisms advanced towards the model, Baddeley (2000) clearly admits shortcomings of the Multi-component Model, "however, a number of phenomena that are not readily captured by the original model" (p.1). While it stressed the connection between WM and LTM, the initial model of 1974 did not consider the mechanism implicated in the said operation. The WM relies on LTM in its activation of previously stored knowledge, as the latter is mandatory for the decoding of newly received information. Concurrently, the LTM is dependent on the WM for the encoding of novel data (Baddeley & Hitch, 1999). Thus, it could be inferred that an interconnection wherein information is continuously flowing between the two mental faculties is essential for the accomplishment of various tasks as comprehension and planning.

1.1.2.4. The Episodic Buffer. Consequently, a fourth component was supplemented to the multi-component model as explanation for the aforementioned critique. The episodic buffer refers to a limited temporary storage mediating information between the WM and the LTM (Baddeley, 2000), and offers a platform for manipulation of information (Baddeley, 2000; Baddeley et al., 2010). As a platform, the episodic buffer ensures interaction between the CE and the two slave systems (the VSSP and the phonological loop). This flow of information could be perceived as a cornerstone for comprehension. To clarify, if each subsystem was unable to, first, communicate its codes to other components of WM and to, second, refer to the schema of LTM, comprehension may prove difficult, as information would float in a vacuum. The notion of binding between subcomponents of WM called for the needed mechanism.

Accordingly, it could be noticed that all components of the Multi-components model are chained to maintaining a certain number of items at a time. Both of the central system (the CE) and the slaves systems (the VSSP and the Phonological Loop) in addition to the Episodic Buffer are not endowed with an infinite retention and processing capacity. Therefore, attempts in clearly defining the capacity of the WM and the various factors possibly influencing the latter were pursued.

1.1   Working Memory Capacity

The definition of WM as a storage faculty and processing unit, obeying to the Multi-Components Model (1978), postulates the view on a limited capacity for WM. As previously discussed, the fragments composing the WM (That is, the CE, the VSSP, the Phonological Loop, and the Episodic Buffer) are all capacity limited (Baddeley, 2000). Accordingly, research attempting to reach a final answer to the question of working memory capacity (henceforth, WMC), as Cowan (2005) confirms, "Many studies indicate that working memory capacity varies among people, predicts individual differences in intellectual ability, and changes across the life span" (as cited in Cowan, 2010, p.1).

However, the answer to the said question proved difficult (Cowan, 2010). As WM is a complex mental system, a number of other mechanisms are able to affect, whether positively or negatively, its items-size (Cowan, 2010). In this regard, individual differences in intellectual abilities, age, and the adopted measures of WMC have been labeled as determining factors in the results of relevant research (Cowan, 2005; Cowan, 2010; Oberaur et al., 2016). For instance, children are known to continually develop their cognitive abilities and processes as they grow up. In this case, a child of six years old would demonstrate a smaller WMC than their counterpart of 12 years old (Oberauer et al., 2016).

Another perspective on the factors limiting the WMC suggested a threefold categorisation. Oberaur et al., (2016) hypothesised that decay, the demand for cognitive resources, and the interference of other information are the reasons resulting in a limited WMC.

1.2.1   Decay

Originally, the notion of information decay has already been discussed in earlier works (eg., Baddeley et al., 1975). Similarly, rehearsal, specifically subvocal rehearsal, was perceived to be a counter measure for the rapid decay of information (Oberaur et al., 2016). Although the process of rehearsal proved effective, the fact that it works in a sequential manner, meaning one memory trace at a time, results in the decay of the information located at the end of the trail (Ma et al., 2014; Oberaurer et al., 2016). Termed differently, a piece of information may decay before arriving to be rehearsed and thus maintained. In this classification, Oberauer et al., (2016) associate this phenomenon with central attention, referring to the ability to focus on one process at a time (Pashler, 1994).

1.2.2   Resource

The capacity limit of cognitive function or process is determined by the amount of a limited resource allocated to it (Ma et al., 2014). This resource can be used for a variety of cognitive functions and processes and can be divided among multiple recipients simultaneously. However, prioritising one function or process may mean that others that require the same resource will be sacrificed. (Ma et al., 2014)

1.2.3   Interference

According to interference-based explanations of working memory capacity, the reason we can only maintain a certain number of representations at the same time is due to mutual interference

among these representations. In other words, having too many representations active simultaneously can lead to a decline in our ability to retain them accurately and effectively. (Oberauer et al., 2016). Furthermore, they present three possible manifestations of interference.

1.2.3.1 Confusion. The interference due to confusion can be explained by a retrieval process called competitive queuing (Oberauer et al., 2016). This process involves a competition between various candidates that are activated during retrieval from working memory. The more frequently a representation is activated, the higher its chances of being chosen for retrieval. According to some models, activation is continuously maintained during the retention interval (Page & Norris, 1998) while others suggest that representations are reactivated during retrieval through contextual cues (Burgess & Hitch, 2006).

1.2.3.2 Superposition. Another type of interference occurs when multiple distributed representations are combined or overlaid on top of each other. These representations can be in the form of activation patterns across a group of units in a neural network or in the form of patterns of connection weights between units, which may cause distortion when a large number of patterns is stored (Oberauer et al., 2016).

1.2.3.3 Feature overwriting. Similar to superposition, feature overwriting concerns the storage of multiple patterns, or information, which in turn may affect each other (Oberauer & Kliegal, 2006). However, the cases of feature overwriting refer to overwriting a common feature between two items in one of them. (Oberauer et al., 2016) Simply, if two sets of digits are stored, and they both share few numbers in common, the second set, for instance, will be provided with additional shared numbers at the expense of the first set.

The limitation of WMC is thought to have both a positive and a negative interpretation. One facet of the coin perceive a large WMC to be taxing for the brain, as an excessive number of activated neuro firings may result in confusion or interference as well as a constant decay in some information (Cowan, 2010). Besides, neuroimaging studies (e.g: Jonides et al., 2008; Klinberg, 2009). Flipping the coin, the other facet sees a limited WMC as a valuable asset. While the former view claims a shortcoming of the human brain's ability in processing large sets of data, the present perspective advances mathematical simulations backing-up a WMC ranging from three to five items (Cowan, 2010).

1.3   Working Memory and Learning

Given its connection to LTM, WM has been continuously thought of as part of the learning process (Pickering, 2006; Cowan, 2013; Oberauer et al., 2016). Through the Episodic Buffer, WM mediates processed information to the LTM, which conforms to the basic premise of learning: storing information in LTM. Accordingly, the WM is a mandatory step in the process of learning. In this light, Cowan (2013) states, "... there are several ways in which working memory can ,influence learning. It is important to have sufficient working memory for concept formation. The control processes and mnemonic strategies used with working memory also are critical to learning" (p.14).

1.3.1   Working memory and concept formation.

Granted that learning could be perceived as the formation of new concepts, the function of WM as center of information binding suggests a possible relation between the two. Harold et al., (1998), in this respect, argued that although one may be endowed with enough capacity to remember concepts, a low WMC would obstacle efficient comprehension, as comprehension requires further processing involving decoding and integration of information from and to the

LTM. Cowan (2013) stressed this view as he claimed that a low WMC may hinder the completion of complex tasks.

1.3.2   Working memory and control processes

There seems to be a consensus among researchers that maintaining focus is a crucial factor in effective learning. Straying away from the intended objectives may lead to gaining knowledge, but not the intended knowledge. It has been observed that individuals who perform well in tasks that require the combination of storing and processing information in working memory are more likely to stay on track .

Although the research was conducted on adults, it has implications for children as well. According to Gathercole et al. (2006), difficulties with working memory are a significant factor in learning disabilities. Children who were accused of not following instructions were often found to have low working memory capacity. They either struggled to remember the instructions or lacked the necessary resources to remain focused on the task and pay continuous attention for the required duration. Children with various types of learning and language disabilities generally perform below grade level on working memory tasks, and those with low working memory and executive function tend to struggle in school. (Sabol & Pianta, 2012).

1.3.3   Working memory and mnemonic strategies

A strong working memory becomes crucial when acquiring new information, as logical connections have not yet been established, causing an increase in working memory load. Until the material can be logically structured, working memory is taxed, especially when there are insufficient associations between the elements (Cowan, 2013). It is widely believed that working memory is most closely linked to fluid intelligence, which is the ability to find solutions to novel

problems (Wilhelm and Engle, 2005). The most common mnemonic technique is likely to be chunking, which involves creating new associations or recognising existing ones to reduce the number of individual items to be remembered in working memory. This approach does not increase the basic capacity of working memory, but instead fills each working memory slot with a complex chunk. Individuals who use this technique are still limited to a base level of approximately seven items when dealing with unpracticed lists, such as letters. This is supported by evidence from studies conducted by Ericsson et al. (2004) and Wilding (2001) which replicate this finding.

Conclusion

The present chapter reviewed the evolution of the concept of WM throughout the years as it was slowly shaped as a crucial step in the process of learning. Specifically, the two main influential models, The Modal model and the Multi-components model, were discussed with a provision of both their strengths and shortcomings. Departing from the latter, the limited capacity of WM and its implications on learning were shed light upon as they constitute the core of the understanding of the role of WM in learning. Proceeding this overview, the following chapter will tackle the second of variable, reading comprehension, in aim of providing comprehensive account on it.

Chapter Two: Reading Comprehension

Introduction

As a completion of the previous chapter, the following literature review tackles the concept of Reading Comprehension from different angles, attempting to provide a holistic yet comprehensive account. Though starting with mere definitions of reading, the chapter attempt to present different views on reading comprehension as its importance on the language teaching and learning processes, its different components, and mainly its relation to cognition and memory given the latter's direct link to our work. However, it seems fitter, first, to define the aspect of reading independently, for reading comprehension could be perceived as merely a byproduct of the reading process.

2.1 The Reading Skill

It is safe to claim that reading, as a linguistic skill, has been established of paramount importance for the development of EFL learners' language proficiency (Mann, 1984). Actually, prominent linguists, such as Stephan Krashen, emphasised the importance of the reading skill in second language acquisition. More importantly, the views on the nature of the reading skill differed Different perspectives and definitions were advanced on the matter. As cited in Zeghichi (2020), Smith (1985) described the term reading as holding a "multiplicity of meanings". The variety, and possible inconsistency, in the definition of this linguistic skill stems from the adoption of different angles by researchers as well as the situation wherein the term is employed (Zeghichi, 2020).

Perhaps the most straightforward definition of reading sees it as the inference of meaning of a large set of words, which altogether constitutes paragraphs and texts (Grabe & Stoller, 2002). However, the concept of reading is thought to be composed of multiple layers that could not be efficiently accounted for in single-line definitions (Razi, 2011). Accordingly, more profound and thorough explanations of the reading process were proposed. In this sense, Baudoin et al's (1994),

as cited in Zeghichi (2020), description of reading can be defined as a complex activity that comprises both word recognition and comprehension. Word recognition involves the reader's ability to perceive the correspondence between written symbols and spoken language, while comprehension refers to the process of constructing meaning from words, sentences, and paragraphs. In essence, reading is a multifaceted process that involves the reader visually recognizing the language, and then using their brain to make sense of the text, including any associated ideas, memories, or knowledge.

Besides, Goodman (1971) contended that reading is not a simple word-for-word decoding process, but rather a cognitive process that involves linking prior knowledge to the actual text to infer meaning. Goodman asserted that reading is a dynamic and deliberate mental activity whereby the reader actively constructs meaning from the written words. In his view, reading is a psycholinguistic process that involves guessing and inferring, and the reader's pre-existing knowledge is critical to successful comprehension. Grellet (1981) shared Goodman's perspective, stating that reading is a continual process of making informed guesses, and the reader's background knowledge is often more crucial than the actual text.

According to Strang (1978), reading goes beyond merely identifying and pronouncing words correctly or understanding the meaning of individual words (as cited in Chouaf, 2019). Instead, it entails using one's cognitive faculties, emotions, and imagination to comprehend the hidden meaning encoded in the text. Put simply, reading is an active process that involves reconstructing the ideas of the author. To be a successful reader, one must possess the ability to visually perceive and decode the written words, as well as comprehend and respond to the information presented. It could be summed, then, that reading involves a large set of processes.

Given that those processes are not always used equally in all cases wherein reading is employed, multiple types of reading were suggested.

2.1.1   Types of reading

Given that reading involved multiple processes, and that it could be viewed from multiple angels, numerous types of readings were advocated by different scholars. In those terms, intensive reading, extensive reading, and scanning and skimming are three of the main core types of reading discussed in the literature.

2.1.1.1 Intensive reading. Harmer's (2001) posited that intensive reading adopts a more concentrated and less relaxed approach, typically employed for shorter texts, with the purpose of attaining specific learning objectives under the close guidance of a teacher. Within this mode of reading, the learner is expected to procure an in-depth comprehension of the text, while exercising critical discernment pertaining to its content, intent, arguments, and linguistic construction. Intensive reading is conventionally conducted at a reduced pace, yet necessitates an elevated level of comprehension, as it places emphasis on meticulous scrutiny and analysis. In accordance with the I.S.P National (2009), intensive reading can serve as a potent technique for augmenting learners' grasp of language attributes and refining their proficiency in reading strategies, alongside bolstering their aptitude for comprehension. (as cited in Zeghichi, 2020). Hence, the purpose of intensive reading resides in facilitating students' acquisition of a comprehensive understanding of the text, nurturing their reading proficiencies, and advancing their vocabulary and grammatical acumen (Renandya & Jacobs, 2002; as cited in Barjesteh et al., 2012)

2.1.1.2 Extensive reading. According to Harmer (2001), the practice of extensive reading entails a deliberate and methodical engagement with lengthy written materials, such as novels or books, which pique the learner's personal interest, with the overarching objective of

comprehension. Typically conducted outside the confines of formal instruction, this form of reading aims to cultivate the reader's self-assurance and pleasure derived from the act of reading. As asserted by I.S.P National (2009), during extensive reading endeavors, learners should manifest an intrinsic curiosity towards the text, directing their attention towards grasping its intended significance, rather than fixating on its linguistic features. Long and Richards (1971) offered an elucidation of extensive reading as a process characterized by students immersing themselves in copious amounts of compelling material, usually beyond the classroom setting, with a primary focus on extracting the essence or gist of the text while bypassing unfamiliar vocabulary. At the crux of the extensive approach to reading instruction lies the conviction that students' reading proficiency will witness marked improvement if they engage in copious self-selected texts that genuinely captivate their interest, all with the overarching aim of acquiring a broad understanding (Barjesteh et al., 2012).

2.1.1.3 Scanning and Skimming. Scanning is a reading technique characterized by rapid eye movements over a text to locate specific information, such as names, numbers, or keywords, in a quick and targeted manner. In contrast to skimming, which involves obtaining a general understanding of a passage, scanning requires the reader to have a clear objective in mind before initiating the reading process. It is important to note that attempting to comprehend every single word during scanning or skimming can be detrimental, as it may hinder the overall flow of ideas in the text.

2.2 Models of reading

Various reading models have been proposed by experts and educators to explain the nature of reading and describe the processes involved. The latter can be summarized in the Bottom-up model, the Top-down model, and the Interactive model. To understand these models, it is essential

to define the term "model." As per Davies (1995), a model of the reading process is "a formalized theory, usually depicted visually, that explains how readers comprehend (or fail to comprehend) text by processing information." (p.57, as cited in Chouaf 2019). In simple words, a model of reading is an attempt to visualize the mental and visual processes that occur in the reader's eyes and brain while comprehending the text.

2.2.1 Bottom-up model

The Bottom-up model positions itself under the behaviorist umbrella. The basic premise of this models is the combination of the units constituting the text in order to form meaning. In the bottom-up model, letters are combined into words, then words are assembled together into phrases, and finally phrases, as segments of sentences, are linked in order to from sentences. The bottom-top model could be perceived as having a certain hierarchy (Adams, 1982). However, some researchers have criticized this model for its lack of feedback between the different stages, preventing lower processing stages from interacting with higher ones to decode meanings. This makes it difficult to consider the influence of sentence context and prior knowledge of the text topic in promoting word recognition and comprehension (Smith, 2004)

2.2.2 Top-down reading model

While the bottom-up model rested on a behaviorist basis, the top-down reading model stemmed from cognitive psychology. As cited in Suraprajit (2019), Goodman (1971) sees top-down reading model as "a psycholinguistics guessing game". Termed simply, the top-down reading model considers reading as the generation of meaning through the incorporation of the passage's information with the reader's background knowledge. While comprehension, in the bottom-top model, starts at the level of the linguistic units of the reading material, the actual model views that the starting base of comprehension is the reader's mind (Suraprajit, 2019).

2.2.3 Interactive Reading Model

Admittedly, the bottom-up and the top-down reading processes posit certain weaknesses. In this regard, Rummelhart (1977) introduced the interactive reading model, which combines both of the above discussed models in response to their limitations. The interactive reading model attempts to provide a comprehensive and satisfactory explanation for the reading comprehension process. Departing from this basis, the interactive model defines reading comprehension as the integration of multiple ranging from the linguistic knowledge to the contextual awareness while placing less emphasis on decoding skills and more on comprehension issues that involve higher-level components. To become proficient readers, individuals need to balance both the initial and higher-level components to comprehend the written text.

2.3 Purposes of reading

Writers aim to entertain, convey a message, or make a lasting impression on their readers. Similarly, readers may have specific needs they want to fulfill when they engage in reading. In language classrooms, teachers may assign reading tasks with different purposes, depending on the activity, skill, language aspect, and situation. Harmer (1991, as cited in Chouaf, 2009) identified two broad categories of reading purposes: reading for usefulness and reading for interest.

2.3.1 Reading for leisure

Reading for pleasure, which is also known as reading for interest, involves reading with enthusiasm based on personal preference. This type of reading is not obligatory, whether it occurs during leisure time or in an educational setting. The reader's focus is on experiencing pleasure rather than seeking information, and this can be either intellectual or emotional in nature (Smith, 2014, as cited in Chouaf, 2009).

2.3.2   Reading for usefulness

One of the primary reasons students read is to acquire information. This objective has two main goals. According to Harmer (2001) the first goal is to gather information for its own sake. This means that a selected text is read to acquire knowledge that would help clarify confusion or answer a question. The second goal is to obtain information that can be used to complete a task. For instance, reading a manual thoroughly before operating a machine is essential.

2.4 Factors affecting reading

To put it simply, concepts ranging from the reader's cognitive processes and abilities, the reader's psyche and motivation, their linguistic repertoire and awareness, and even the complexity of the material itself are seen related to difficulties encountered in RC. As stated by Sadeghi (2007), "Generally speaking, two factors may influence RC: internal and external". This author explained that internal factors, or *reader variables*, refer to the cognitive abilities, the prior knowledge and even one's affective status. In this sense, cognitive abilities allow the integration of information and the evoking of prior knowledge, which is mandatory for comprehension, "background knowledge is crucial for reading comprehension" insisted Anderson and Freebody (1981, p.84).

2.4.1   Reader variables

Numerous studies have aimed to explore how a reader's emotional and psychological state can impact their ability to understand written material. Factors such as the reason for reading, proficiency in the language, level of interest in the text, background knowledge of the topic, motivation, and stress all play a role in determining how well one can perform when reading (Gilakjani & Sabouri, 2016). For example, when students are under examination pressure, their concentration and understanding are likely to be affected. Motivation is also significant, with self-motivated students showing more interest in reading material and being able to adapt more easily

to reading activities and instructions compared to learners who are extrinsically motivated. It is important to note that teachers should not expect anxious, uninterested, or demotivated learners to be fully engaged in reading tasks. In addition, medical problems, such as speech or hearing impairments, or difficulties with decoding/word recognition, can hinder participation in reading activities. Reading comprehension difficulties can also be associated with some medical problems such as dyslexia, which involves difficulty in recognising speech sounds and making sound-letter associations (Hollwell, 2013, as cited in Gilakjani & Sabouri, 2016).

2.4.2   Text variables

Although there is limited research indicating a clear correlation between text features and reading comprehension, it makes sense that knowledge of certain text-based characteristics, such as genre, syntax, and vocabulary, can contribute to a better understanding of the text to some extent (Gilakjani & Sabouri, 2016). For instance, if the reader's goal is to get a general idea of the material, they can skip unfamiliar words and try to infer their meaning from the context. Familiarity with various genres can also provide readers with guidance on how to approach the text and extract information more efficiently

2.5 Reading comprehension

The definition of reading comprehension is a subject of controversy, but all definitions agree on the importance of understanding written text. Reading comprehension involves extracting and constructing meaning through interaction between the reader, the text, and the purpose of reading. Active participation in the reading process, access to the text, a clear purpose, and a social context are necessary for achieving reading comprehension. Greenal and Swan (1986) defined reading comprehension as the ability to understand what is read accurately and efficiently and to discuss or summarize the text successfully. Thus, reading comprehension is the ultimate goal of

reading, involving active engagement with the text to create meaning and understanding by combining text-related ideas with prior knowledge.

2.5.1 Components of reading comprehension

Reading is a more complex process than commonly believed, leading scholars to propose theories that attempt to explain the visual and nervous system processes involved. Despite the lack of a comprehensive formula to represent reading comprehension, the Simple View of Reading (henceforth, SVR) is preferred by some scholars due to its simple and comprehensive nature. First proposed by Gough and Tunmer in 1986, the SVR posits that reading is composed of two equally important components: word recognition (decoding) and language comprehension. The SVR serves as a guide for teachers to assess students' progress and weaknesses in reading comprehension, and to provide appropriate instruction. It incorporates the five areas of reading instruction identified by the National Reading Panel (NRP, 2000): phonemic awareness, phonics, fluency, vocabulary, and comprehension.

The ability to recognize words is something that can be taught, and over time, it becomes more automatic and natural as the brain learns to identify and manipulate phonemes. With practice, students can develop a larger vocabulary of words they can read without thinking, and they can even learn to read words they have never seen before. Yet, the components required for language comprehension are not necessarily skills that can be taught, but rather, they are mental processes that can be difficult to develop. These include aspects like background knowledge, vocabulary, and literacy knowledge, which are specific to certain domains. Therefore, the more familiar a student is with the content and vocabulary, the easier it will be for them to comprehend language.

2.5.1.1 Word Recognition skills. According to Murray (2016), some scholars use the term word recognition to describe the ability of a reader to accurately and effortlessly identify written words in a short amount of time. Murray explains that word recognition can occur with just a quick glance and requires automaticity in reading isolated words. Termed differently, skilled readers developed enough automaticity to instantly recognize words. The latter is, in turn, acquired through the development of the subsequent sub-skills.

2.5.1.2 Phonological awareness. As McBride-Chang (1995) states, "The importance of phonological awareness in studies of reading development and impairment can hardly be overstated" (p.1). Phonological awareness is a crucial component of automatic word recognition. It is to break down units into smaller segments as phonemes and syllables. The twist of phonological awareness is in its function as a bridge between the text and its comprehension; failure in phonological awareness can severe the flow of information.

2.5.1.3 Decoding. Gough and Tunmer (1986) posited that decoding holds a degree of controversy regarding its role in reading comprehension. Evenly flowing with this debate, different researchers have different interpretations of the term "word decoding." Gough and Tunmer define the notion of word decoding as the ability to extract and understand words quickly and accurately. Others, however, equate it with 'sounding out'.

2.5.1.4 Sight word recognition. While decoding could be decisive in reading comprehension proficiency, readers who maintain an adequate level of this skill ,in fact, do not decode words letter-by-letter. Instead, they rely on words features in order to accomplish rapid decoding. By doing so, they are relying on the notion of sight word recognition (Aaron et al., 1999). Sight word recognition is a crucial element for successful automatic word recognition. It is the ability to recognize and understand words that appear frequently in a text but have

unconventional spelling patterns. Aaron et al., explain that it is a challenging task that requires students to memorize them.

2.5.3 Reading Comprehension and Memory

Through a close examination of the concept of reading comprehension, it seems logical to infer that the process of comprehension, as it incorporates a myriad of sub-processes, does correlate with the faculty of memory. The process of reading a large set of words continually while trying to achieve processing, comprehension, and retention calls for a need to display the link between the two.

2.5.4 Atkinson and Shiffrin

In 1968, Atkinson and Shiffrin proposed the Multistore model, also known as the Modal model, which divides human memory into separate systems, namely sensory memory (henceforth, SM), short-term memory (henceforth, STM), and long-term memory (henceforth, LTM). According to Malmberg et al. (2019), these three systems work together to form the basis of human memory While the Atkinson-Shiffrin model is considered to be oversimplified compared to other memory models, it is still widely accepted and serves as a basis for ongoing research.

2.5.4.1 Sensory memory. This is the initial stage of memory where our sense organs detect the environmental input, including what we see, hear, and feel. Sensory memory (SM) has a large capacity, but its duration is very short. Cherry (2020) notes that SM can be divided into three categories: iconic memory (for visual input), echoic memory (for auditory input), and haptic memory (for tactile input), yet it should be noted that they vary in terms of duration and maximum capacity. Attention allows only the material that a person chooses to focus on to pass to the short-term memory (STM), while other information is forgotten**.**

2.5.4.2 Short Term Memory. The second memory store is known as short-term memory, which is responsible for handling the current concepts that individuals are processing. Similar to SM, STM has limited capacity and duration. According to Cherry (2020), if individuals want to remember more items for a longer time, they need to rehearse. Atkinson and Shiffrin (1986) regard rehearsal as the mental process that helps in maintaining information in STM. After a certain period, and through selective attention, some information will be automatically transferred from STM to LTM, but rehearsal plays a crucial role in maintaining and transferring information from STM to LTM.

2.5.4.3. Long Term Memory According to the Atkinson Shiffrin model, the long-term memory is the final memory store. It is characterised by relatively permanent storage and long duration, allowing individuals to remember things from a long time ago, and even for a lifetime. Unlike sensory memory, LTM is not concerned with sensations, but with the creation of meaning. The model suggests that STM and LTM are related through the process of "coding," which involves transferring and storing information in LTM, as well as "retrieval," which allows individuals to recall information from LTM back to STM. Unlike SM and STM, information stored in LTM does not decay or get lost, although it may sometimes be irretrievable. These features make LTM unique.

2.5.2   Role of working memory in reading comprehension

Although SM and LTM play important roles in reading comprehension, working memory (henceforth, WM) is considered to have the most crucial role. Research has shown that WM has the capacity to hold information in the brain until it is fully processed, making it necessary for information to be temporarily stored in WM while reading a sentence. The major mission of WM is to retrieve relevant long-term knowledge and transfer the outcome of its operation to LTM for

storage (Baddeley & Hitch, 1974; Baddeley, 2012). Students with low WM capacity may struggle to combine new information with what they already know (Gathercole et al., 2006). WM is also essential for holding links between the text's end and beginning, which is crucial for effective reading comprehension. Gathercolet et al., (2006) confirmed that WM is a strong predictor of individual variation in reading comprehension.

Conclusion

Aiming to present an overview on reading comprehension, this chapter attempted to unveil the twists of reading comprehension through shedding light on its different components, the researchers different definitions on the concept, and its assessment. Given the context of our research, the relationship between reading comprehension and working memory seems of paramount importance to be discussed and highlighted. In this sense, the reviewed literature suggested a close correlation between the two variables, as the working memory allows for the successful completion of any reading comprehension exercise, regardless of whether the aim of the latter is to process words, understand the text, store information, or all of them combined.

Departing from the belief that methodology constructs the research's core, the following chapter attempts to present a thorough theoretical description on the adopted methodology for the current research in hope to provide a comprehensive basis before tackling the data analysis, and to ensure an adequate justification of our methodological choices.

Chapter three: Research Methodology for this Study

Introduction

This chapter displays both a theoretical and practical accounts of the research methodology upon which the current study rests. It begins with providing a review on the central and most common research paradigms, approaches, designs, data collection tools or instruments, and data analysis procedures commonly used in the context of educational research. Subsequently, a more study-relevant presentation of the selected research design for the current study will be displayed. This section functions as means to elucidate the logic behind the adoption of the different methodological component of this study wherein detailed description of the followed procedures in the implementation of the used data collection instruments will be provided.

3.1 Research Methodology: Theoretical Background

To ensure an efficient understanding of the adopted methodology, a theoretical review on the concerned notions of research methodology might aid in the said task. Hence, the upcoming sections attempt to offer sufficient information on the research paradigms, approaches, designs, data collection instruments, data analysis procedures, and sampling techniques respectively.

3.1.1 Research Paradigms

In undergoing research, one should stress a point of importance of how the problem is perceived. Although the latter might be answered by a choice of a certain research approach or a data collection instrument over another, the natural perception of problems, in fact, stems from our view of the world itself. The said view is what is labeled as a research paradigm. In this sense, Cohen et al., (2018) share a similar vision as they describe the research paradigm as the angle from which one views knowledge and, in a more general sense, the world. Essentially, the term "paradigm" itself holds the aforesaid definition as Kuhn (1970) explains that a paradigm is merely

a perspective of science, which holds its own definitions of what is acceptable and how it is deemed acceptable (as cited in Henouda, 2019).

The description of the term paradigm as being a set of beliefs governing one's view of the world evokes the need to clarify two further concepts around which it revolves: ontology and epistemology (Kivunja & Kuyini, 2017). It can be already deduced that the research paradigm can be interpreted as a philosophical dimension to research. While the research approaches, designs, data collection instruments, and data analysis procedures propose a concrete value to research, the research paradigm holds the abstract facet of the coin. This philosophical nature originates from its link to ontology and epistemology (Cohen et al., 2019).

The former, ontology, denotes one's philosophical assumptions in constructing their perception of truth and reality (Kivunja & Kuyini, 2017). Scott and Usher (2014) consider ontology to be of paramount importance to the research paradigm as those ontological assumptions are tools of making sense of the world (as cited in Kivunja & Kuyini, 2017). Furthermore, a broader look on the ontological spectrum allows for a distinction between two main views: Realism and relativism. Realism, as the term may symbolize, advances that knowledge exists outside of human manipulation, intervention, or experience (Jonassen, 1991). Realism, in this sense, can be synonym to objectivity as the world is seen similar to everyone. Cohen et al., (2018) define the realist view as "The realist position, however, contends that objects have an independent existence and are not dependent for it on the knower" (p.05). Relativism, on the other end, sees the world as being shaped by our own conceptions and experiences (Baghramian & Carter, 2015).

Epistemology completes ontology as it stands for the methods believed to be valid for the acquisition and communication of knowledge (Cohen et al., 2018). The epistemological views flow in parallel with their ontological counterparts as an empiricist view and an interpretivist view

can be sorted (Tuli, 2010). Regarding the empiricists, their perception of valid knowledge is directly tied to observation and hypothesis testing. Simply put, they believe that knowledge should only be gained through observation. This view shadows the realism ontological reasoning, for both advocate for an independent existence of knowledge. Oppositely, the interpretivist view tails the relativistic perspective, advocating that knowledge can only be attained from our perspectives (Cohen et al., 2018).

Departing from this, a set of paradigms, each of which characterized by its own ontological and epistemological beliefs, were developed. In this respect, social science research, from which educational research stemmed, is known for its paradigmatic pluralism as multiple paradigms co-exist (Cohen, 2018). Correspondingly, the selection of a particular paradigm, be it intentionally adopted or subconsciously developed, eventually delineates the subsequent choices of other methodological aspects (Mackenzie & Knipe, 2006). Hence, Creswell (2009) differentiates between four worldviews.

Post-positivism paradigm views the world from an empirical lens. In other terms, post-positivists perceive that knowledge should be tested as means of achieving validation and certainty (Creswell, 2009). In this sense, they challenge the view to knowledge as an absolute, unchangeable truth. Also known as the scientific method, post-positivists call for a constant revision of theories and the existing body of knowledge as, in their stance, is fallible. The post-positivism reliance on empirical evidence deems it relevant to quantitative research, for it is based on numeric measurements.

While post-positivism suggests constant verification of the data, interpretivism defends a relatively more subjective view on knowledge. By definition, interpretivism advocates for a truth that is sculpted by our interaction with the world wherein knowledge can only be generated in a

social context (Creswell, 2009; Hoadjli, 2019). In contrast to the post-positivist view, the interpretivists emphasize the importance of agency and the participants' subjective views on the phenomenon. In fact, knowledge attainment, following this paradigm, entails an obligation on exploring people's perceptions and experiences, and constructing knowledge upon them. As explain by Creswell (2009), researchers who undergo qualitative research usually position themselves under this paradigm because they rely on tools aiming to elicit open-ended answers.

It could be said that the post-positivist and interpretivist paradigms represent the two ends of the spectrum; while the former believes wholly in empirical evidence, the latter promotes knowledge as a social construct. Accordingly, the pragmatist paradigm invites to strip the pursuit of knowledge of the need to ally with only one side. Termed differently, researchers should seek knowledge by any means necessary, which may range from empirical testing to interpretation of perceptions and opinions (Creswell, 2009). By focusing on the problem itself rather than the means to reach it, the pragmatist view attempts to encourages the exploitation of the available tools to gain a comprehensive understanding and reach plausible explanations. Pragmatism depends primarily on the nature of the research problem at hand as the compass that determines which direction a given study should follow.

Finally, it is worth mentioning that a number of factors including a researcher's ontological and epistemological positions, the incentives behind his/her desire to conduct research, the commonly adopted paradigms in a certain field of inquiry, and the nature of the research questions to be investigated, can motivate the adherence to one research paradigm rather than another. In either case, the utility of determining the research paradigm, i.e., the philosophical and theoretical mold that shapes the research process both methodologically and rhetorically, lies in

the coherence and lucidity with which one can proceed to sketch the rest of the steps to be taken for the accomplishment of his / her research objectives.

3.1.2 Research Approaches

Upon clarifying the commonly discussed research paradigms in most of the literature, it becomes possible to infer that those ontological and epistemological could somehow be considered the basis of what comes after. Grix (2004) describes the ontological and epistemological assumptions as, "Ontology and epistemology are to research what 'footings' are to a house: they form the foundations of the whole edifice" (p.57). Accordingly, the research approaches are the subsequent consideration in an efficient research methodology outline; they, mostly, are given birth by the paradigmatic orientation. To clarify, a post-positivist researcher would adhere usually to quantitative research while qualitative research would be mostly more adopted by followers of the interpretivism research paradigm.

Research approaches display both of the philosophical beliefs as well as practical methodological aspects (Creswell, 2009). In educational research, three core research approaches are often discussed in the literature: the quantitative approach, the qualitative approach, and the mixed-methods approach, and they, usually, are bound to the research paradigms ordered respectively. The quantitative approach, as being backed by the empirical views, revolves around the quantifying data through hypothesis testing and investigations for relationships between variables (Creswell, 2009). The quantitative approach relies ideally on generation of numerical data and statistical analysis (Hoadjli, 2019). For this sake, it devotes data collection instruments developed to obtain data through close-ended questions and experiments. Quantitative research stresses objectivity in analysis as data is processed via use of statistical methods of analysis.

Conversely, the qualitative research approach tackles problems from another perspective. In this approach, emphasis is shed on interpretation of participants' insights and impressions (Creswell, 2009). A qualitative research typically generates data through the exploration of people's opinion, attitudes, experiences, and social phenomenon. Although comparatively basic statics can sometimes be generated, the ultimate aim of qualitative research is extracting themes or theories from non-numerical data as words and images, which, in contrast to the former, might incorporate a degree of subjectivity (Kothari, 2009). Consequently, Vanderstoep and Johnston (2009) explain that qualitative research findings are usually limited to the studied sample, "For these reasons, the qualitative approach is typically less concerned with aggregate generalizations. Much of qualitative research does not claim to be generalizable. Rather, it claims only to represent the people studied" (p.167).

Logically, it could be observed that the quantitative and qualitative approaches constitute a dichotomy. While the former advocates the collection of numerical data, hypothesis testing, and reaching results through statistical tests, the latter allows for the exploitation of subjective views and permits a more flexible analysis possibly different from one research to another. Creswell (2018) perceives the matter as merely "different ends to a continuum" (p. 41). They, in fact, complete each other, as research mostly tends to either of the two without a total disregard to the other.

In parallel with the pragmatist paradigm, the central point of the said continuum represent the mixed-methods approach. A mixed-methods approach designates the acceptance of both views. Since the qualitative and quantitative approaches designate two the two extremes, they arguably present a set of flaws. For example, quantitative research lacks contextualization as this type of research is usually conducted in artificial settings while qualitative data is less methodological

systematic (Hoadjli, 2019). Therefore, in hope to fill the gaps, the mixed-methods approach associates both numerical data and interpretation of insights in its research. By doing so, the research work is rendered more solid as it benefits from the pros of both preceding approaches. Instead of focusing on which sides fits better for a given research, the mixed-methods approach attempts to find how the two would work together, in harmony, to complete each other and to produce the best possible results (Dörnyei, 2007).

3.1.3 Research Design(s) / Strateg(ies)

Constructing one's research methodology, in a holistic sense, ranges from the most abstract sides, the research paradigm, to the most concrete aspects. In this respect, the research design, also known as the research strategy, stands for the plan of action specific to the qualitative, the quantitative or the mixed-methods approach that relates the theoretical assumptions to its practical aspects to ensure attaining results relevant to the advanced research questions (Creswell, 2009; Boru, 2018). Adjacent to promising the use of the appropriate methods and procedures, an well-developed research design's effect could be stretched to time and cost efficiency (Bouaziz, 2021). Following this vein, the selection of the research design will define the subsequent choices of the data collection instruments and data analysis procedures.

Through scouting a portion of the literature, a fair number of research designs are recurrent in the field of education research. Research designs can be categorized in their affiliation with their respective research approach, and they are equally termed as quantitative research designs, qualitative research designs, and mixed-methods research designs (as shown in Table 1). Prior to the selection of the proper research design for a given study, suitability, feasibility, and ethicality should be considered although sometimes it is not possible to check all of three boxes at once (Denscombe, 2010).

Table 1

Alternative Strategies of Inquiry (Adapted from Creswell, 2018, p.49)

Quantitative	Qualitative	Mixed-Methods
-Experimental designs	-Narrative research	-Sequential
-Non-experimental designs, such as surveys	-Phenomenology	-Concurrent
	-Ethnographies	-Transformative
	-Grounded theory studies	
	-Case study	

3.1.3.1. Quantitative research designs. Though quantitative research designs have their roots in empirical reasoning, they incorporate both experimental and non-experimental designs (as shown in Table 1). Experimentation designs reflect the brutal, typical method of conducting quantitative research (Dörnyei, 2007; Creswell, 2014). There exists a myriad of experimentation designs such as true experiments, quasi-experiment as, factorial designs, and single subject experiments. However, it should be noted that the validity and reliability differs from one design to another. In this respect, true experiments, wherein interventions are conducted, are seen to yield the most valid and reliable results (Creswell, 2014), yet they are seldom used in educational research as randomization often proves difficult to fulfill. Hence, similar, yet less reliable, experimental designs have been developed and are constantly adopted in the educational research such as the quasi-experimental design, which disregards randomization (Creswell, 2009). A common way to implement the quasi-experimental design is to devote a single pretest posttest group instead of both an experimental group and a control group. Creswell (2014) warns that although the latter might seem efficient and sufficient in investigating the effect of a treatment, say

a strategy training, on a group, it fails to exclude other possible variables that can be the cause of improvement (Dörnyei, 2007).

Adjacently, non-experimental quantitative designs as survey research include the use of structured questionnaire and interviews without the inclusion of any treatment (Creswell, 2009). Consequently, non-experimental quantitative designs do no look for alteration; they focus on investigating relationships that might be more or less discrete. Under the non-experimental quantitative designs, one can further elucidate the correlational design.

The correlational design, as its name denotes, refers to the investigation of a relationship between two (or more) variables. Correlation, in its essence, does use statistics in verifying whether the two studied variables share any association; however, it does not imply causation, which aligns with the general saying 'correlation does not mean causation'. This precise limitation of correlation design can only be overcome through experimentation as the latter allows for more sophisticated isolation of variables, and therefore a possible look into causation. Correlation has various applications, including testing the relationship between variables and making predictions based on this relationship. If there is a strong correlation between variables, we can use this to predict the probability of the presence of one variable based on the presence of another. In other words, the ability to make accurate predictions relies on the strength of the relationship between or among the variables (Mackey & Gass, 2005).

3.1.3.2. Qualitative designs.   Social sciences encompass various qualitative designs, but certain ones are prevalent among researchers, particularly those who are new to the field. The table below presents preliminary details about these designs.

Table 2

Some Qualitative Research Designs

Strategy	Purpose of research
Case studies	Understand the complex relationship between factors as they operate within a particular social setting
Ethnography	- Describe cultural practices and traditions - Intrepret social interaction within a culture
Phenomenology	- Describe the essence of specific types of personal experiences - Understand things through the eyes of someone else
Grounded Theory	- Clarify concepts or produce new theories - Explore a new topic and provide new insights

Note. Adapted from Denscombe, (2010),p.5-6.

It should be clarified, however, that the case study design is stretched to encompass both quantitative and qualitative studies. Mackey and Gass (2005) suggest that case studies are commonly associated with the longitudinal research approach, which involves studying phenomena at regular intervals over a prolonged period

3.1.3.3. Mixed-Methods designs. Since the current study adopts a mixed-methods research approach, and aligning with the present chapter's scope, clarifying the mixed-methods research designs becomes mandatory to elaborate further on the selected design. The idea behind the birth of mixed-methods designs came as a logical reaction to the increase of the use of the mixed-methods approach (Creswell, 2009). As quantitative and qualitative methods have been combined to exploit research to its full potential, the emergence of designs that support the convergence of the two poles became compulsory. Accordingly, various designs were put forward depending on the order whereby data was collected, how the different kind of data, i.e., quantitative and qualitative data, will be combined, and which of the two types of data is more pertinent. Denscombe (2010) defines the mixed-methods designs as,

> It refers to a research strategy that crosses the boundaries of conventional paradigms of research by deliberately combining methods drawn from different traditions with different underlying assumptions. At its simplest, a mixed methods strategy is one that uses both qualitative and quantitative methods. (p.137)

Dörnyei (2007) explains that regarding the mixed-methods research, several attempts to provide an exhaustive account for all possible quantitative-qualitative research designs combinations were pursued, but none of them could satisfy the said need. In spite of the failure to do so, Creswell (2018) classifies the mixed-methods designs under three chief pathways. Concerning sequential mixed methods designs, either of the quantitative or qualitative data precedes the other (Creswell, 2009) with the aim to expand or detail further on the investigated matter. Concurrent mixed methods designs position both types of data, quantitative and qualitative data, on the same line. Put simply, data in this case is collected simultaneously, which is straightly opposed to the sequential data collection in the sequential mixed methods research designs. Lastly,

transformative mixed methods designs do not obey to an exclusive order of data collection; it seeks merely to combines both of the discussed data types, in either ways, to answer ideological questions (see Figure 3).

Figure 3

Mixed Methods Research Typologies

FIGURE 2.1 Mixed methods research typologies
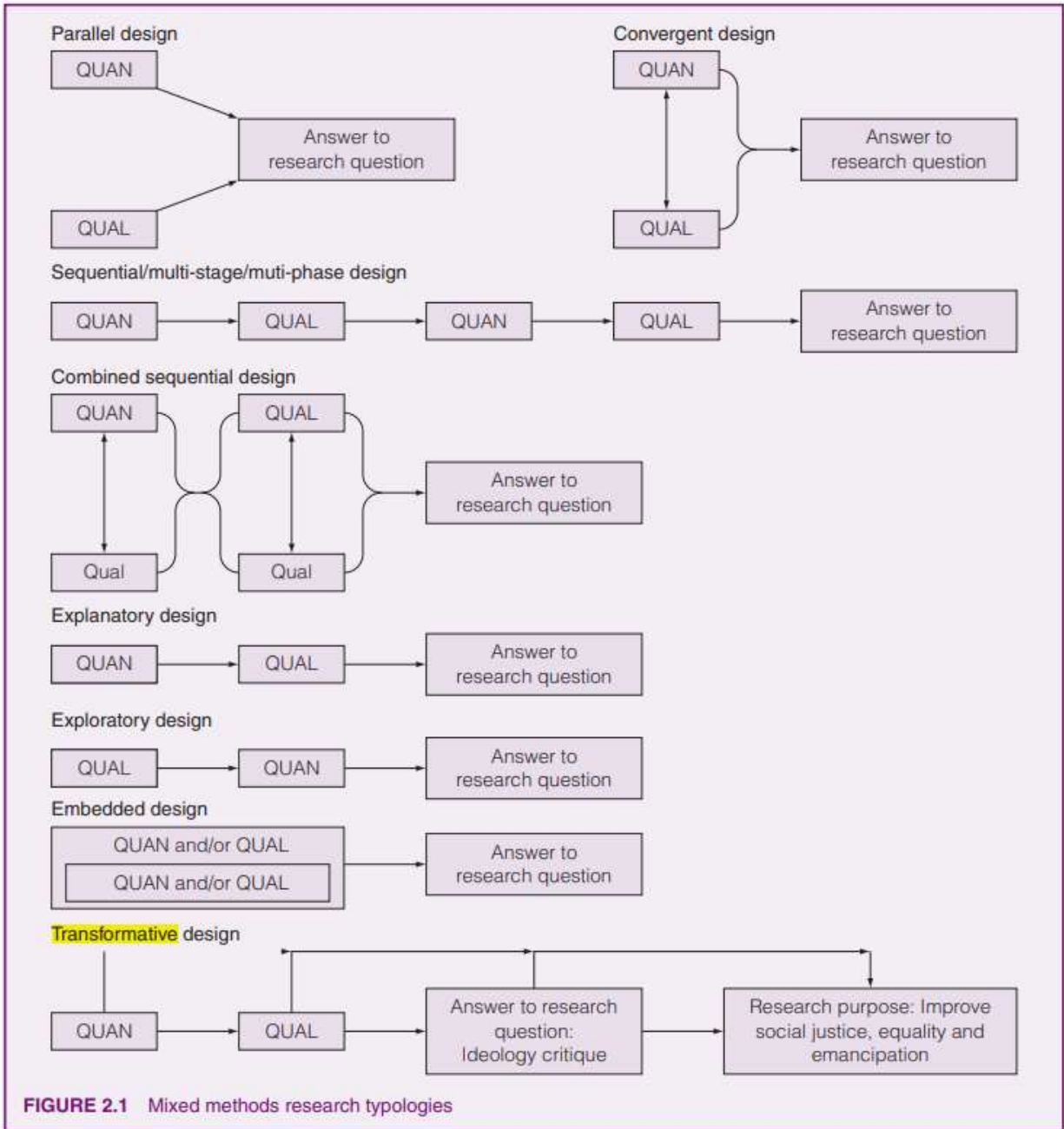
Note. From Cohen et al., (2018), p.40

Besides the discussed sorting, Creswell and Plano Clark (2018) advance two further designs rooting from the sequential mixed methods design. The explanatory sequential design prioritizes the collection and processing of quantitative data, which serves as a basis for the

subsequent phase concerned with the qualitative data. In contrast, the exploratory sequential design, upon which the current study rests, sheds its focus on the qualitative data first, and eventually turns to the quantitative side of the study. Additionally and perhaps more importantly given the current study, the embedded design refers to the use of both types of data, with a tendency towards one over the other. Though the embedded design does not impose any obligation on the order of data collection, it emphasized the needs to keep them separate from each other (Cohen et al., 2018).

3.1.4 Data collection instruments

Diving into the more practical facets of research methodology, the collection of data can be analogically perceived as the transition to the executable parts of the outlined research. Dörnyei and Csizér (2011) label the proper selection data collection tools as the , "The backbone of any survey study" (p.74). The data collection instruments, as the rest of the other aspects of methodology, are not selected arbitrarily; they are dictated by the purposes of the study (Cohen et al., 2018). Indeed, the methods, referring to the techniques and tools used for data collection, vary from one discipline to another. Nonetheless, the premise remains intact: capturing raw data, primary or secondary, for further analysis down the line. Similar to the research approaches and designs, the data collection instruments are classified in comparable manner. However, it should be noted that while certain data collection tools are exclusive to one research approach / research design as experiments for quantitative research, another portion of those tools can be used for both types of research (Kumar, 2011).

Mixed-methods research does benefit from a mixture of the two, as both data collection instruments from both sides should be incorporated. Accordingly, in this section, we will clarify on the commonly used data collection tools in both types of research, and provide insights on how

some can be fit differently depending on the context wherein they are used. For the sake of relevance, the data collection instruments will be presented in the same sequence as they were ordered in our data collection.

Interviews are commonly associated to qualitative research. According to Kothari (2004), interviews are meant to elicit oral answers through oral stimuli. Hence, by definition, interviews are only conducted in a spoken manner. The spontaneous channel of interaction created in the interview allows for the exploration of deeper insights as the interviewees, mostly, are not restricted by time or space, at least not directly, in contrast to surveys and questionnaires. (Cohen et al., 2018). The interviewer's constant presence during the procedure spares the problems of misunderstanding questions or provision of unsatisfactory answers, whether in terms of depth or length, as the researcher is put in a position in which they can manipulate their subjects to, first, elicit what they would consider 'better' answers, and, second, to intervene in case of any miscommunication or misunderstanding.

While the interview displays a number of strengths, it should be bore in mind that it comes with its fair share of weaknesses. Interviews are naturally costly in time for both the researcher and the participant (Cohen et al., 2018). In contrast to questionnaire that can be administered in a shorter period and, usually, are answered quicker, interviews should be scheduled as one's timetable should be completely emptied during the date of the interview. As Cohen et al., (2018), "On the other hand, interviews are expensive in time, they are open to interviewer bias, they may be inconvenient for respondents, interviewee fatigue may hamper the interview and anonymity may be difficult" (p.506). Though the basic notions of the interviews remain the same, the literature differentiates between structured interviews, semi-structured interviews, and unstructured interviews (Dörnyei, 2007).

Structured interviews are usually used in quantitative research in situations where a written questionnaire is no longer feasible and approachable to a certain category of respondents (e.g., illiterate people). Again, this type of interviews is useful when the interviewer is aware of what s/he does not know and can construct questions that will, in return, yield the needed responses for his/her study (Dörnyei, 2007). As opposed to the structured interviews, unstructured interviews (sometimes also referred to as 'in depth interviews', 'ethnographic interviews' or 'life history interviews'), are used only in qualitative studies with the goal of achieving a profound understanding of the interviewees' points of view. This category of interviewing allows maximum flexibility with only minimal interference from the research agenda with the intention of creating a comfortable atmosphere in which interviewees may reveal more than they would in formal contexts, with the interviewer assuming a listening role (Dörnyei, 2007). Dörnyei (2007) describes a third type of interview called the "semi-structured interview," which is also employed in qualitative research. This approach is used when the interviewer possesses abundant and adequate information about the subject under discussion, allowing them to develop broad questions related to specific topics without using predefined response options that could constrain the interviewees' responses. The goal is to elicit more in-depth and comprehensive answers.

Abiding by the order we have set earlier, questionnaires are another main data collection tool that is equally flexible as the interview. They can be defined as a written compilation of a number of questions aiming at measuring or evoking certain answers (Brown, 2001; Kabir, 2016). Questionnaires promise a reach to a greater sample, in usually less amount of time, and for a relatively cheap price compared to the interviews, which might explain their popularity (Hoadjli, 2016; Cohen et al., 2018). However, questionnaires are restrictive in their question-answer strings. For starters, question-items are subject to misunderstanding. Although the questions should abide

to certain rules, such as avoiding a double negatives and leading questions, the researcher often cannot intervene to provide further clarification if needed. Besides, questionnaires typically offer a limited space for answers. Regardless of how 'long' it might seem as this depends on the question-item as well as being a purely subjective evaluation, a limited space might subconsciously condition participants into either condensing answers throughout which they possibly would let off few details, or stretching their responses as to fill the provided space. By doing so, unnecessary lengthy answers might be messy and confusing.

Questionnaires tail the same classification as interviews. Structured questionnaires are often used in quantitative research wherein close-ended questions are employed to get precise measurements (Dörnyei, 2007). In this regard, multiple-choice questions, Likert scales, and dichotomous questions are among the frequent types used in such questionnaires. Close-ended questionnaires naturally generate data to be eventually statistically processed. Their counter-parts, unstructured questionnaires, are considered as a pure qualitative data collection tool. In contrast to the former, those questionnaires look for deeper answers through advancing open-ended questions. Qualitative questionnaires often exploit people's opinions, attitude, perceptions, or experiences about a certain phenomenon (Denscombe, 2010). Lastly, yet importantly, researchers may question respondents using close-ended and openended questions (semi-structured questionnaire). This category of questioning often begins with a series of structured questions, with slots to tick or scales to rank, and finishes with a section of unstructured questions for more detailed answers (Dawson, 2007).

For brevity's sake, the chapter will merely focus on the data collection tools that have been used in this study. Following this arrangement, one of the most prevalent data collection instrument for quantitative studies are tests. Testing is a prevalent approach to gathering data, wherein the aim

is to assess the validity of an idea or an individual's knowledge. Researchers typically use this method to determine if the independent variable has an impact on the dependent variable. Cohen et al. (2018) emphasize the effectiveness of tests in generating quantitative data, stating that tests offer researchers a potent means of collecting data and an extensive range of tools for gathering numerical data instead of verbal data.

3.1.5 Data analysis procedures

At the end of the trail, the stage of data analysis is where findings are found, and therefore is where answers to the research questions are reached. Likewise, the research hypotheses, if any, are either accepted or rejected in the same phase. The analysis of data, by this definition, has a considerable weight on the overall work as any inconvenience may be critical for proper generation of results. Akin to the previous steps, the choice of any data analysis procedure(s) is not conducted arbitrarily. Tailing the severance between quantitative and qualitative analysis in essentially every already-discussed step of the research methodology, the data analysis procedures differ between the two types of research.

3.1.6 Ethical Considerations

Considering that educational research often involved interaction with individuals through treating their answers on surveys or recording their opinions on different matters, it is appropriate to conform to a set of ethics that ensure the protection of the participants from possible intended or unintended offenses. Given that the collected data may be sensitive, Hickey (2018) asserts that it is essential to avoid potential harm.

Apropos of this, Cohen et al. (2018) say that the ethical considerations may differ according to "the context and nature of the study" (p.463). A prominent concern to account for regarding consent is informed consent. In most cases, it is possible, and thus mandatory, to

guarantee the participants' own willingness in participating in a given study prior to the administration of any survey or test. When doing so, the selected individuals' anonymity and confidentiality are ensured, as well as they are granted the right of stepping off the research work if any inconvenience or offense are faced. It should be noted that in some cases, the participants' are unaware of their presence in the research project. The latter usually happens in studies wherein quiet observations or online platforms are relied upon in data collection (Cohen et al., 2018). In this case, preserving the anonymity of the participants becomes even of greater necessity as their consent was not collected.

Quantitative research may be seen as relatively easier in terms of data analysis. Though the picture of using statistics could be daunting for novice researchers in areas where mathematics are not very prevalent (Cohen et al., 2018), most of the quantitative data analysis is usually processed by computers (Dörnyei, 2007). In this type, data are analyzed using descriptive and / or inferential statistics (Kothari, 2004). Descriptive statistics allows for comparatively basic calculations as averages and means with an aim of drawing general ideas from the data.(Kothari, 2004). Descriptive statistics are sometimes usable with qualitative data analysis, specifically in using content analysis. In this case, descriptive statistics allow for the quantification of words and set of meanings investigated.

Descriptive statistics in itself is cut into three main categories. Measures of frequencies are set to calculate repeated scores and percentages. It should be noted that this is as far as quantitative data analysis is used in qualitative research (specifically in content analysis). Secondly, measure of central tendency refer to mathematical operations that define "which items have a tendency to cluster" (Kothari, 2004, p.132). In doing so, they rely on the mean, the mode, and the median. The mean, termed differently, is the average of the presented scores. The mode represents the repeated

value(s) in a set of data, and the median is the central point of a series of numbers ordered in either an ascendant or a descendant manner (Kothari, 2004).

By convention, quantitative research often aims for generalization of findings. For this purpose, inferential statistics are the means to generalize findings (Kothari, 2004; Dörneyi, 2007). They incorporate a number of statistical test which permit a more thorough examination of the generated numbers. Dörneyi (2007) defines inferential statistics as means of inference and predictions making. The importance of inferential statistics in quantitative research can also be seen in hypothesis testing. In brief, hypotheses are put forward at the beginning of quantitative research, and they are eventually sorted out to be rejected or accepted, which is done through inferential statistics.

As aforementioned, qualitative data are processed and analyzed using other procedures. Given the nature of this data that is mostly extended written answers, data cleaning and organization become of paramount importance (Cohen et al., 2018). Besides, Cohen et al., (2018) state that lacks scientific rigidity as qualitative analysis procedures are less systematic compared to their quantitative counterparts. They recommend that before starting the analysis, the researcher should become acquainted with the data by reading, reviewing, and listening to it. The next step involves transcribing, organizing, and coding the data using different techniques such as highlighting, using words, numbers, and so on. This process helps in identifying themes and creating temporary categories. Finally, the researcher should link categories, recognize possible interpretations, and report the findings.

Qualitative researchers commonly use narrative analysis, discourse analysis, and content analysis among various data analysis methods (Bhatia, 2018). Content analysis is frequently used

in descriptive studies for analyzing interviews, which has three primary components: creating units of analysis, performing statistical analysis of those units, and displaying outcomes effectively, according to Cohen et al. (2018). Mayring (as cited in Cohen et al., 2018) argues that this method's popularity lies in its emphasis on linguistic features, contextual meaning, and its verifiability through codes and categories. In mixed methods designs, data analysis is performed separately within quantitative and qualitative approaches, as well as between them (Creswell, 2009). Combining insights and information from both qualitative and quantitative data, mixed methods analysis is regarded as a fruitful approach.

3.2 Research methodology of the study: Choices and rationale

It has been repeatedly stated in this chapter that any methodological decision does not stem in a vacuum; proper selection regarding the research methodology of a study is tied with the nature of the study, the research questions, and the research aims. Aligning with this thought, the current study aimed at investigating the correlation between the verbal working memory capacity and L2 reading comprehension. In doing so, it sought to check the extent to which teachers of the Reading subject at the department of English Language and Literature in Biskra university are aware of the role of the cognitive factors in L2 reading comprehension, namely the verbal working memory capacity. For this purpose, the study adopted a pragmatic paradigm wherein actual stances of teachers regarding the matter could be looked into as well as the said correlation could be conducted. The mixture of both data allowed for exploring different ends, which in turn required the use of different means in collection and analysis. Accordingly, the mixed-methods approach was best fit our study as it aligns with the philosophical beliefs rooted in the pragmatic paradigm.

The mixture of the two approaches imposed, at least to an extent, the selection of a mixed-methods research design. At this point, further considerations had to be taken into accounted for;

the integration of the quantitative and qualitative data sets in terms of sequencing and the ultimate result are seen as determinative in this case (Leavy, 2017). Abiding to those terms, the convergent parallel design corresponds best to the aims of the study. The exploitation of the teachers' awareness and the investigation of the correlation between the two set variables are not to be integrated for the generation of a sole purpose, and they the two sets of data did not have to be collected in a specific order. This design disregards the sequencing of data collection and offers the option to view one type of data as secondary to the other, which in our case is the qualitative data. Adjacently, the settings wherein the study was conducted imposed certain limits on cost and time as well as they rendered it difficult to access a large sample of participants. Those restrictions directed the selection of the qualitative design towards the case study design, which in turn dictates that the findings reflect the views of only the studied sample and cannot be generalized.

To answer the research questions advanced at the beginning of the study, a myriad of tools were used either for a the same purpose or each for a distinct one. Semi-structured interviews, a structured questionnaire, an TOEFL-like reading proficiency test, an L2 reading comprehension, and a Reading Span task.

3.2.1 Data collection methods

3.2.1.1. The questionnaire. As to back-up the assumptions advanced by the researchers that students may be facing difficulties in the aspects of L2 reading comprehension fulfilled by the verbal working memory, a fully structured questionnaire was developed and administered to ensure, to an extent, the existence of the said matter.

3.2.1.1.1. Structure and aim. The aim of the questionnaire was to ensure that the subjects, to be tested later on, somehow encounter difficulties in certain segments of L2 reading comprehension. Those parts are believed to be at least partially affected by the working memory.

Since the questionnaire sought to gather accurate data from the students' perspective, it consisted of 15 close-ended questions, with the exclusion of question looking for the age. The questions were either dichotomous, multiple choice, or Likert scales. Since the questionnaire was looking into L2 reading comprehension, it was administered only to students of first and second year license level, as those are academically enrolled on a Reading subject.

The first two question-items of the present questionnaire aim at examining the participants' problems in reading comprehension in a broad sense. They introduce many possible factors from which the students' may be impacted. Next, the questionnaire restricts its inquiry onto merely the functions fulfilled by the working memory. The questions do not explicitly evoke the working memory capacity, as this may confuse the participants. Instead, we advanced questions stated in plain terms, yet which will permit to deduce whether the said issue is actual or not. The questions are ordered in sets. The first set examines the memory span. The second looks into comprehension while excluding vocabulary as a confounding factor, and the last one dives deeper as it investigates the difficulty of questions which require a greater cognitive effort (reflection, inference making). Again, all of the aforementioned aspects are operated by the working memory, and all of them can be apprehended by capacity of this mental faculty. Table 3 demonstrates the objectives of each question or set of questions.

3.2.1.2.2. Piloting and validation Questionnaire piloting and validation are paramount of ensuring the accomplishment of the set goals by the end as well as the credibility of the results (Cohen et al., 2018). The questionnaire was first validated by two teachers with enough experience in the field of applied linguistics research. Accordingly, they were able to extract a number of flaws, which ranged from the questionnaire's layout to the content itself. Those remarks were immediately considered as neglecting them might have disrupted the flow of the investigation.

Proceeding the validation stage, the questionnaire was administered alongside an opinionnaire to five students of both levels to guarantee somehow that the target population could efficiently provide relevant answers. The piloting stage also in some way confirmed that none of the questions were sensitive or offensive to the target sample. Lastly, it is important to state that those participants' answers were only considered in adjusting and revising the questionnaire, and that none of them was incorporated in the final data set.

Table 3

The Questionnaire Structure and Objectives

Section	Content	Items	Objective
Section one	Background information	1-3	To gather the relevant background information on participants. In this case, their tertiary level, their age, and their history with brain deficits. Those information may be critical in such studies as age and brain deficits have been found to affect the performance rate of cognitive faculties.
Section Two	Difficulties encountered in L2 reading comprehension	5-6	To explore the problems encountered by the selected students' in L2 reading comprehension from a broader view that is not restricted to the aspects possibly influenced by the working memory
		7-15	To inquire more thoroughly on sections in L2 reading comprehension where individual differences in working memory might come

Section	Content	Items	Objective
			into play by raising specific issues as meaning inference and remembering different segments of the text.

***3.2.1.2.* The interview.** While the questionnaire and the tests are purely quantitative, the interview represents the qualitative side of the study. Semi-structured interviews were conducted at the same time of finalizing and administering the questionnaire.

3.2.2.2.1. Structure and aim. The semi-structured interviews consisted of nine pre-determined questions addressed to actual and ex teachers of the Reading subject. Because of the recent inclusion of Reading as an academic subject at our department, teachers of this subject are scarce. Hence, only four teachers who fulfilled this condition as well as being available and agreeing on the terms of proper interview accomplishment, namely being recorded, were interviewed. The questions are ordered to slowly, yet efficiently, guide the investigation's path into the direction of the main study's purpose. The interview begins with a general introduction examining the teachers' experience and their view regarding the recent inclusion of the Reading subject. Stepwise, it starts to raise questions on text selection and, then, introduces the cognitive factors. The interview's scheme attempts to lead gradually the researcher and interviewee into the effect of working memory capacity on the students' L2 reading comprehension. By the end, the interview's scope becomes narrowed as it implicitly raises questions regarding the teachers' awareness on the working memory capacity and its effect on reading comprehension. Those aims are further detailed on Table 4 joined below.

Table 4

The Interview Items and Their Objectives

Item(s)	Objective
1	To gain knowledge on the teacher's experience. Although this may not be directly related to our study, it may be an explanation certain decisions.
2	To gain an insight on the teacher's perception on the addition of Reading as an academic subject. Answers to this question might predict and correlate with the teacher's commitment to the subject, and therefore their consideration and awareness of the cognitive factors influencing L2 reading comprehension.
3-4	To check on whether the teacher's takes into consideration the cognitive factors in their planning of their Reading session
5	The fifth question is two-sided. The fifth question is two-sided. The question servers a different purpose depending on the answers provided during the previous inquiries. In case the teacher is aware of the cognitive factors that affect reading comprehension, we will attempt to inquire deeper into what exact parts of cognitive factors they are familiar with. Subsequently, we aim to check their familiarity with the working memory capacity. In case they are not, it will stress the unawareness of teachers regarding the said concept.
6-9	At last, we aim directly at investigating the awareness of teachers on working memory capacity and its effect on the reading comprehension. While at the beginning the questions were comparatively broad, the target, upon reaching those questions, is precise: the teachers' awareness of the effect of working memory capacity on reading comprehension. The questions revolve around the functions fulfilled by the working memory, and whether the teachers' have observed or aware of any issues regarding the latter. Then, the last question raises the issue plainly and seeks to see if teachers associate those probable deficits with an exact notion.

3.2.1.3. The tests. Abiding to the nature of the study and the research aims, various tests were used for distinct purposes in order to reach accurate data on the investigated correlation. Problems incorporating cognitive factors are known to be multi-dimensional. Termed differently, through scouting some of the literature, diving into the effect of, specifically, working memory evokes the need to exclude a number of possible intervening variables. Two of the latter have already been accounted for in the students' questionnaire: the students' age range, and their history with brain deficits. However, other factors remain influential to the study.

Accordingly, students who agreed to participate in this study sat first for a TOEFL-like reading proficiency test aiming at assessing the average reading level of the sample. The TOEFL-like reading comprehension test was retrieved online. Through approximating their reading comprehension performance, the process of selecting the proper test, both in terms of the text itself and the joint-questions, became easier and, more importantly, safer. In contrast, arbitrary selection of a reading comprehension test could seriously impact the results as the chosen material might be easily answered by the students, which would somehow inflate the scores, or might be found extremely challenging and daunting. The test consisted of two texts with 15 multiple-choice questions each. The participants were not given any time limit to ensure that they are not rushing their answers; thus, impacting the results. For brevity's sake, only a sample of the test is shown in Figure 4.

Figure 4

An Extract of the First Text Used in the TOEFL-like Reading Proficiency Test

Directions: Read the passage below and answer the questions.

History of the Chickenpox Vaccine

Chickenpox is a highly contagious infectious disease caused by the Varicella zoster virus; sufferers develop a fleeting itchy rash that can spread throughout the body. The disease can last for up to 14 days and can occur in both children and adults, though the young are particularly vulnerable. Individuals infected with chickenpox can expect to experience a high but **tolerable** level of discomfort and a fever as the disease works its way through the system. The ailment was once considered to be a "rite of passage" by parents in the U.S. and thought to provide children with greater and improved immunity to other forms of sickness later in life. This view, however, was altered after additional research by scientists demonstrated unexpected dangers associated with the virus. Over time, the fruits of this research have transformed attitudes toward the disease and the utility of seeking preemptive measures against it.

A vaccine against chickenpox was originally invented by Michiaki Takahashi, a Japanese doctor and research scientist, in the mid-1960s. Dr. Takahashi began his work to isolate and grow the virus in 1965 and in 1972 began clinical trials with a live but weakened form of the virus that caused the human body to create antibodies. Japan and several other countries began widespread chickenpox vaccination programs in 1974. However, it took over 20 years for the chickenpox vaccine to be approved by the U.S. Food & Drug Administration (FDA), finally earning the U.S. government's seal of approval for widespread use in 1995. Yet even though the chickenpox vaccine was available and recommended by the FDA, parents did not immediately choose to vaccinate their children against this disease. Mothers and fathers typically cited the **notion** that chickenpox did not constitute a serious enough disease against which a person needed to be vaccinated.

Strong belief in that view eroded when scientists discovered the link between Varicella zoster, the virus that causes chickenpox, and shingles, a far more serious, harmful, and longer-lasting disease in older adults that impacts the nervous system. They reached the conclusion that Varicella zoster remains dormant inside the body, making it significantly more likely for someone to develop shingles. As a result, the medical community in the U.S. encouraged the development, adoption, and use of a vaccine against chickenpox to the public. Although the appearance of chickenpox and shingles within one person can be many years apart—generally

Subsequent to the collection and processing of the first test, the results allowed for the selection of the Nelson and Denny Reading test form E. The NDRT is a standardized reading test that has already been used in multiple similar studies. However, it was adapted as to match the non-nativity of the sample. Originally, the test is composed of two sections: a vocabulary section and a reading comprehension section. Logically, for the sake of the study, only the second section was preserved. Additionally, the first text was deemed somehow difficult for the students' assessed reading proficiency, so it was also disregarded. The test, then, became structured of eight passages and 28 multiple-choice question. Besides, the average score of the studied sample matches the description of the NDRT form E, which is suitable for people from age 14 upwards. Similarly, the

participants were not restricted by time. In addition, they were allowed to use dictionaries in case of vocabulary ambiguity. The latter was an attempt to minimize the effect of vocabulary difficulty on their answers as, it should be reminded, that problems rising from lack of vocabulary are not affiliated with the working memory. A sample of the passages and their questions is shown in Figure 5.

Figure 5

A Sample of the NDRT Administered to the Participants

Regarding the measurement of the verbal working memory capacity, we relied on our selection on the tasks that tackles both the processing and the storage systems of the working memory. In this respect, the Reading Span task has already been found as an appropriate data collection method for working memory capacity (Danemane & Carpenter, 1980). The basic

premise of RST is to remember the last word of an increasing set of sentences while attempting to guess whether the displayed sentences are semantically and grammatically correct or not. The test consisted of a total of 60 sentences divided into sets of two, three, four, five, and six sentences, with three trials for each. The sentences were displayed on a computer monitor, and the participants were asked to remember the last words of sentences until the end of the set wherein they had to recall the last words in order. It should be noted that the test was done far enough from the rest of participants, so they would not memorize the words beforehand. Scores were saved on an excel sheet.

3.2.2 Data collection procedures

The data collection phase did not submit to any strict order of collection in terms of quantitative and qualitative data. However, it was crucial that the questionnaire was administered before the rest of the quantitative data collection instruments as it ensured the relevance of the chosen sample. In order to meet ethical requirements and the needs of the research, it was necessary to obtain signed informed consent from participants before conducting the study. This involved obtaining permission from the head of the department of English and the deputy in charge of pedagogy, who both agreed to the use of classrooms during unfilled hours and to conducting the study with the students of the said department. The participants, students and teachers alike who were selected as the sample for the research study, provided their informed consent about their willingness to participate. The consent letters provided brief details about the study topic, its purpose, the tasks involved, and the rights guaranteed to the participants, including anonymity and confidentiality.

3.2.3 Data analysis procedures

As the current study followed a mixed-methods approach, the data analysis phase involved combining analysis techniques from both of these approaches. Regarding the qualitative part of our data, thematic analysis was relied upon to help make sense of the non-numerical information collected from the interviews. In this respect, MAXQDA 2022 to facilitate the task of transcribing, organizing, and coding the data as well as extracting the relevant themes.

Braun and Clarke (2006) define thematic analysis as pathway for the identification of patterns in a corpus of data. They also assert a failure in emerging a "clear agreement about what thematic analysis is and how you go on doing it" (Boyatzis, 1998, as cited in Braun & Clarke, 2006). However, Braun and Clarke still suggest a list of sequential, yet recursive, steps that may be somehow helpful in conducting a thematic analysis.

As qualitative data may be overwhelming, gaining a sense of familiarity with the collected data is vital. Admittedly, the process may be tedious as it usually involved re-readings in an attempt to pinpoint possible patterns and deduce as much information as possible. Braun and Clarke (2006) perceive this step as an implicit justification for why qualitative research is centered around smaller samples; The activity of multiple readings of the data is evidently time consuming. It is worth mentioning that this step does not have to be conducted independently. Termed differently, familiarization can occur while transcribing recorded data, for instance.

As the process of reading goes one, initial codes are, then, extracted. Coding data is a key step in the analysis of both kinds of data, meaning quantitative and qualitative data. In the case of thematic analysis, coding can be seen as the identification of segments or parts of data that may be useful in the later steps. When doing so, one may be looking for specific segments to be coded,

yet it also possible to code something that was not planned before, which parallels with the idea of familiarization. The notion of coding itself may be static, but the approach for doing it may differ from one to another. In our case, coding was conducted through MAXQDA 2022 wherein different colours were assigned to the different extracted segments.

Proceeding the extraction of codes, the search, and eventual generation, of themes takes place. It could be simple defined as sorting the found codes into recurrent themes, which are most of the times broader than the codes themselves (Braun & Clarke, 2006). Those themes should be repeatedly reviewed as they may be subject to adjustments as merging or separation. Lastly, the final themes can be defined and named according to their content.

Conversely, quantitative data was described through descriptive statistics as well as Spearman statistical test. The former were used for both the structured questionnaire and the tests, but their weight was greater for the questionnaires. Specifically, percentages were relied upon in the analysis of the online students' questionnaire. Concerning the tests, measures of central tendency (mainly the mean) measures of spread (the variances and standard deviations) were displayed. They were mainly measured in order to determine whether the scores were normally distributed. As we aimed at correlating the scores, Spearman test of correlation was conducted using SPSS 26. The Spearman test was selected instead of its counterpart, Pearson correlation, given, first, the non-random sampling procedure and, second, the non-normally distributed data of the WMC score.

3.2.4 Population and Sampling technique

As our study was not aimed at generalizing the findings to a wider population, we conducted research on a specific subset of the population. Specifically, our population comprised undergraduate EFL students and instructors of the Reading subject at Biskra University, aligning

with the study's objectives. To obtain an in-depth understanding of the phenomenon under investigation, particularly with regard to teachers' awareness and practices, we selected four teachers, two are actual teachers and the remaining two are ex-teachers of the Reading course.

Based on a convenience sampling technique, 30 students were chosen to be part of this research work. Specifically, the sample consisted of 11 first year license student and 19 second year license student. We deliberately targeted those two levels as they are still studying Reading academically, and therefore they are more consistently exposed to reading materials and activities of reading comprehension.

Conclusion

In the third chapter, we attempted to ground our decisions and choices regarding the adopted research methodology. In doing so, a theoretical overview on the entirety of the conceptual framework components was presented as a theoretical justification for the chosen methodology of this study. Eventually, the adopted methodology was presented and discussed. In the upcoming chapter, the collected data will be presented and analysed, where relationships and conclusions will be drawn.

Chapter Four: Fieldwork and Data Analysis

Introduction

The current chapter intends to report the findings of the current investigation, which are backed-up by the methodology and rational explained in the previous chapter. This substantially encompasses the numerical, as well as the verbal data that were collected from the teachers' interviews, as well as the students' questionnaire and tests. Subsequently, and following the analysis of each instrument's collected data using a fitting data analysis procedure(s), this chapter attempts to provide a detailed discussion and summarization, along with the synthesis of the findings by visiting the initially raised research questions.

4.1 Results and Discussion of the Findings

4.1.1 The Teacher's Interviews

Q01. How long have you been teaching EFL?

Table 6

Teachers' Experience of Teaching EFL

Teachers	Experience
1	Four years
2	Four years
3	14 years
4	Five years

The first question directly inquired on the experience of the selected teachers in teaching EFL, which, according to their answers, ranged from 14 to four years. One can raise the query on

why the question was about teaching EFL rather than teaching reading as it might be argued that the scope of the question was somehow broad in relation to the aims of the study. In response to the latter, it should be taken into account that Reading, as an academic subject, was added recently. The recent inclusion of reading, which will later on be detailed more, had a number of implications among which a lack of experience, at least presumably, and a limited number of teachers with experience in the concerned subject. Hence, we directed our question to the teaching of EFL in general as reading is evidently a core skill in foreign language teaching.

Q02. Knowing that the Reading subject was added recently into the first and second year license levels curricula, were you in favour of this decision? Please elaborate on your stance.

All of the interviewed teachers affirmed that they were undoubtedly in favour of this decision. This question was raised in order to gain an insight on the feelings the teachers had on the addition of the Reading module. In theory, a positive attitude towards the matter would result in more commitment and possibly greater efforts in polishing the decision. In contrast, teachers with negative attitudes would most likely achieve less in the teaching of reading, at least in comparison to the counterparts. It should be mentioned that this question was raised with a pre-idea of a negative correlation between teachers' attitudes towards the addition of reading and their teaching performance and commitment.

More importantly, Teacher 1 specifically confirmed that they had already been trying to include reading in their teaching of other courses as Oral Expression. They expressed on different occasions that, "I teach Oral Expression (chuckles) I give them homeworks where they have to read", and, "I do this [referring to reading] all the time even if it's not scheduled in the syllabus, but I insist on them to read,...". Those efforts are not the consequence of an unjustified feeling; all

teachers repeatedly stated how important reading is. While vocabulary acquisition was agreed upon by all teachers as a concrete benefit of reading, critical thinking development, reaching communicative competence, and enhancing the writing skill were also brought-up as gains from the process of reading. Through confirming teachers' awareness on the importance of reading, we could advance to questions to check on their awareness on cognitive factors.

Table 7

Samples of Teachers' Attitudes on the Addition of Reading.

Teacher	Response sample
1	I support the decision (chuckles) I, I do this all the time even if it is not scheduled in this syllabus, but I insist on them to read, I want them to read as (intelligible).
2	I wasn't actually given the opportunity to vote, because I have been given the course to be taught, but I wasn't against it, actually I loved that. It adds more than it harms of course.
3	Very beneficial [...] So, it is very beneficial, and am I so happy because, eum, I got the opportunity to teach that module.
4	I think Reading is, euh, of course very beneficial for students, and the decision to add it a module will definitely help students to improve their reading skills, which will be helpful in the future.

Q03. Would you, please, explain how you usually hold a typical reading session, including the preparations you make, the factors on which you rely when choosing a text for example, etc.?

Bearing in mind that the ultimate aim of the interview is to gain insights on the awareness of teachers on the effect of cognitive faculties on reading comprehension, developing an adequate idea on how their preparation for the session and their activity during the session goes allows to pinpoint some hints on the mentioned aim. In this case, three out of the four teachers insisted on their focus on the vocabulary, a theme that will be repeatedly emphasized throughout the whole interview. Table 3 shows samples of answers of the teachers.

Table 8

Samples of Teachers' Considerations in Preparation for the Reading Session

Teacher	Response
1	In general, I, euh, I provide them with a book. It's a nice book, a very interesting book, and very useful book for teaching reading. It contains what? Euh, the different types of reading, and, euh, related with texts, then questions about this texts. Those questions are usually not related to the content of the text, no. they are related to the format.
2	I just planned to teach it practically. I provide my students with different texts, of course reading comprehension texts: passages with related questions. […]. In terms of the tasks, for the topics I try to use topics that attract the students. The social topics, topics which are related to our daily life more, and I found that this was really beneficial.
3	I try to, euh, to focus, let's say, on the meaning, let's say, the meaning of text. for ex, not the literal meaning only, okay? I try to do, euh, let's say, how to say it? Behind behind the lines.
4	I always try to choose a text that is fun for the students but beneficial at the same time. What I mean by this is that, euh, a text that is good for them in terms of their level and vocabulary and all and also it should be interesting so they don't get bored.

It could be further elicited by the teachers' responses to the third question that there is an absence regarding a conventional procedures of teaching reading. In this respect, it could be noticed that while the Teacher 2, three, and four relied on passages with related questions, which

directed their foci on reading comprehension, the first teacher set their efforts on the strategies of reading and studying the formats of the texts. Teacher 2 backed-up this thought as they expressed, "Though I want to add that Reading is a bit new here so every teacher is teaching in the way they prefer". The lack of a standard approach to teaching reading, at least locally, would later on be helpful on explaining certain inconsistencies in the teachers' responses mainly between Teacher 1 and the remaining interviewees.

Besides, we could also evoke another sub-question at the same stage regarding the type of questions they address to their students. The responses to this inquiry were influenced by the former discussed matter i.e., the teacher's focus during the session. To clarify, teachers who focused on reading comprehension raised questions on inference making and the implicit meaning, for instance. In this regard, Teacher 3 asserts that, "I focus on thematic questions and questions about the implied meaning." An insight onto the course of the reading session of each teacher aids us in explaining their answers as, for example, asking questions on merely the format will definitely not correlate with the verbal working memory capacity, which is the case with Teacher 1.

Q04. What problems do your students usually encounter in reading comprehension?

Narrowing down the scope of the questions, this question permitted the elicitation of three recurrent themes in the teachers' responses.

Table 9

Students' Responses to the Common Difficulties Encountered by Students in Reading Comprehension

Teacher	Response
1	It's more about the unfamiliar words. [...] Simplicity, the length of the text, and [...], euh, you know I think the main problem is the reading task itself. I face problems when they don't read
2	They struggle with new vocabulary. [...]. Sometimes they struggle with some questions when there is an implicit meaning. [...] when it comes to questions which look for something beyond the sentence it becomes a bit difficult for them. [...] Generally, they are good when it comes to reading comprehension questions: the simple questions like giving titles, etc. So, yes, just as I said, when you turn the notion towards something more implicit, they find it a bit hard.
3	Among the problems that, euh, among the problems I can talk about is that the students sometimes are struggling when it comes to unfamiliar words or vague words. […] they do not know the correct pronunciation, sometimes they suffer from, euh, reading multi-syllabic words. If, for example, euh, they come across the word 'unstoppable', so they feel they will struggle in order to read such word. As I have mentioned punctuation, sometimes the problem of

Teacher	Response
	punctuation, sometimes they do not stop or they do not make enough time to move to another idea.
4	They complain of unfamiliar words especially idioms etc. They also sometimes say that they cannot understand the context of the text because it is strange to them. [...], and also there is the problem of culture difference because, for example, they cannot understand some events that are in Europe or the USA.

1. Vocabulary

The issue of vocabulary was strongly emphasized by all teachers. Students' complaint about difficulty in understanding certain words or passages, due to lexical problems, were pertinent in the Reading subject sessions according to the teachers' answers. They explained that they had to constantly engage in phases where they explained words in order to smoothen the process of reading comprehension. Students showed deficiencies in their vocabulary throughout the whole session as queries on words they were unfamiliar with were raised at different times of the session, ranging from its beginning until its end.

2. Inference making

Inference making has been similarly pointed out as a recurrent problem encountered by students in the sessions of Reading, yet it should be noted that it was not remarked by all of the interviewed teachers. The latter can be explained by the different teaching approaches adopted by the teachers, which were looked for in the previous question. Logically, teachers who do not raise questions of comprehension targeting inference making cannot observe any deficiencies in the matter as it has not been stimulated from the first place. Oppositely, it could be noticed that all teachers who asserted the inclusion of such question did observe this problem.

Inference making in itself is a process that can be traced back to a combined work of multiple mental faculties among which some are not easily detectable or even concrete. Amid the multiple chords coordinating the process of inference making is the working memory, which is one of the two variables of our study. Based on the literature review presented in earlier chapters, specifically chapter one, working memory plays a considerable role in abstraction and deduction of meaning. Hence, the question allowed us to gain insights from the teachers' lenses on whether the functions fulfilled by the working memory capacity have caused any shortcomings for the students.

3. Length of the text

Text length is evidently one of the basic criteria which are mostly considered in the selection of any appropriate text. Put simply, the longer the text is, the more difficult it becomes to remember the different ideas and pieces of information scattered around the numerous paragraphs. Although the latter may appear dull, the job of connecting those strings of data together in order to create a meaningful, longer string of information is conducted by the working memory. Similar to inference making, the manifestation of the length of the text as a pertinent issue during the Reading sessions aids in acquiring equal insights on the same matter.

More profoundly, as teachers evoked the length of the text, we attempted to elicit further information on this question by stating whether students display similar capacities in remembering pieces of information mentioned at the beginning of the text. Teacher 2, for instance, confirmed that, "This is something I observed in the classes. […] while asking them without giving them time to look for the answers, I find students who directly raise their hands because they have the answers. Some students even while answering they check, they can check before answering and while answering they keep checking the answers from the text."

Q05. Do you think that reading comprehension, as a process, is impacted by cognitive factors? If yes, would you please cite any examples of relevant cognitive notions? If no, would you please explain why?

It should be mentioned that one of core notions upon which the questions of this interview were developed was a presumed idea of unawareness about working memory. With this in mind, it becomes possible that explicitly evoking the term 'working memory' would probably result in confusion, stress, anxiety, and so on. Besides, we were afraid that the direct stating of the said term might affect the teachers' answers, as they would become more conservative fearing irrelevance. Hence, the questions were built so that they are gradually narrowing down the scope on the functions of working memory, without a straight statement of it.

In this respect, this question sought to direct the flow of answers right to the notion of cognition. Cognition has been long researched and found as a constant influence on reading comprehension. Thus, teachers of reading should, in theory, be aware of its effect in order to manipulate it for the best. Contrary to the previous cases, the four teachers endowed almost totally different answers ranging from commitment and motivation to the learning styles, with no hint on the working memory or anything remotely close to it.

Table 10

Samples of Teachers' Responses on the Cognitive Factors Capable of Affecting Reading Comprehension

Teacher	Response
1	Commitment! In terms of being interested in the module itself, because there is mark and there is an exam. […] yes, academic commitment.
2	Sometimes, I can give you an example, maybe when the students have some background knowledge. A fluent reader, or someone who reads too much, find it very easy to cope with the situation if it's difficult in comparison to other students.
3	Yeah, because, euh, we don't have for ex mental abilities, and for others they use for example, euh, for some students, or let's say language users, they use for example, euh, some, let's say, language games. […] so it's about the way of thinking. Listen to me, sometimes if you are for example aware about the importance of reading, okay? so you try to,to ,to read and read again and read some more, okay? in order for example to facilitate things, not for example only in reading or to be a good reader or to improve for example, euh, the speed, euh, of reading.
4	I am not really sure about which cognitive abilities are there, but maybe critical thinking can have an effect on reading comprehension.

A thorough examination on the provided samples would permit one to deduce that not all teachers could barely state relevant cognitive factors, that is if they are to be perceived 'cognitive' to begin with. Teacher 1 and four confirmed that motivation and It could be argued that critical thinking and motivation are, in a certain way, part of cognition. While this stands true for critical thinking, motivation, is more described as either a psychiatric state of will to pursue something in order to reach a certain reward. From another perspective, motivation is, in fact, a set of hormones

which stimulate the human organism for accomplishment with the hope of receiving a defined reward. By comparing the latter to Teacher 1's answers, the results of examinations are the rewards for which students are 'biologically' motivated to study.

Teacher 2, however, highlighted that background knowledge could possibly influence reading comprehension. Indeed, background knowledge is stored as schemas in the long term memory, yet that does not render it a cognitive factor. Background knowledge could be seen as a mere fuel to the process of comprehension wherein novel data is combined with existing knowledge to formulate meaningful information, which is conducted by the working memory. Teacher 2 further confirmed their words, "Yes, that's what I observed, yes. Once I bring a topic which they have prior knowledge in, it helps a lot in facilitating, euh, the comprehension". The importance of background knowledge in comprehension cannot be denied, but the answer does not fall under the umbrella of the question.

A hint towards learning styles, at least according to our interpretation, in addition to further confirmation on motivation were mentioned by Teacher 3. Learning styles simply cannot be conceived a cognitive factor in this case. A learning style is a combination of cognition, mood, age, among other factors which render it somehow difficult to assign with a specific side. Departing from those answers, it could be said that the interviewed teachers' knowledge on cognitive factors is somehow limited.

Q06. Have you noticed any difficulties or differences in the students' ability to associate or to process information?

The sixth questions weights one of the main functions of working memory: associating and processing information. Through asking this question, we look directly for insights on a specific feature of working memory. Indeed, the association and processing of information is not totally

exclusive to the working memory, yet it is known that working memory plays a huge role in doing so.

In this respect, Teacher 2 and three have, essentially, correlated between the quantity of reading undertaken by students and their ability of associating and processing information. Teacher 2 specifically added that some students consider reading the passages twice wherein the second reading serves a critical or analytical processing of the text. The initial reading provides an opportunity for them to engage with the text on a surface level, immersing themselves in its narrative and content. Following this initial exploration, the second reading assumes a critical and analytical nature. It encourages students to delve deeper into the material, scrutinizing its themes, dissecting its structure, and examining the author's stylistic choices. Additionally, they emphasized exposure to the English language as a determining factor in information processing and association capability.

Teacher 4 explained that a large portion of their students faced difficulties in processing information, "they take a long time to process what's going on in the text". In their view, the slow pace of processing was due to their inadequate practice of reading and their unfamiliarity with the different formats of texts and dictions. They further advanced they usually have to constantly direct and provide hints to their students so the latter could associate the different pieces of information treated in the passage. Stepwise, Teacher 4 said that there are differences between students, "However, a small number of students could do that more quickly". Those differences represent merely most average groups of individuals. Differences in information processing and association are part of the individual differences, which can be traced back to the working memory capacity. Termed plainly, students with a limited verbal working memory capacity will subconsciously

spend more time in the processing and associating phase compared to their counterparts whom are endowed with a greater verbal working memory capacity.

Lastly, Teacher 1 denied observing any difficulties in this matter. This could be explained by their teaching approach as they clarified that they focus on somehow short segments, which facilitate this operation, "Actually, I haven't faced this problem because I make the whole group read. For example, I ask them to read the first paragraph only." Despite adopting this approach, Teacher 1 agreed that they could imagine differences in this context. They explained that although they have unintentionally solved this problem, they would have observed differences provided that they have opted for longer extracts.

Q07. Given your experience, do students find more difficulties in tasks that are more cognitively demanding (inference making, logical conclusions, and so on)? If yes, do you associate those problems with a certain phenomenon?

The seventh questions stimulates more functions fulfilled by the working memory while measuring the teachers' awareness of this mental faculty. Understanding which tasks are seen more daunting by students could help us to develop an idea before conducting the tests. Given that the differences in verbal working memory capacity are best noticed in tasks which are more 'cognitively taxing', questions targeting surface levels such as titles association and explicit information extractions may blur the said effect.

Table 11

Samples of the Teachers' Answers on which Cognitive Factors are Responsible for Differences in Tasks which are more Cognitively Taxing.

Teacher	Response
1	It depends on the type of the text. If its fiction, they do those tasks easily. If nonfiction text, any phenomenon, they'll find them more difficult.

Teacher	Response
2	Maybe as I told you, being exposed to English, to passages, to reading. This the first thing, maybe, I can think about. I always tell them that any piece of English is considered to be reading, not only novels and stories and books etc. For people who have critical thinking, skills or abilities, they can infer meaning, yes. Because someone higher in critical thinking or with better skills or abilities is not like someone who doesn't have those.
3	As you know we have different types of questions, so it's very obvious to, for example, to find students struggling when it comes to, for example, to answer, let's say, complex questions compared to simple questions.
4	We have many levels within the same group, so when we say that we have many, many levels. We can have for example different types of learners. Some learners who are visual, students, other, who are for ex auditory etc. So the way of learning is not the same, for the let me talk about even the background knowledge, okay? the prior knowledge of students. for example, you can find some students who have strong, euh, background about certain topics, euh, it doesn- it doesn't matter in the L2. you can find, for ex, euh prior knowledge or background knowledge in the first language and they translate they think or they recall such types of information.

Based on the teachers' responses, it appears that students do encounter more difficulties in tasks that are more cognitively demanding, such as inference making and logical conclusions. However, the nature of the text seems to play a role in these difficulties according to Teacher 1 who draw the difference between the two. The students tend to find these tasks easier when working with fiction texts, while nonfiction texts present more challenges. One possible phenomenon associated with these difficulties could be the students' exposure to English and reading materials. The teachers mentioned that being exposed to English passages and various

types of reading materials is crucial for developing critical thinking skills and the ability to infer meaning. Allegedly, the students with stronger critical thinking skills and abilities are more likely to excel in these tasks compared to those who lack such skills.

Furthermore, Teacher 2's response revolved around the diverse learning styles and levels within a group that they also contribute to the difficulties encountered. Different students may have varying learning preferences, such as visual or auditory learners, which can impact their comprehension and ability to engage with the task. Additionally, three out of the four interviewed teachers declared that the students' prior knowledge and background also play a role in their ability to tackle cognitively demanding tasks. The students with a stronger background knowledge may have an advantage in understanding and making logical conclusions in complex tasks.

Briefly, the students do face difficulties in cognitively demanding tasks, especially in nonfiction texts. Based on the four teachers' responses, the challenges may be attributed to factors such as exposure to English, critical thinking abilities, learning styles, and prior knowledge. Addressing these factors through appropriate instructional strategies and providing a supportive learning environment can help students overcome these difficulties and enhance their cognitive skills. At this point, it becomes clearer that no references to the notion of working memory or remotely close faculties, say the executive functions, are made. More importantly, the origins of the capacity differences in dealing with taxing questions were not linked to specific, clear cognitive ability by any of the interviewees, which may reflect a state of unawareness. One should bear in mind that learning styles' pie is shared between cognition, emotional states, cultural settings, prior experience, and environmental factors. Thus, classifying the leaning styles as solely a cognitive aspect will not be reflecting their real nature.

Q08. Bearing in mind that the working memory is a mental faculty supervising information processing and association, and that its 'performance' differs between individuals, do you think it can have an effect on reading comprehension?

The eighth and last question revealed the notion of working memory explicitly. As clarified above, there was a tendency to avoid overt referencing to the notion of working memory as the interviewer hypothesised that teachers' are unfamiliar with it. After some attempts of providing clear and simple definitions on the working memory and the working memory capacity for the interviewees, they all affirmed that the differences they observed are, hypothetically, related to the working memory capacity. Given the fact that it varies from one person to another, the four teachers avowed that it could explain the homogenous information processing and association capacities within the same class and at the same university level.

Table 12

Samples of Teachers' Views on whether the Working Memory can have an Effect on Reading Comprehension

Teacher	Response
1	It's very helpful, a privilege that not all students have. Based on what you said, those differences can definitely originate from this cognitive aspect.
2	Yes, it seems to me like it can have a direct effect on the students' achievement on reading comprehension. Although, of course, it is not the only factor, but yes, I think it surely contributes on making it easier for students who have a better mem- working memory.
3	I agree with this because if you have a better ability to understand you will definitely find less difficulties in dealing with reading comprehension questions. […] the more working memory you have, the easier it is for you to treat questions like the implicit meaning and thematic meaning.

Teacher	Response
4	Yes, it makes sense to me based on the definition you provided. There are always differences in students' answers and I think this could be a reason why not all of them give the same answer.

Holistically, all of the four teachers are positive on a correlation between the working memory capacity and reading comprehension. They seem to believe that the greater the capacity is, the easier it becomes for students' to process and associate data, which helps in treating questions of reading comprehension. In addition, Teacher 3 did affirm that the working memory can be a defining element in the students' efficiency in answering cognitively taxing questions. Through a closer examination, one can deduce that teachers had no knowledge on the working memory as they based all of the answers on the provided definitions. It is probably also worth noting that some of them were asked on whether they are familiar with it, to which they answered negatively.

Teacher 1 thought that it would be beneficial to learn about the working memory, its effect, and foremost how it can be enhanced in order to exploit its maximum potential, "I think it's an interesting aspect that students will benefit from if they improve it". Indeed, the debate on whether the working memory can be improved or not for the purpose of achieving better at reading comprehension remains out of the scope of the study, as achieving this requires a whole different research project. Teacher 1 also added that, "I have so many students who I think have a good 'this memory'.", which demonstrates that upon reflecting on their own experiences, teachers might be able to spot instants where the effect of working memory was somehow more clear.

4.1.2 The Students' Questionnaire

Section one: Personal information

Q1. Specify your tertiary level

Table 13

The Respondents' Tertiary Level

Option	Number
L1	7
L2	23

Figure 4

The tertiary level distribution of the sample
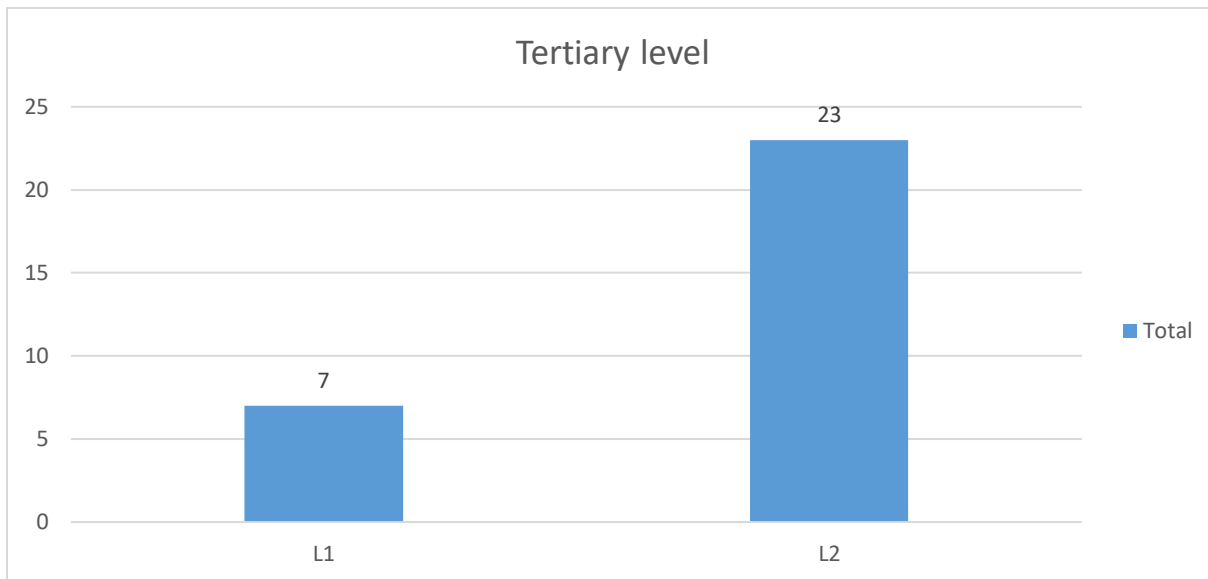
The first section, entitled personal information, seeks to collect data about the students' profiles. The tertiary level of students was collected to ensure that those who participated in the study are of undergraduate level, specifically first and second year license levels, as they are the only two levels concerned with the addition of the Reading module.

Q2. Specify your age

Table 14

The Students' Age

Age	Number
18 years old	2
19 years old	14
20 years old	9
21 years old	3
22 years old	2

Figure 5

The respondents' age distribution
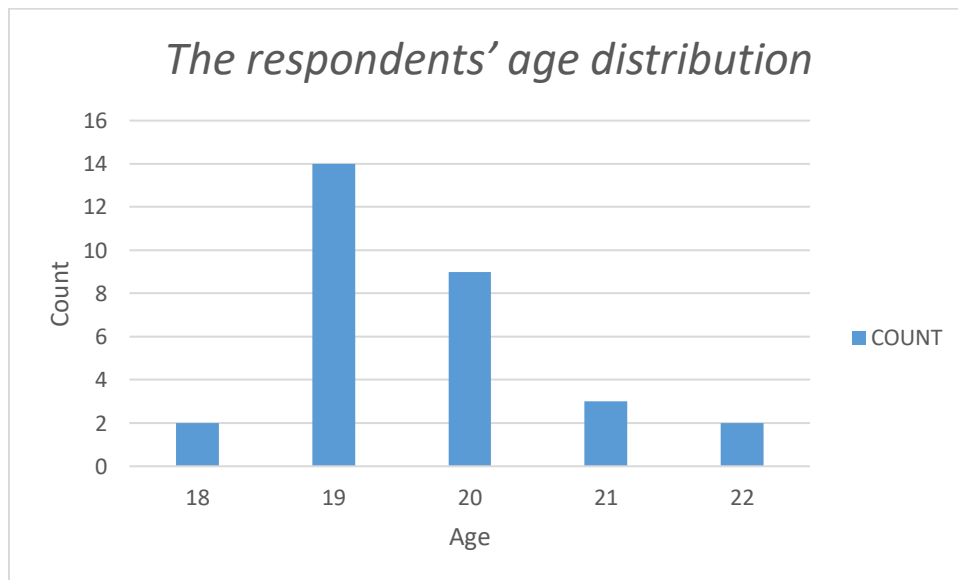
Similar to the previous question, question two sole aim is to ensure a homogeneity in the age range of students. Indeed, age is not always a valid consideration in all research works. However, it is justified in this study to ensure a similar age range due to cognitive changes that might occur between the common age ranges (children, teenagers, young adults, adults, and old

people). If the study incorporated all ages without making clear boundaries between them, the results may not be accurate. Hence, it possible to notice that the chosen sample of the study is composed only of young adults, with the majority being 19 years old of age.

Q3. If you have suffered from any brain injury, please specify it below. In case you have not, please type a "no"

Table 15

Students' History with Brain Injuries

Option	Number
Yes	0
No	30

Lastly in the personal information section, the third question confirms that the participants who agreed to enroll in this study do not suffer from any previous brain injuries, in the broad term. Given that the brain is a sensitive organ, any medical issue might aid in decreasing or increasing certain abilities, and therefore might result in certain anomalies in research findings. Thus, it seemed important to make sure that the participants did not have any medical history with brain injuries or traumas.

Section two: Reading comprehension

Q5. What factors are more likely to increase the difficulty of reading comprehension for you?

Table 16

Respondents' Views on Factors Commonly Causing Difficulties in Reading Comprehension

Response	Count	Percentage
The vocabulary of the text	23	76.6%
The length of the text	14	46.7%
The allocated time for reading the text	9	30%
the questions themselves (i.e.,some questions are more challenging than others)	18	60%
Other	0	0%

The fifth questions defines the beginning of the second section, which aims at seeking whether the selected participants happen to face difficulties in what is presumed to be affected by the working memory. It should be noted that despite offering the option to tick more than one answer, the aim of the question was not, by any means, to look at underlying relations between any of the numerous probabilities. Instead, the objective of this query was to check where students thought to be encountering difficulties in reading comprehension in a holistic view. The options advanced by this question do not provide a detailed view on the problem itself, whether it is related to the working memory or not.

Still, it could be noticed that the length of the text and the nature of the questions were third and second most selected options ticks, with 30% and 60% rate of selection respectively. The students, then, confirmed that some questions which are comparatively more cognitively taxing result in more complications compared to their counterparts. It should be bore in mind that the origins of this issue can be tracked to multiple reasons as the students' language proficiency level,

students' motivation, cognitive factors as working memory, etc. Thus, the results of this question are no more than a mere superficial assumption provided by the respondents' perspectives.

Q6. What type of questions in reading comprehension do you find the most challenging?

Table 17

Respondents' Thoughts on the most Challenging Questions of Reading Comprehension

Option	Count	Percentage
Drawing logical relations and connections	17	56.7%
Deducing (extracting) implicit meaning and messages	16	53.3%
Making predictions	11	36.7%
Finding the general theme of the text	5	16.7%
Suggesting a title for the text	0	0%
Other	1	3.3%

The sixth question can be perceived as a detailed look into the previous one. Inquiring on which types of questions exactly, which in the previous questions were selected 18 times as a recurrent problem, was in our view important as the definition of a "challenging question" may differ. Hence, we specified a number of questions varying in difficulty. For instance, drawing logical relations and connections is arguably more difficult than a title suggestion. Besides, we advanced some types of questions, namely the first three, wherein the notion of working memory may be influential. In this regard, answers of the respondents favoured those types of questions as drawing logical relations and connects was perceived to be challenging 56.7% of the time.

Similarly, implicit meaning inference was chosen next as the most challenging question by 53.3% of total answers. If anything, those ratios point towards a deficiency in those areas. Indeed, the natural difficulty of those questions in comparison to the remaining ones gives them a 'natural' advantage, yet this difference could also be attributed to a number of other factors. It should be kept in mind that those answers are only the results of the respondents' reflections; they do not raise any experimental data that could highlight the direct cause of this problem.

b. To what extent do you agree with the following statements?

Table 18

Students' Responses to Questions of Memory

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Q07. I find it more difficult to understand and retain ideas expressed in long sentences	13.3%	16.7%	20%	46.7%	3.3%
Q08. When reading, I find it difficult to understand and retain many ideas at once.	20%	16.7%	16.7%	36.7%	10%

According to the provided percentages, it seems that 46.7% of the respondents find it more difficult to understand and retain ideas expressed in long sentences. This suggests that a significant portion of individuals struggle with comprehension and retention when confronted with lengthy sentence structures. Similarly, 36.7% percent of respondents struggle in the comprehension and retention of multiple ideas at once. The objective of those two questions was to weigh whether the respondents' faced a challenge in the processing of multiple ideas or longer strings of data. The percentages also indicate that other 13.3% and 20% of the students seem to have no complaints on long sentences and multiple ideas retention and comprehension respectively.

Table 19

Students' Responses to Questions of Memory (9 and 10)

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Q09. When reading, I find it difficult to retain an idea that I read a few lines ago.	20%	30%	20%	30%	0%
Q10. When I finish reading the text, I find difficulties remembering a piece of information mentioned at the beginning of the text.	13.3%	26.7%	20%	30%	10%

The ninth and tenth question were grouped in the present analysis as they serve a similar purpose. According to Baddeley (1992), working memory is responsible for both the storage and processing of information. Hence, the two concerned questions dive into the storage department of the latter, and seek to elicit whether the respondents' would display a tendency to struggle to remember ideas scattered around the text. The answers showed that, in both cases, 30% of participants agreed to face some difficulties in information retention, with 10% who strongly agreed with the second statement. At the same time, 50% and 40% of respondents denied facing difficult moment in remembering pieces of information mentioned in the first instants of texts.

While presenting inconsistencies, the distribution of the results is somehow balanced. It could be noticed that for each of the two questions, 50% of respondents took a negative stance, while the remaining were either neutral or positive about the problem. It is possible that those differences in views are a mere reflection of the fact that working memory capacity differs between individuals (hence, its classification under the individual differences). Besides, similar to the

previously discussed matters, the positive results or the differences in attitudes do not point out directly at the working memory. The factors underlying a difficulty in remembering could be numerous. For instance, familiarity with the subject matter, which by no means has to do with the working memory capacity, could be decisive in the ease of retention of information.

Table 20

Students' Responses to Questions on Processing in Exclusion of Vocabulary

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Q11. Although I am familiar with the text vocabulary, sometimes I feel obliged to repeat some lines multiple times in order to understand.	10%	3.3%	23.3%	33.3%	30%
Q12. Although I am familiar with the text vocabulary, sometimes I feel lost and unable to make sense of what is written.	10%	10%	20%	43.3%	16.7%

Abiding to the same logic of grouping questions aiming at the same objective, the eleventh and twelfth raise the issue of information processing while attempting to exclude the variable of vocabulary. As presumed, and as shown in question five, most respondents evoke vocabulary as a prominent problem in reading comprehension. Therefore, we attempted to check if the respondents would still complain about the information processing in a settings where vocabulary pose little to no issues. After advancing this assumption, 123.3% (out of 200% as both answers are counted combined) of students agreed to experience instances of processing difficulty, while only 33.3% appeared to hold a smooth processing capability. Lastly, 43.3% of respondents remained neutral.

Statistically, the vast majority of participating students seem to undergo firmly issues in processing. Since comprehension is embedded within processing, those issues would then affect the students' ability to understand.

Table 21

Students' Responses on the Extent to which they Encounter Difficulties in Complex Questions

Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Q13. When a question requires some reflection, I find it more difficult..	6.7%	16.7%	26.7%	26.7%	23.3%
Q14. I find it difficult to draw relationships between the abstract concepts (i.e., concepts which are not explicitly mentioned).	3.3%	16.7%	30%	20%	30%
Q15. I find it more difficult to draw logical conclusions than to suggest a title for the text.	10%	16.7%	26.7%	13.3%	33.3%

The last three questions of the questionnaire had as an objective to check the extent to which the respondents' face hitches in types of questions which are arguably more cognitively taxing. By definition, this type of questions require further cognitive processing as the elements needed for a proper answer are usually not explicitly stated; They can be implicitly hinted at or are the product of deduction. The results proved a tendency towards a strong recurrence of this problem as most respondents strongly agreed on the two last statements (30% and 33.3% respectively). At the same time, 23.3% admitted that reflection questions can trigger a greater effort to be dealt with. Oppositely, 16.7% of the respondents, in all of the three statements,

disagreed, meaning they do not seem to be facing any troubles or whatsoever in the advanced type

of questions.

4.1.3 The Reading Proficiency Test Results

Table 22

Students' Scores in the TOEFL-like Reading Proficiency Test

Participant Number	Scores
1	19
2	15
3	17
4	12
5	12
6	15
7	17
8	9
9	20
10	10
11	13
12	10
13	13
14	9
15	6
16	17
17	16
18	13
19	20
20	10
21	15
22	15
23	14
24	13
25	12
26	15
27	16
28	13
29	15
30	11

Table 22 displays the sample's scores (n=30) to a TOEFL-like reading proficiency test. The test consisted of two texts of 15 multiple-choice questions each, with a possible total score of 30. In an attempt to reproduce the conditions wherein Reading examinations are undertaken, the participants had one hour and a half to finish the test, and they were not allowed to use the help of any dictionary or electronic device. The scores range from 6 to 23 with an average of 13.7. According to the TOEFL scale, a 13.7 is perceived as a low-intermediate level (B1) as it falls between the range of 4 to 17.

Table 23

Descriptive Statistics of the Reading Proficiency Test

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
RC	30	14.00	6.00	20.00	13.7333	3.34183	11.168
Valid N (listwise)	30						

4.1.4 The Reading Comprehension Test Results

Table 24

Students' Scores in the Nelson-Denny Reading Test

Participant Number	NDRT Score
1	16
2	14
3	15
4	16
5	13
6	15
7	16
8	16
9	16
10	20
11	21
12	20
13	16
14	18
15	15

Participant Number	NDRT Score
16	20
17	20
18	20
19	22
20	23
21	15
22	15
23	14
24	16
25	19
26	15
27	20
28	20
29	23
30	11

Table 24 displays the sample's scores (n=30) to the adopted version of the NDRT Form E test. The test was scored out of 28, as the vocabulary section as well as the first passage were omitted. The former was overlooked due to its irrelevance regarding the research aims while the latter, meaning the first passage, was rated somehow difficult in accordance to the participants' levels. Besides, it should be noted that the participants were allowed to use dictionaries if needed. Based on the literature review and our presumption, vocabulary was deemed to be of great influence, and might blur the accuracy of the results if one is intending to look straight into the comprehension facet. Furthermore, it could be noticed that the results are varied, ranging from 11 out of 28 to 23 out of 28. This variation in results may be traced back to the non-homogeneous background of the respondents despite sitting for a proficiency test beforehand.

In order to have further insights onto the NDRT Form E test results, descriptive statistics were conducting using IBM SPSS 26. The results are shown in Table 25 as well as Figure 8

Table 25

Descriptive Statistics of the NDRT Form E Test Scores

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
RC	30	11.00	11.00	23.00	17.3333	3.09987	9.609
Valid N (listwise)	30						

Figure 8

Normality Distribution of the NDRT Form E test scores
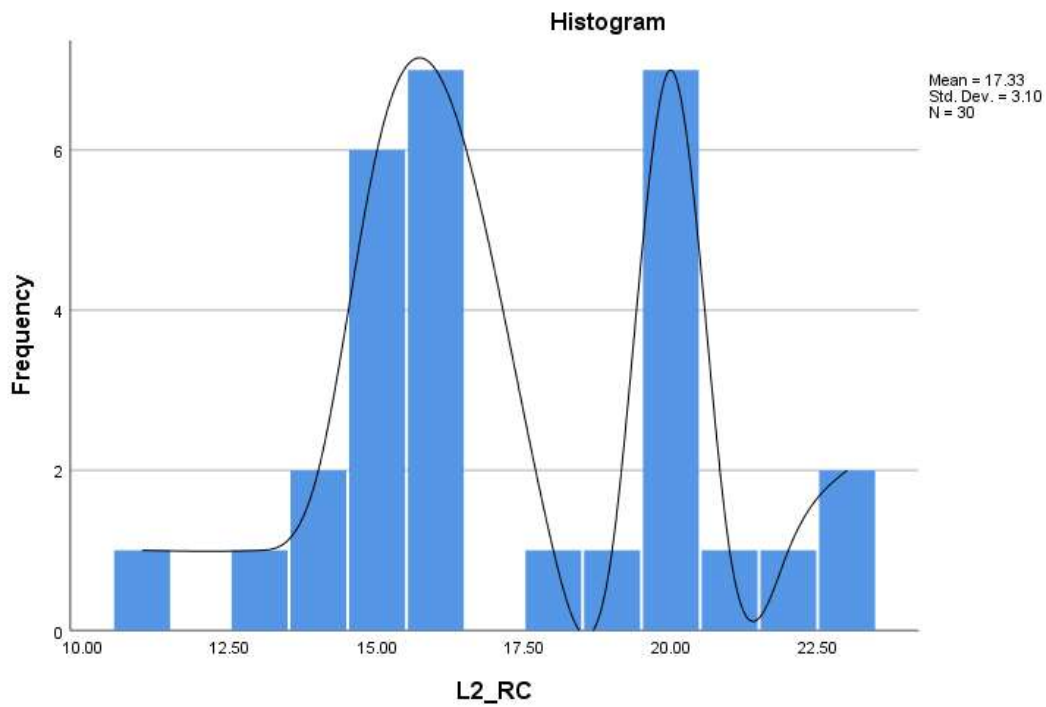
4.1.5 Reading Span Task Test Results

Table 26

Respondents' Scores in the Reading Span Task

Participant Number	RST Score
1	4
2	4
3	4
4	4

Participant Number	RST Score
5	3
6	3
7	4
8	3
9	3
10	5
11	4
12	3
13	3
14	6
15	3
16	4
17	3
18	4
19	4
20	5
21	3
22	3
23	4
24	3
25	3
26	3
27	4
28	4
29	5
30	3

The Reading Span task was selected as it targets both the storage and processing departments of the working memory. According to Danemane and Carpenter (1978), the RST has been found as a better measure for working memory capacity in comparison to the other common measures, such as forward digit span, which target only the storage faculty. The results of the test ranged from 3 to 6; Those results abide to the common range of the working memory capacity averaging from 3 to 7. Similar to the NDRT Form E test scores, descriptive statistics were sought in order to check for normality and further measures.

Table 27

Reading Span Task Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
WMC	30	3.00	3.00	6.00	3.7000	.79438	.631
Valid N (listwise)	30						

Figure 9

Normality distribution of the Reading
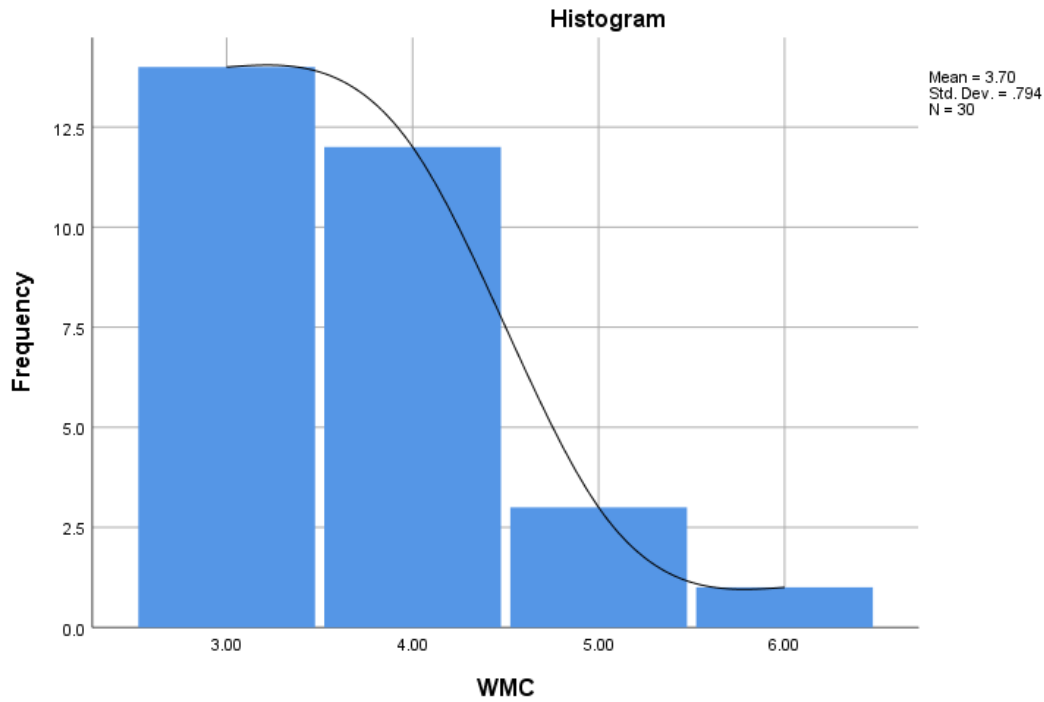
In order to confirm the non-normal distribution of data, Table 27 shows the results of both the Shapiro-Wilk test as well as the Kolmogorov-Smirnov tests of normality in which *Sig.* was found less than .05 (Sig. <.05). Thus, it could be concluded that the scores are not normally distributed.

Table 28

Results of Normality Tests

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
WMC	.278	30	.000	.781	30	.000

4.1.6 Results of the Correlation

Correlation refers to a numerical measure that demonstrates the extent of association between two or more variables. It quantifies the relationship between variables without establishing a cause-and-effect connection. The degree of correlation is determined using a statistic known as the correlation coefficient, often represented as r, which ranges from -1 to 1. When the correlation coefficient is close to zero, it suggests a minimal or negligible relationship between the variables. A correlation coefficient close to one indicates a positive relationship, where an increase in one variable corresponds to an increase in the other. Conversely, a correlation coefficient close to minus one indicates a negative relationship, where an increase in one variable corresponds to a decrease in the other.

An appropriate selection of the statistical analysis method would result in more accurate data. Likewise, if one fails to pick the proper statistical test, the findings may be argued to be less credible and inaccurate. Besides the nature of the study, one should consider four elements in choosing the proper statistical test. While our study ticks the box of numerical data, it fails to achieve random sampling, and normal distribution of scores. The adopted sampling technique was convenience sampling which is classified under the umbrella of non-random sampling methods. Based on Figures 3 and 4, it could be noticed that the scores of the RST test are not normally distributed. Therefore, abiding to the methodological and statistical guidelines, Spearman

correlation test is more fit in this context as it calculates correlation without assuming normality of scores.

Obeying to the conventional, systematic procedure of verifying a possible correlation between two variables, the null hypothesis had to be tested first. The latter denies any statistical association between L2 reading comprehension and verbal working memory capacity. Proceeding the conduction of Spearman bivariate correlation to the scores obtained from both tests (the NDRT Form E and the RST), Table 17 demonstrated a Spearman $\rho= 0.501$, which indicates a positive moderate correlation. Figure 10 shows a scatterplot displaying the relationship between the two measured variables. Based on Mindrila and Balentyne (2013) guidelines on scatterplot's analysis, the direction, strength and form of the fit line shows moderate positive linear correlation.

Based on the data, the null hypothesis (H_0) is rejected and the results are statistically significant with a moderate positive correlation between the verbal working memory capacity and L2 reading comprehension of the studied sample.

Figure 10

Scatterplot Displaying the Correlation between WMC and L2 RC
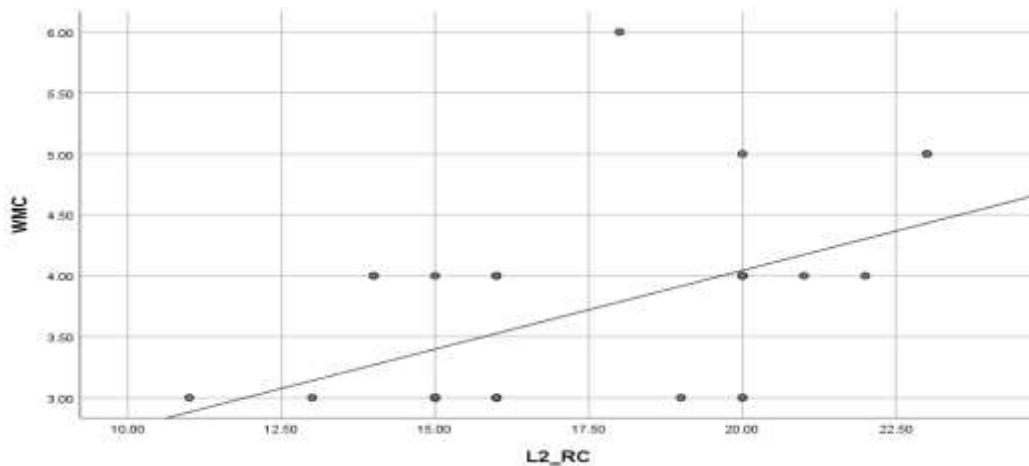
4.2 Synthesis of the Findings

Given that a preliminary analysis of the findings was already discussed in the results section, the following section will provide a more extensive examination and interpretation. This segment aims to clarify the main discoveries of the study, explore potential connections between them, and determine if there are any discrepancies or agreements between the quantitative and qualitative outcomes. It is crucial at this stage to revisit the research questions that guided the study, which were addressed through the implementation of fieldwork and the analysis of both qualitative and quantitative data.

Research question 1: How aware are teachers of Reading regarding the role of cognitive factors in shaping L2 reading comprehension

The first question sought to explore the teachers' awareness on the role of cognition on the students' reading comprehension. Given that no allusion to the cognitive factors was made during the researcher's academic years, the proposed hypothesis claimed that teachers' awareness on the matter was limited. In order to confirm or to disregard this, interviews were held with four teachers of the Reading subject. Interviews allowed for the exploitation and elicitation of information, which would be helpful in coming up with the final decision. The interviews were, then, analysed thematically.

The results of the interviews revealed much deeper data than the presumed one. The novel addition of Reading as an academic subject with neither a proper training beforehand nor a conventional curriculum to be followed resulted in clear diverse approaches to teaching. This diversion is not exclusive to the adopted materials; It was found that while some teachers emphasized reading comprehension, others set their foci on reading strategies and the exploration of different formats of texts. Inconsistencies in the teaching of Reading, eventually, resulted in

varied answers, as teachers relied on their own efforts to keep-up with the requirements of teaching Reading. Termed differently, the responses revealed that, most of the time, teachers provided different answers, which sometimes failed to align. As there was an absence of clear, preconceived guidance on the focus and the approach to teaching the concerned module, each instructor depended on their own view of the importance of reading and constructed their teaching method around it.

For instance, Teacher 1 believed that the familiarization with the different types and formats of texts would be of paramount importance in the academic journey of students, specifically in drafting their MA dissertation. Hence, they laser-pointed all of their attention on developing the students' ability to manipulate the different formats of texts rather than improving their proficiency on dealing with reading comprehension. Arguably, the discussed emphasis may not result in clear hitches as comprehension is often embedded in most reading passages or reading tasks. However, the intentional neglect of the comprehension section can explain the teachers' inadequacy in observing possible difficulties in reading comprehension.

Besides, the interviews also revealed that, more often than not, teachers could not bring up a defined cognitive measure linked to the L2 reading comprehension ability of the students. Mostly, teachers advocated for other factors as vocabulary and lack of reading practice. In fact, the issue of vocabulary was prominent throughout the entire study. The interviewed teachers' first response to the inquiry on problems encounters by their students' in reading classes was always related to vocabulary. Departing from this thought, one may come up with two inferences. First, vocabulary proficiency is a recurrent problem in EFL classes. Though it can be argued that this notion is commonly agreed upon, the teachers' rush into complaints on vocabulary problems further confirms it. Second, the teachers' literacy on problems regarding L2 reading

comprehension is restricted to vocabulary. This can be further justified by their inability to evoke any other significant factor apart from vocabulary. More often than not, the studied teachers limited the scope of their answers to either vocabulary deficiencies or the importance of reading in the enlargement of vocabulary. It could be simply said that the four teachers' views on reading mainly revolved around vocabulary.

As aforementioned, the teachers' answers demonstrated an absence of literacy in terms of cognitive factors. This unawareness could be argued to be stretched even beyond the cognitive factors related to reading comprehension since some answers were debatably irrelevant such as commitment and motivation. Aligning with this, the teachers' did not refer, by any means, to the notion of working memory, which reflects clearly their unawareness on the matter. Indeed, the working memory may be somehow difficult to stumble upon if one is not looking closely on the cognitive factors surrounding reading comprehension, yet the issue of a holistic unawareness on the role of cognition remains even by overlooking the latter.

Based on the teachers' repeatedly falling short when a given question either alludes to or directly points at the role of cognition, generally, and the role of working memory, specifically, it could be concluded that the teachers' literacy on mental faculties capable of affecting reading comprehension is somehow limited.

Research question 2: To what extent do students encounter problems in reading comprehension sections which are more cognitively taxing?

At the beginning of the research work, the researcher built their assumptions on their own experience, as well as the observations of their own classmates. Given that those remarks were limited to different portion of the population, i.e., the researcher's classmates, it seemed important

to inquire on whether the chosen sample would have similar complaints, or not. To achieve this purpose, a structured questionnaire was developed and administered online via google forms to the selected sample. Prior to any interpretations, it should be noted that the questionnaire was not posted publicly, which would have rendered it less credibly. Instead, it was only sent to those who agreed on participating in the study. Next, the questionnaire results were, holistically, in favour of further difficulties met by the students in tasks or questions which are more cognitively demanding, which aligns with the proposed hypothesis for this question.

Though a large portion of the sample admitted experiencing difficulties in, for instance, inference making and making predictions, an approximately equivalent portion opposed those views. In different occasions, they selected options which reflected a relative easiness in questions that are usually more delicate to treat. This inconsistency can be normally interpreted as a direct reflection of the notion of individual differences in any given classroom. In our settings, classrooms are known to lack homogeneity. Putting aside the debate on which extreme of the spectrum serves the students' better, heterogeneity or homogeneity of classes, differences in such views and capacities are perfectly normal. In fact, a case wherein answers were completely one-sided would have raised more questions in such context as heterogeneous classes naturally give raise to such variations.

In addition, the questionnaire emphasized the issue of vocabulary advocated by teacher, which also aligns with other findings of other research works (such as Qarquez & Radzuawn, 2017; Keiw & Shah, 2020). The statistical findings of question five confirm our assumption raised earlier on vocabulary being a persistent problem in EFL classes. The results of the questionnaire could point at different directions as such questions are unable to determine causality of any given problem. For instance, a closer look into the issue of lengthy sentences might be traced back to

more than one problem. Long sentences often require more working memory to process and retain the information. Individuals with limited a WMC may find it particularly difficult to grasp the full meaning of a long sentence and remember all its details. As a result, comprehension and retention would be affected. Furthermore, lengthy sentences may increase the likelihood of encountering unfamiliar vocabulary, complex syntax, or convoluted phrasing, especially given that unfamiliar diction was equally indicated by teachers and students to be causing trouble. These factors can further impede understanding, especially for individuals with lower language proficiency or cognitive challenges.

The findings of the questionnaire align with the hypothesis stated for this question; The researcher assumed that the students meet more difficulties in areas where WM's role is clearer. Questions, where both the storage and processing faculties, are targeted were mostly selected as being more challenging in comparison to simpler questions. Those findings correlate with the teachers' answers. Upon being asked on which questions are more challenging for students, the interviewed teachers confirmed that questions evoking the implicit meaning or those which are reflective in nature are usually more troublesome. Thus, the teachers' observations align with the results of the students' questionnaire in, first, vocabulary being a persistent hitch in EFL classes and, second, in the discussed type of questions demanding more efforts from students.

Research question 3: Is there any significant relationship between the verbal working memory capacity and L2 reading comprehension?

The third and last question constitutes the main aim of our study: to inquire for any correlation between the verbal working memory capacity and L2 reading comprehension. This question was raised based of the preliminary literature review of similar studies, which found out a positive correlation between the two. As already described, we found out a moderate positive

correlation between the two quantitative variables with a correlation coefficient of p= .501. It could

be then deduced that our study findings align well with other similar research works (Georgious

& Das, 2015; Hossain et al., 2015; Bader, 2016; Heriyawati et al., 2018).

The positive, though moderate, correlation between the verbal working memory capacity

and L2 reading comprehension aligns with the previously reached data through the interviews and

the questionnaire. Given that the teachers' confirmed the potential effect of working memory

capacity on reading comprehension upon being familiarized with the concept, and the students'

acknowledgment on finding more issues in dealing with comparatively complex questions were

working memory plays a role, the statistical findings of spearman correlation could successfully

be crosschecked across the three data collection tools.

Furthermore, the attempts to exclude vocabulary as an intervening variable at this step

has become more justified given the results of the interviews and the questionnaire. Indeed, if the

participants were allowed the use of dictionaries, the correlation might still be positive. However,

for the sake of the accuracy of results, allowing the use of dictionaries rendered the results more

credible. Besides, through crosschecking the respondents' questionnaire answers and their tests

results, it could be deduced that a fair number of students' whom denied facing difficulties in

complex questions achieved higher in both the NDRT Form E test and the RST. This further

proves the correlation between the two notions. However, it should be mentioned that not all

students matched perfectly the last observation. In some instances, a high score in the RST was

faced with a relatively low score in the NDRT Form E test. These anomalies can be explained by

the complex nature of reading comprehension since it can be affected by multiple factors, both

cognitive and non-cognitive factors (Sadeghi, 2007). In fact, those factors can even be attributed

to the daily state of psyche of the concerned participants, their will of participation, and similar factors which are more or less difficult to account for.

Conclusion

This chapter was dedicated entirely for the presentation of results and the analysis of collected data and their interpretation. The latter was incorporated through the reliance on qualitative analysis measures for the interviews and descriptive statistics for the questionnaire and the tests. More specifically, the questionnaire relied on descriptive measurements, mainly on percentages, while the correlation was conducted using Spearman correlation given the non-random sampling, and the non-normal distribution of results. The last section was allocated the discussion and synthesis of the results wherein the three research questions were answers and their joint hypotheses were either confirmed or disregarded.

General Conclusion

Ever since FLL started to become more polished in terms of theory, scope, approaches and so on, the enhancement of the four language skills is still perceived as a cornerstone for achieving a proper progress in EFL classes. EFL learners, in this regard, are supposed to hold adequate capacities in manipulating the skill of reading. Although it may seem relatively plain on the surface, reading could be seen as an amalgam of factors wherein minor alterations could be ultimately decisive in the outcome. Comprehension, particularly, calls for a harmony of multiple aspects differing in nature ranging from context familiarity to deeply rooted cognitive footings as inhibition and working memory. Indeed, achieving higher levels of comprehension with deliberate detail to every possible intervening factor or influencing variable could be delicate. At the same time, a fairly better reading comprehension could become a basic requirement for an efficient learning progress.

The study's initial spark originated from the researcher's awareness on a somehow clear deficiency regarding reading comprehension. It could be noticed that a portion of EFL learners repeatedly falls short concerning reading comprehension. Primarily those hitches could be associated with the treated topics, which were mostly domain-specific, wherein specific diction and sentences structures that were arguably daunting for most students were employed. However, the persistence of the matter regardless of the variations of passages formats and content fueled the researcher's trigger. Following his literature review, a map of the sources of difficulties in reading comprehension was pictured. Proceeding this step, it became clear that the problems may be deriving from a cognitive footing. The researcher, then, hypothesized that working memory, a commonly acknowledged factor in reading comprehension, could be one of the reasons revolving the observed problem.

Consequently, the current study aimed at inquiring on whether any association could be found between reading comprehension and working memory. It should be mentioned that a number of studies have already succeeded in identifying a correlation between the two notions, yet the matter is still open to research. The latter is due to the results being context-specific, and to the nature of individual differences which feature a probability of displaying anomalies. In doing so, instructors' awareness on the role of cognition was also brought-up in order to polish any lack of literacy if found.

For this purposes' sake, the present research rested on a Mixed-methods approach stemming from the pragmatic view of the researcher. Besides the default philosophical view, the Mixed-methods approach allowed a proper exploitation of the aims of the study. Correspondingly, a Case-Study Design as an embedded research design were joint in an attempt to appropriately encircle the objectives of the study. Aligning with this decision, a myriad of data collection instruments was adopted. In order to fill the qualitative side of the balance, semi-structured interviews were held with (ex)-teachers of the Reading subject with an aim to survey their awareness, generally, on the role of cognition on reading comprehension and, precisely, on their familiarity with the notion of working memory. Conversely, a questionnaire and two tests were presented to evaluate the sample's difficulties in reading comprehension and to inquire on any correlation between the two variables. Besides, the use of more than one instrument, which approximately flows in the same path permitted to triangulate the findings to an extent.

On the surface, the results revealed a somehow limited teachers' literacy on the role of cognitive factors on reading comprehension and a positive correlation between the two quantitative variables for students. However, a closer and a more thorough look into the findings may display some connections between the different types of the collected data. The teachers' observations on

the recurrent problems in their Reading classes were reflected in the students' questionnaire. In this case, the participants admitted facing further issues in vocabulary and complex questions, both of which were highlighted by the interviewed teachers. Additionally, it could be argued that the questionnaire results were also reflected in the correlation found by the end, which was settled with a correlation coefficient of .501. The alignment of the findings of the different adopted data collection instruments validates, to an extent, the role of working memory in reading comprehension. Indeed, the reached correlation does not, by any means, equal to causation. However, it is safe to assume that working memory holds an influence on reading comprehension.

Departing from the last statement, the present study does not seek to point-out the main factor underlying the deficiencies or differences in reading comprehension. It merely built a basis upon which further investigations, whether locally or not, could be conducted. In order to optimize the EFL teaching-learning experience, further research may devote more efforts in investigating specifically the most influential variables on RC. Stepwise, given the documented results on of the interviewed teachers, other studies may strive to enhance the awareness on the influence of the different cognitive factors and its effect on RC.

Recommendations and Implications

This section aims to provide practical recommendations based on the conclusions drawn from the study. To address these concerns effectively, it is essential to take specific actions. Drawing inspiration from the overall findings of the study, the suggestions put forth by both students and teachers, and the shared aspects between them, the following recommendations and implications are provided for teachers and students.

- Teachers should enhance their awareness on the role of cognition. They might take part in trainings, seminars, or other instructional events that specifically address the role of cognitive factors in L2 reading comprehension. This will help them better understand and incorporate cognitive strategies into their teaching practices.

- A clear curriculum for Reading subject should be developed. This will ensure consistency across classrooms and provide teachers with guidelines for focusing on both reading comprehension and reading strategies.

- Raise awareness of students on cognitive factors more explicitly. The latter may help in improving reading comprehension, such as activating prior knowledge, making connections, visualizing, and monitoring comprehension.

- Implement diverse reading comprehension tasks wherein monotony of questions is avoided.

- Students might attempt to improve their working memory through engaging in activities that enhance their working memory capacity, such as practicing active reading techniques, summarizing information, and engaging in memory exercises. These strategies can improve their ability to process and retain information while reading.

- Although laying out of the outlined aims of the study, students should expand their vocabulary knowledge. This can enhance their comprehension of texts and facilitate overall language proficiency.

- Students should familiarize themselves with the effect of the different cognitive factors on RC. By doing so, they may be able to recognize more of their strengths and weaknesses; they, then, should exploit their strengths more and polish their weaknesses.

- Eventually, we come to realize that the variable of RC could be sliced into further, smaller segments. In order to be aware on the exact point of correlation, and to achieve more accurate results, researchers may attempt to seek the correlation of WM with a specific aspect of RC instead of dealing with the latter variable as a whole.

Limitations and Suggestions for further research

Admittedly, one research work cannot reach perfection. Factors, or limitations, are either intentionally applied on any given study. In this regard, limitation of terms are those uncontrollable factors marking weakness in the study. They are usually shortcomings on the adopted methodology. Theofanidis and Fountouki (2019) explain the term as, "[...] are closely associated with the chosen research design, statistical model constraints, funding constraints, or other factors..." (p.156). The uncontrollable nature of limitations does not impede their effect on the study, yet suggestions for more optimized future research works could be elicited from them.

It should be mentioned that although the selection of the RST was not arbitrary as it was based on studies confirming its efficiency, as well as the research context, the RST itself suffers of issues of subjective judgment. The lack of a standardized list of sentences that should be relied upon when using the RST assigns the effort of developing sentences to the researcher. While this may present some advantages as taking the participants language proficiency level into consideration, it affects the rigidity of the test as, for one, the researcher's judgment may be flawed and, for two, the results of the studies may differ because of the matter. Accordingly, more sophisticated measures may be adopted as a replacement to the RST.

On the same note, the unavailability of advanced tools as EEGs and MRIs somehow restricted the findings to arguably a superficial level. While the results were positive, reliance on

such instruments may be helpful in the brain and its different cognitive faculties in details. In relevance to our study, the activated areas of the brain during reading comprehension tasks could be pointed-out.

In the same realm of data collection instruments, the questionnaire is subject to limitations such as recall bias, social desirability bias, and subjective interpretations. In this respect, participants may interpret questions differently based on their own understanding or perspectives. This can lead to variations in responses, making it difficult to compare or generalize findings across participants. Researchers may also interpret participants' responses subjectively, introducing potential biases in data analysis and interpretation.

Lastly, the sample size and sampling technique adopted in the research work obstructed the generalization of the findings. Indeed, the conducted choices regarding those two matters were in favour of the feasibility of the present study. However, further works may shift to random sampling techniques that promise findings that are more accurate as well as enlarging the size of the sample to incorporate further participants, whether of the same age range and medical history or not, that may yield interesting data.

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Appendices
Appendix A: Participant Informed Consent

Participant Informed Consent

Dear Participant,

As a part of the completion of this research work, you are kindly invited to take part in this investigation. The present letter aims at detailing the study's main idea, aim and process. Besides, it also serves to guarantee the safety of your personal information and the answers you provide.

The present study's purpose falls on investigating the correlation between working memory capacity and EFL learners' reading comprehension. Accordingly, the researcher will

supervise a set of three tests aiming, altogether, at achieving the said objective.

In this regard, you are kindly invited to take part in this research. In case of agreement, you will be invited to sit for three tests scheduled separately. Besides, a questionnaire will also be administered aligning with the study's aims.

Please be assured that your anonymity and privacy will be completely protected, and the data you provide will serve solely the present research.

If you agree on participating in this study, please sign the attached consent form. Your cooperation will be greatly appreciated.

For any further inquiries regarding this research project, you are welcome to contact the researcher.

Yours sincerely,

Researcher Contact Details:

Zakaria Mohamed ATHMANI

Email: med.zakaria.athmani@gmail.com

Mohamed Kheider University of Biskra

Faculty of Letters and Foreign Languages

Department of English Language and Literature

I have read and clearly understood the researcher's request. I consent to volunteering as a participant in the research project being undertaken by Zakaria M. ATHMANI

Name:…………………………………………………………………….

E-mail:…………………………………………………………………

University:………………………………………………………………..

Faculty:…………………………………………………………………...

Department:…………………………………………………………….....

Date:…………...................

Signature

Appendix B: Consent Letter for the Head of the department of English Language and

Literature

Informed Consent

Dear Head of the English Language and Literature Department,

Aligning with my MA thesis, I am conducting a research study investigating the correlation between working memory capacity and learners' reading comprehension. In essence, I will be carrying a total of three tests on a portion of second year students of English.

Hence, I am kindly requesting your consent to supervise the participants during the mentioned tests, which aim at examining a possible relationship between working memory capacity and the students' reading comprehension. Prior to that, a questionnaire aiming at validating the problem will be administered.

Anonymity, privacy and confidentiality of participants will be protected, and the gathered data will only assist our research findings.

If you consent to the participation of these students in this study, please sign the attached consent form.

Your permission is highly appreciated.

Please contact the researcher in case of confusion or ambiguity.

Yours sincerely,

Researcher Contact Details:

Zakaria Mohamed ATHMANI

Email: med.zakaria.athmani@gmail.com

Mohamed Kheider University of Biskra

Faculty of Letters and Foreign Languages

Department of English

I have read and clearly understood the researcher's request. I consent to allowing second year

students to participate in the research project conducted by Zakaria M. ATHMANI

Name:……………………………………………………………………….

E-mail:………………………………………………………………………

University:………………………………………………………………..

Faculty:…………………………………………………………………..

Department:…………………………………………………………….

Please sign here

Date:…………….................

Appendix C: Interviewees Informed Consent

Informed Consent

Dear,

 As a part of the completion of this research work, you are kindly invited to take part in this investigation. The present letter aims at detailing the study's main idea, aim and process. Besides, it also serves to guarantee the safety of your personal information and the answers you provide.

The present study's purpose falls on investigating the correlation between working memory capacity and EFL learners' reading comprehension. Accordingly, the researcher

will hold a total of six (6) interviews so as to collect data aligning with this study purposes.

In this regard, you are kindly invited to take part in this research. In case of agreement, you will be invited to sit for an interview once the schedule is arranged.

Please be asssured that your anonymity and privacy will be completely protected, and the data you provide will serve solely the present research.

If you agree on participating in this study, please sign the attached consent form. Your cooperation will be greatly appreciated.

For any further inquiries regarding this research project, you are welcome to contact the researcher.

Yours sincerely,

Researcher Contact Details:

Zakaria Mohamed ATHMANI

Email: med.zakaria.athmani@gmail.com

Mohamed Kheider University of Biskra Faculty of Letters and Foreign Languages

Department of English Language and Literature

I have read and clearly understood the researcher's request. I consent to volunteering as a participant in the research project being undertaken by Zakaria M. ATHMANI

Name:…………………………………………………………………….

E-mail:……………………………………………………………………

University:………………………………………………………………..

Faculty:…………………………………………………………………...

Department:……………………………………………………………...

Please sign here

Date:……………

Appendix D: Consent Letter for the Deputy in Charge of the Pedagogy of the English Department

Informed Consent

Dear Deputy in Charge of the Pedagogy of the English Department,

Aligning with my MA thesis, I am conducting a research study investigating the correlation between working memory capacity and learners' reading comprehension. In essence, I will be carrying a total of three tests on a portion of second year students of English.

Hence, I am kindly requesting your consent to supervise the participants during the mentioned tests, which aim at examining a possible relationship between working memory capacity and the students' reading comprehension. Prior to that, a questionnaire aiming at validating the problem will be administered. In addition, we may hold the interviews in the teachers' lounge or empty classes during the students' breaks, for which we humbly ask for your consent.

Anonymity, privacy and confidentiality of participants will be protected, and the gathered data will only assist our research findings.

If you consent to the participation of these students in this study, please sign the attached consent form.

Your permission is highly appreciated.

Please contact the researcher in case of confusion or ambiguity.

Yours sincerely,

Researcher Contact Details:

 Zakaria Mohamed ATHMANI

Email: med.zakaria.athmani@gmail.com

Mohamed Kheider University of Biskra

Faculty of Letters and Foreign Languages

Department of English

I have read and clearly understood the researcher's request. I consent to allowing second year

students to participate in the research project conducted by Zakaria M. ATHMANI

Name:……………………………………………………………………….

E-mail:……………………………………………………………………

University:………………………………………………………………..

Faculty:…………………………………………………………………..

Department:……………………………………………………………....

Please sign here

Appendix E: The Interview Questions

Teachers' interview

1. How long have you been teaching EFL?

2. Knowing that the Reading subject was added recently into the first and second year
   license levels curricula, were you in favour of this decision? Please elaborate on your
   stance?

3. Would you, please, explain how you usually hold a typical reading session, including the
   preparations you make, the factors on which you rely when choosing a text for example,
   etc.?

4. What problems do your students usually encounter in reading comprehension?

5. Do you think that reading comprehension, as a process, is impacted by cognitive factors?
   If yes, would you please cite any examples of relevant cognitive notions? If no, would
   you please explain why?

6. Have you noticed any difficulties or differences in the students' ability to associate or to
   process information?

7. Given your experience, do students find more difficulties in tasks that are more
   cognitively demanding (inference making, logical conclusions, and so on)? If yes, do you
   associate those problems with a certain phenomenon?

8. Bearing in mind that the working memory is a mental faculty supervising information
   processing and association, and that its 'performance' differs between individuals, do you
   think it can have an effect on reading comprehension?

Appendix F: The Students' Questionnaire

Students' Questionnaire

Dear student,

You are kindly invited to provide responses to the present questionnaire, attempting to examine certain difficulties encountered in reading comprehension. Please do thoroughly read and reflect on the questions, as your answers will aid the progress of our study.

Be certain that your anonymity is ensured and the provided answers will be used only for academic purposes aligning with our research aims. Please bear in mind that your answers will not be judged (there is no correct or wrong answer), and that you can rightfully skip a possibly offensive or uncomfortable question-item.

In case of inquiries, or if in need of further clarification, do not hesitate to contact us at med.zakaria.athmani@gmail.com

The researcher

Section I: Personal Information

Q01. Specify your tertiary level:

- L1 ☐
- L2 ☐

Q02. Specify your age: ☐

Q03. If you have suffered from any brain injury, please specify it below. In case you have not, please type a "no"?

....

Section Two: Reading Comprehension

Please answer the following questions as indicated in the instructions.

a. Order the following options from the most difficult to the least difficult

Q05. What factors are more likely to increase the difficulty of reading comprehension for you?

- The vocabulary of the text. ☐
- The length of the text. ☐
- The allotted time for reading the text. ☐
- The questions themselves (i.e., some questions are more challenging than others) ☐
- Other: ....

Q06. What type of questions in reading comprehension do you find the most challenging?

- Suggesting a title for the text. ☐
- Making predictions ☐
- Drawing logical relations and connections ☐
- Deducing (extracting) implicit meaning and messages. ☐
- Finding the general theme of the text ☐
- Other: ....

b. To what extent do you agree with the following statements?

The item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Q07. I find it more difficult to understand and retain ideas expressed in long sentences.					
Q08. When reading, I find it difficult to understand and retain many ideas at once.					

Q09. When reading, I find it difficult to retain an idea that I read a few lines ago.					
Q10. When I finish reading the text, I find difficulties remembering a piece of information mentioned at the beginning of the text.					
Q11. Although I am familiar with the text vocabulary, sometimes I feel obliged to repeat some lines multiple times in order to understand.					
Q12. Although I am familiar with the text vocabulary, sometimes I feel lost and unable to make sense of what is written.					
Q13. When a question requires some reflection, I find it more difficult.					
Q14. I find it difficult to draw relationships between the abstract concepts (i.e., concepts which are not explicitly mentioned).					
Q15. I find it more difficult to draw logical conclusions than to suggest a title for the text.					

Thank you for your participation,

Appendix G: The Opinnionaire (Sample)

The Opinionnaire

1. Are there any repetitive questions?

Yes ☐   No ☐

 - If yes, please specify them.

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

2. Did you find any grammar/spelling mistakes in the questions?Yes

☐   No ☐

 -If yes, please notify them below.

……………………………………………………………………………………………

……………………………………………………………………………………………

………………………………………………………………………………………..

3. Are there any irrelevant questions that need to be removed?

Yes ☐   No ☐

 -If yes, please provide the number of the question(s) below.

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………….

4. Is the questionnaire of reasonable length?Yes

☐   No ☐

5. Is the questionnaire of reasonable length?

Yes ☐ No ☐

6. Are there any ambiguous questions that need to be reformulated and / or clarified?

Yes ☐ No ☐

-If yes, please indicate which questions require rewording.

…………………………………………………………………………………………………

…………………………………………………………………………………………………

………………………………………………………………………………………………

7. What do you think of the layout?

…………………………………………………………………………………………………

…………………………………………………………………………………………………

………………………………………………………………………………………………

8. Are the response categories appropriate?

Yes ☐ No ☐

9. If there are any questions that you believe are of close relevance to the purposeof the questionnaire but were not included, please write them below.

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

Thank you very much for your time and collaboration

Appendix H: The Validation Form (Sample)

Validation Form

I hereby certify that I have read the students' questionnaire in the study carried out by Zakaria M. ATHMANI who is presently working on his MA dissertation at Biskra University. I have provided the researcher of this study - investigating the correlation between working memory capacity and reading comprehension - with remarks and comments concerning the layout, as well as the contents of the questionnaire.

Background Information on the Expert:

Name:…………………………………………………………….

University:…………………………………………………...

Present Occupation:…………………………………………………...

Degree:…………………………………………………………..

Telephone Number:…………………………………………………...

Email Address:…………………………………………………..

Signed:…………………………………………………………..

Researcher Contact Details:

Zakaria M. ATHMANI

Email: med.zakaria.athmani@gmail.com

Mohamed Kheider University of Biskra

Faculty of Letters and Foreign Languages

Department of English Language and Literature

Appendix I: TOEFL-like reading proficiency test (Text 1)

The Four Great Kangaroos

Although the kangaroo is Australia's most famous <mark>indigenous</mark> species, few people outside of the country know many details about the animal. In fact, there are several different kangaroo species, including the western grey kangaroo, the eastern grey kangaroo, the red kangaroo, and the antilopine kangaroo. Though still bound together by traits characteristic of the genus Macropus, the four different types of kangaroo--also known as the four "Great Kangaroos," as they are the largest species in the genus--can behave very differently in terms of their native habitats, activities, and migration patterns.

The eastern grey kangaroo lives, as its name implies, on the east coast of Australia. Not only is the eastern grey the most common kangaroo, but it is also the quickest, as the fastest recorded kangaroo was a large female traveling at 40 miles per hour. It is by far the most populous kangaroo species; around ten million eastern greys inhabit the continent. To put that in perspective, Australia's current human population is only 23 million. The eastern grey prefers to inhabit large open areas of grassland, with <mark>shrubbery</mark> for daytime shelter, as it forages for food at night. Nevertheless, eastern greys have been seen in various climates, including coastal areas, woodlands, subtropical forests, and mountainous regions.

■The western grey is difficult to distinguish from the eastern grey; for many years, the two were thought to belong to the same species. ■The western grey is distinguished, in the first place, by its habitat, on the west (rather than the east) coast of Australia. ■Secondly, it is different from the eastern grey in that it is a very vocal species. ■Mother western grey kangaroos communicate to their offspring, or joeys, with a series of clicking noises, which eastern grey mothers do not do. Though less <mark>adaptable</mark> than the eastern grey, the western grey can still be found in a variety of habitats, including grasslands, forests, or woodlands near water. Zoologists believe that the population of western grey kangaroos increased dramatically as Europeans settled in Australia, because this led to the creation of more pastures, where members of the species could find their main food source, grass.

Unlike the two species of grey kangaroos, the red kangaroo is found throughout Australia, though there is a concentration of reds in the west corner of New South Wales, in the

southeastern part of the country. The red has the ability to store water for periods of time, and so does not need to inhabit the same fertile areas as its grey cousins. Instead, this species can be found in more **arid** climates, including scrubland and deserts. The species has a remarkable ability to find nutritious food sources even in areas that seem devoid of life. Less social and more nomadic than the grey kangaroos, the red has the distinctions of being the largest of all kangaroos, the largest mammal native to Australia, and the largest living marsupial.

Finally, the antilopine kangaroo breaks the trend among the three greats named for their color, drawing instead from a comparison to the antelope, which zoologists thought the kangaroo resembled with its distinctive appearance. Traveling in packs of up to 30 kangaroos, the antilopine inhabits the northern tropical and western regions of Australia, preferring flat, open lands, though their habitat does sometimes extend to eucalyptus woodlands. Like the eastern gray, the antilopine sleeps under the shade of shrubs during the hottest part of the day, grazing during the evenings from approximately an hour after sunset until 8am. It has the largest range of all the great kangaroo species, and is known to travel up to a third of a mile (76 hectares) from its group's territory. In the wet season, antilopine females outnumber the males by a ratio of two to one; in the dry season, this increases to three to one.

Even these four species of kangaroos do not fully represent their genus. Although the most populous are the "great" kangaroos, or the largest, there are many other, smaller species (up to 47) found throughout Australia. Like the four greats, these kangaroos are often descriptively named. There are large populations of tree-kangaroos, for example, in wooded areas, as well as various species of rat-kangaroos. If you're traveling through Australia, keep your eyes open: You never know if you're actually looking at a kangaroo you never knew existed.

Question 01: The word "**indigenous**" in paragraph 1 is closest in meaning to

    A. Large

    B. Important

    C. Known

    D. Local

Question 02: The author discuess the term "The Great Kangaroos" in paragraph 01 in order to emphasize the kangaroos'

A. Prevelance

B. Importance

C. Fame

D. Size

Question 03: According to paragraph 02, the eastern grey kangaroo is different from other species in its:

A. Population size

B. Preferred habitat

C. Occupation of varied climates

D. Distinctly larger body

Question 04: The word "**shrubbery**" in paragraph 02 is best closest in meaning to:

A. Trees

B. Grass

C. Bushes

D. Caves

Question 05: It can be inferred from paragraph 03 that

A. European settlement in Australian led to a decrease in the numbers of eastern grey kangaroos as farmland took over.

B. When Europeans settled in Australia, they cultivated the land on heir homesteads so that grew grass.

C. The increased numbers of western grey kangaroos helped to distinguish them from eastern grey kangaroos

D. Europeans settlers did not find the western grey kangaroos threatening because of the soothing clicking sounds the kangaroos made.

Question 06: The word "**adaptable**" in paragraph 03 is closest in meaning to

A. Flexible

B. Common

C. Agile

    D. Mobile

Question 07: Which of the sentences below best expresses the essential information in the highlighted sentence in paragraph 04? Incorrect answers would change the meaning or leave out essential information.

    A. New South Wales, in southeastern Australia, is important as a sanctuary for red kangaroos.

    B. Red kangaroos are similar to grey kangaroos in many ways, except where they could be found.

    C. Grey kangaroos cover a wider area of the country than the red kangaroo, which is only found in the southeast.

    D. Red kangaroos are different from other species because they inhabit different areas of Australia.

Question 08: According to paragraph 4, red kangaroos are able to be more nomadic than either species of gray kangaroo because the reds

    A. Can find food in any environment, even when other animals cannot.

    B. Do not need to stay with a tribe, because they live as individuals.

    C. Their larger size allows them to travel far due to their longer stride.

    D. Their ability to retain water lets them live in different climates.

Question 09: The word "arid" in paragraph 4 is closest in meaning to

 A. Distant

 B. Diverse

 C. Dry

 D. Difficult

Question 10: The author's discussion of the antilopine kangaroos' gender balance in paragraph 5 indicates that

A. it varies according to the season

B. it favours large populations of males

C. it is caused by the species' ability to travel

D. Antilopine kangaroos thrive in the rain

Question 11: According to paragraph 5, which of the following is NOT a unique feature of the antilopine kangaroo?

A. Appearance

B. Radius of travel from its pack

C. The origin of its name

D. Its preferred habitat

Question 12: The phrase "these kangaroos" in paragraph 6 refers to

A. Great Kangaroos

B. tree and rat kangaroos

C. all kangaroos

D. smaller kangaroos

Question 13: Look at the four squares [■] that indicate where the following sentence can be added to the passage. "However, the Western and Eastern Grey kangaroos actually do not interbreed and remain entirely separate". Where would the sentence best fit?

A. First square

B. Second square

C. Third square

D. Fourth square

Question 14: An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the **THREE** answer choices that express the most important ideas in the passage. Some sentence do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

There are four main kinds of kangaroos in Australia, known as the "Great Kangaroos."

A. Individual species of kangaroo vary in their activities and habitat.

B. The eastern and western kangaroo are often confused.

C. The Great Kangaroos pre-dated European settlement in Australia

D. These kangarooos include the eastern and western greys, the red, and the antilopine kangaroos.

E. Some species of kangaroo are nocturnal and sleep during the day.

F. Kangaroo species are not limited to the Great Kangaroos.

Appendix J: TOEFL-like reading proficiency test (Text 2)

Directions: Read the passage below and answer the questions.

History of the Chickenpox Vaccine

Chickenpox is a highly contagious infectious disease caused by the Varicella zoster virus; sufferers develop a fleeting itchy rash that can spread throughout the body. The disease can last for up to 14 days and can occur in both children and adults, though the young are particularly vulnerable. Individuals infected with chickenpox can expect to experience a high but **tolerable** level of discomfort and a fever as the disease works its way through the system. [**The ailment was once considered to be a "rite of passage" by parents in the U.S. and thought to provide children with greater and improved immunity to other forms of sickness later in life].** This view, however, was altered after additional research by scientists demonstrated unexpected dangers associated with the virus. Over time, the fruits of this research have transformed attitudes toward the disease and the utility of seeking preemptive measures against it.

A vaccine against chickenpox was originally invented by Michiaki Takahashi, a Japanese doctor and research scientist, in the mid-1960s. Dr. Takahashi began his work to isolate and grow the virus in 1965 and in 1972 began clinical trials with a live but weakened form of the virus that caused the human body to create antibodies. Japan and several other countries began widespread chickenpox vaccination programs in 1974. However, it took over 20 years for the chickenpox vaccine to be approved by the U.S. Food & Drug Administration (FDA), finally earning the U.S. government's seal of approval for widespread use in 1995. Yet even though the chickenpox vaccine was available and recommended by the FDA, parents did not immediately choose to vaccinate their children against this disease. Mothers and fathers typically cited the **notion** that chickenpox did not constitute a serious enough disease against which a person needed to be vaccinated.

Strong belief in that view eroded when scientists discovered the link between Varicella zoster, the virus that causes chickenpox, and shingles, a far more serious, harmful, and longer-lasting disease in older adults that impacts the nervous system. They reached the conclusion that Varicella zoster remains dormant inside the body, making it significantly more likely for someone to develop shingles. As a result, the medical community in the U.S. encouraged the

development, adoption, and use of a vaccine against chickenpox to the public. Although the appearance of chickenpox and shingles within one person can be many years apart—generally many decades—the increased risk in developing shingles as a younger adult (30-40 years old rather than 60-70 years old) proved to be enough to convince the medical community that immunization should be preferred to the traditional alternative.

Another reason that the chickenpox vaccine was not immediately accepted and used by parents in the U.S. centered on observations made by scientists that the vaccine simply did not last long enough and did not confer a lifetime of immunity. In other words, scientists considered the benefits of the vaccine to be temporary when given to young children. They also feared that it increased the odds that a person could become infected with chickenpox later as a young adult, when the rash is more painful and **prevalent** and can last up to three or four weeks. Hence, allowing young children to develop chickenpox rather than take a vaccine against it was believed to be the "lesser of two evils." This idea changed over time as booster shots of the vaccine elongated immunity and **countered** the perceived limits on the strength of the vaccine itself.

Today, use of the chickenpox vaccine is common throughout the world. Pediatricians suggest an initial vaccination shot after a child turns one year old, with booster shots recommended after the child turns eight. The vaccine is estimated to be up to 90% effective and has reduced worldwide cases of chickenpox infection to 400,000 cases per year from over 4,000,000 cases before vaccination became widespread. In light of such statistics, most doctors insist that the potential risks of developing shingles outweigh the benefits of avoiding rare complications associated with inoculations. Of course, many parents continue to think of the disease as an innocuous ailment, refusing to take preemptive steps against it. As increasing numbers of students are vaccinated and the virus becomes increasingly rarer, however, even this trend among parents has failed to halt the decline of chickenpox among the most vulnerable populations.

Question 1: the word "**tolerable**" in paragraph 01 is closest in meaning to

   A- Sudden
   B- Bearable

C- Infrequent

D- Unexpected

Question 2: According to paragraph 01, which of the following is the true chickenpox virus?

A- It leads to a potentially deadly disease in adults.

B- It is associated with possibly permanent rash.

C- It is easily transmittable by an infected individual.

D- It has been virtually eradicated in the modern world

Question 03: Which of the following best expressed the following sentence (underlined in paragraph 01) [**The ailment was once considered to be a "rite of passage" by parents in the U.S. and thought to provide children with greater and improved immunity to other forms of sickness later in life]** Incorrect answer choices change the meaning in important ways or leave-out essential information

A- U.S parents believed that having chickenpox benefited their children.

B- U.S parents believed that chickenpox led to immunity against most sickness.

C- U.S parents wanted to make sure that their children developed chickenpox.

D- U.S parents did not think that other vaccinations were needed after chickenpox.

Question 04: Which of the following can be inferred from paragraph 02 about the clinical trials of the chickenpox vaccine?

A- They took longer than expected.

B- They cost a lot of money to complete.

C- They took a long time to finish.

D- They were ultimately successful.

Question 05: The word "**notion**" in paragraph 02 is closest in meaning to:

A- History

B- Findings

C- Fact

D- Belief

Question 06: According to paragraph 03, which of the following is true of *Varicella Zoster*?

A- It typically attacks adults who are over 60 years old.

B- It is linked to a serious disease that occurs more commonly in adults.

C- It likely is not a serious enough threat to human health to require a vaccine.

D- It is completely eradicated from the body after chickenpox occurs.

Question 07: The word **"prevalent"** in paragraph 04 is closest in meaning to:

A- Dangerous

B- Widespread

C- Infectious

D- Contaminated

Question 08: The author uses **"booster shots"** as an example of

A- A scientifically approved medicine to eliminate chickenpox

B- A preferred method of chickenpox rash and fever treatment

C- A way to increase effectiveness of chickenpox vaccine.

D- A strategy for parents to avoid vaccinating their child together

Question 09: The word "**countered"** in the passage is closest in meaning to:

A- Affirmed

B- Refuted

C- Supported

D- Defied

Question 10: According to paragraph 04, many parents did not choose the chickenpox vaccine because

A- They believed that the virus was weak and especially harmful.

B- They thought the scientists did not have enough data to reach a conclusion.

C- They were unsure about the utility of the vaccine given its expected duration.

D- They were convinced it was potentially very toxic, particularly for older children.

Question 11: According to paragraph 05, which of the following was true of the rates of chickenpox before the chickenpox vaccine became widely used?

A- It was 10 times higher.

B- It was consistently rising

C- It declined over time.

D- It fluctuated over several decades.

Question 13: Complete the table below by indicating which systems describe chickenpox and which describe shingles.

Chickenpox	Shingles

A- Public vaccination campaigns against it began in the 1970s.

B- It was considered an irksome but relatively harmless ailment.

C- It primarily afflicts adults

D- It is a serious, lingering illness.

E- It negatively affects the nervous system.

F- Infection primarily occurs as a result of close contact with infected rashes.

G- There is a confusion as to what exactly virus causes it

Appendix K: Teacher 1 Interview Transcript

The Researcher: So, good morning, this is AMZ, and this is the interview with T1. so this interview

is under the study in which we're investigating the correlation between VWMC and L2 RC.

Teacher 1: Okay

The Researcher: We'll start first with a very introductory question, just to break the ice, and then

we'll get into stuff that are more technical.

Teacher 1: Okay

The Researcher:Just a very general question, how long have you been EFL ?

Teacher 1: Should i- Good morning, should I count the years when I was a supplement teacher?

The Researcher: Yes, sure, any experienc

Teacher 1: Since 2009

The Researcher: 2009, more than eleven years. So, we move to the second question. We know that

the reading subject was added recently. I myself haven't been taught reading in university. Were

you in favour of this decision? Were you against the addition of reading as a module?

Teacher 1: No, of course. I support the decision **(chuckles)** I, I do this all the time even if it is not

scheduled in this syllabus, but I insist on them to read, I want them to read as much **(unintelligible)**

The Researcher: So can you el- Okay, you elaborated on why you in favour of course, so you've

always been af fan of introducing reading even when you didn't have to. So-

Teacher 1: Yes, yes, yes, I teach oral expression **(chuckles)** I give them homeworks where they

have to read.

The Researcher:Okay, I really understand. So you are a teacher of reading now, would you please

explain how a typical reading session is usually held? How do you usually start, which materials

you provide, just very briefly.

Teacher 1: No, in general I, euh, I provide them with a book. It's a nice book, a very interesting book, and very useful book for teaching reading. It contains what? Euh, the different types of reading, and, euh, related with texts, then questions about this texts. Those questions are usually not related to the content of the text, no. they are related to the format-

The Researcher: Ah, I see.

Teacher 1: They are related to the format of the text, okay? to the topic of the text, first, then a they give, what **(hesitation)**, a small like time to the content. in other words, the book is dealing with, euh, the skill of reading more than the content of reading. You want me to write you the name of the book? It'll help you a lot.

The Researcher: Sure, we can do that after the interview.

Teacher 1: Yes

The Researcher: So, euh , you don't provide separate texts. You provide them with a book at the first session-

Teacher 1: In the 2nd year. in the 2nd year, we are working on reading strats. In the first session, i introduce the module, I tell them it s a module that will help you in preparing your master 2 dissertation. It will, euh, 'kima ngolo' improve your reading because you are -

The Researcher: I was a victim of this. So-

Teacher 1: And they blame me. They tell me, " why you are talking of something which seems very far".

The Researcher: They'll understand when they get to it because reading is very important for the master thesis. Well sicne you provided a book and not separate texts. When you chose this book, you did look at the texts of course, you had a look, at least a general look on the texts. What factors

did you take into consideration? Did you take like , for example, the vocabulary, the form, whether it matches the students' level or not, etc

Teacher 1: All of this criteria plus the length of the texts.

The Researcher: Vocabulary, -

Teacher 1 :Simplicity and the length of the text because we are limited in time.

The Researcher : Moving on to questions of reading comprehension. What problems do you usally, do your students usually encounter in reading comprehension?

Teacher 1: The reading task itself. I face difficulty in making them read. I have to observe them like small children -

The Researcher: You have to always push them

Teacher 1: I have to walk and watch them out and **(chuckles)** use 'hadik' the stare because they escape reading, they do not want to read.

The Researcher:They are not used to reading, this is why.

Teacher 1: They don't have 'hadik' the will-

The Researcher:The motive.

Teacher 1: Mhm

The Researcher: When it comes to the questions that are usually asked after the text

Teacher 1: Mhm

The Researcher: I assume that some students face some problems in those questions. For example, let's say they are unable to understand a questions or they are unable to answer a certain type of questions. Do- Have you observed that in your students?

Teacher 1: You know I face problems when they don't read. Once they finish read, they become able to answer any question.

The Researcher:Even the content?

Teacher 1: Mhm, because I make some efforts in explaining-

The Researcher:Oh, so there is an addition by you.

Teacher 1: Yes, I help myself by this okay? I stop them and ask them, " did you face any unfamiliar words?" They give the words I explain them.

The Researcher: When you ask them, they do complain about some difficulties like some unfamiliar words, some information that is a bit ambiguous maybe

Teacher 1: It's more abotut the unfamiliar words.

The Researcher:Okay, it's more about the vocabulary.

Teacher 1: Yes, they don't have problems with the ideas.

The Researcher: Okay, I understand. This may go back to your choice of the text. You chose something that matches their level

Teacher 1 :Yes, simple texts.

The Researcher: We're going to look at the reading comprehension from the students perspective.So, we know that many factors that affect the reading comprehension for example we have the main one which is the vocabulary-

Teacher 1: Mhm, I think the main one is the reading task itself. I want to insist on this. They read in arabic but in English they think it is a privelege for excellent students only.

The Researcher:I understand, this is true. The vocabulary, the length, the simplicity, the task of reading itself, but do you think there are some cognitive factors that come into play, or that affect the RC. For example, for example, let's exclude this one because i'm going to say it. So people say that the intelligence of the student affects their ability to understand a text. Do you agree?

Teacher 1: Yes, intelligency plays a great role in RC

The Researcher:So apart from intellgence, do you have any other examples? any other euh-

Teacher 1: Commitment! In terms of being interested in the module itself, because there is mark and there is an exam

The Researcher:So we have committment and maybe a part of it is also motivation?

Teacher 1: Motivated in order to get the mark. This is the only, euh, 'kima ngolo' motive that makes them attend the session and do the activity.

The Researcher:I understand-

Teacher 1: Academic committment

The Researcher:It's all about the marks. So we're now going to be more and more specific. When they read a text, and , I knwo you've told me that once they read your students do not face any problems, but when they're reading, during the task of reading, and when you ask them out of the blue, do you notice any problems? Sometimes maybe they have problems in making,euh , let's say this is a long text and there is a piece of information at the end of text, and information at the beginning of the text. Do you sometimes find difficulties in associating those two information ? SO they have to read again, or you have to tell them to read again?

Teacher 1: Actually, I haven't faced this problem because I make the whole group read. For example, I say, " read the first paragraph.". I start, do I start from my right hand or my left hand? When they choose which side, they all have to read the same paragraph

The Researcher:I see, so they read one paragraph at a time.

Teacher 1: Yeah, I make this in order to make them grasp the content of the paragraph to gain time and and to answer correctly.

The Researcher: This makes more sense since they're reading one paragraph only, they have more time to grasp.

Teacher 1: I have already solved this problem. I insist that the reading should be individual. Otherwise, maybe I'd have faced this.

The Researcher:So you think if they had to read all the text at once, and then answer questions, they'd have faced some problems in remembering information?

Teacher 1: Sure, they will. So why if the text is long, I ask them to read at home. Usually when I do this, they become able to answer those questions easily, and I don't face "hadok" problems. Otherwise, as you said, they're not going to work.

Teacher 1:

The Researcher:So this is probs the last question. Given your experience, do students find more difficulties in questions or tasks that are more cognitively demanding. i'll explain this, for example you have qsts about the content, you have a qst like suggest a title ,a nd another one that says if you can propoze a logical conclusion to the text. Do you think they find more difficulty in the second one than the first once

Teacher 1: It depends on the type of the text. If its fiction, they do those tasks easily. If nonfiction text any phenonemonon, it ll be hard.

The Researcher: Our study is about WM. **(def of WM).** do you think it can cause a problem in WM?

Teacher 1: It's very helpful, a privelege that not all students have.

The Researcher:It differs nd cannot be observed

Teacher 1: It can be discovered. When i want to challenge them, i go to this -

The Researcher:Reflction qst?

Teacher 1: That require them to make the link between what is infront of them and what we have seen before. I have many good students who have 'had lgood' memory.

The Researcher:Based on my defition, do you think there is a way to avoid this?

Teacher 1: We need to oblige them to do tasks to enhance their wm. because it is there, some people are very active **(laughs),** and others who are all the time sleeping. The solution is to impose on them.

The Researcher:Thank you so much.

Appendix L: Teacher 2 Interview Transcript

The Researcher: Good afternon, this is AMZ, and we are with T2. This is the interview as part of our study 'study title'. So shall we start?

Teacher 2: Yes, of course

The Researcher:We start first, ofc, with a question to break the ice. Tell me , please, how long have you been teaching EFL?

Teacher 2: Fourth year, which means I have three years of experience until now.

The Researcher:So, em, the Reading subject was added recently. Were you in favour of this decision?

Teacher 2: Yes actually I've heard, being recruited recently euh newly, actually heard that adding such course by the ministry at the level of your department. I wasn't actually given the opportunity to vote, because I have been given the course to be taught, but I wasn't against it, actually I loved that. It adds more than it harms ofc. This is just as a first impression.

The Researcher: Now that you're a teacher of reading, would you please explain briefly how a typical reading session is usually held? So what tasks do you provide? How do you manage -?

Teacher 2: Yes just an overview?

The Researcher:Yes

Teacher 2: Yeah, euh, taking into consideration the notion that when I, euh, had been given the course, I had no syllabus, okay? No clear idea ,or about, euh yes, about teaching, and actually on how to be taught, and the year ofc plays a major role; it was first year. As a teacher, I found myself, euh, in such situation with no coordination of teachers ofc. This if ofc smth else. And it was new for all teachers,but I decided, actually, to my knowledge **(unintelligible)** in the skills. We had the name of reading as 'étude de texte' okay? So this is the name. So normally if we base

our teaching on the name only of the module itself, so it will be **(unintelligible)** . I just planned

to teach it practically. I provide my stndts with different txts, of course reading comprehension

texts: passages with related questions. Anything that is related to reading theoretically for

example starts etc. I always mix. I just, euh, have tasks. In the task itself, I do have the reading

passage with all the questions, I do provide sometimes in the margin especially some defintions

of the starts etc anything which is theoretical. They apply it there inside the class while having

the text. What do also I do integrate also other skills in addition to I have some things related to

OE to speaking, to writing, and **(unintelligible)** we had like some pre-questions, pre, euh, pre-

reading questions. Generally they are practical. In terms of the tasks, for the topics I try to use

topics that attract the students. The social topics, topics which are related to our daily life more,

and I found that this was really beneficial. In terms of management, yes, I didn't struggle actually

with them, maybe sometimes. So one hour, I try to design tasks for one hour. Otherwise,

concerning stnds, we had some passive students, but generally, euh, yes, this is the

(unintelligible).

The Researcher: Thank you for the explanation. So, when you're teaching you observe that your

students face some problems in RC. Can you elicit some of the those problems? in RC if

possible.

Teacher: Exactly you're talking about having a text and the questions related to that?

The Researcher: Yes.

Teacher: They struggle wiht new vocab, yes, most of the time because some students keep

asking me, 'what's the meaning of that word, Madam?" etc. Sometimes they struggle with some

questions when there is an implicit meaning, for example, yes, this is very found in students

especially the level which plays a major role. First year students when it comes to questions

which require some critical thinking or beyond sentences it's a bit difficult to them, but they do care more about vocabulary, that's the thing they ask about all the time, but, generally, and sometimes they misunderstood the questions being asked in relation to the text. Generally, they are good when it comes to RC questions. They are good at the simple questions, giving titles, etc. So, yes, just as I said, when you turn the notion towards something implicit they find it a bit hard. That's a general idea

The Researcher: We can say that, to sum up, the questions that require more reflection are generally, euh, found more difficult.

Teacher: Yes they struggle with that

The Researcher: DO you think those- Do you think there are some cognitive factors that are responsible for this difficulty? Let's say for example some researchers say that intelligence can be defining in this case.

Teacher 2: Yes, cognitively. Yes, I can say, yes, if we're talking about the cognitive side, maybe intelligence, maybe the ability of students to recognize what they are reading about. Sometimes, I can give you an example, maybe when the students have some background knowledge, or schemata, they **(unintelligible).** This is something, they already have been exposed to such phase before. This is number one, yes. I think maybe also this isn't done much cognitively, reading too much. Being exposed to any type of readings. Maybe it's not cognitive, but I find it that students who do so find it easier. A fluent reader, or someone who reads too much, find it very easy to cope with the situation if it's difficult in comparison to other students.

The Researcher: Actually interesting. Do they read outloud in your class?

Teacher 2: Ah, actually they do, and I ask them to do. They do read aloud in every session, and I have many many other students who sometimes don't have a chance. If I feel that the passage is

long , I divided it in order to give the chance to everybody, yes, but every session there must be aloud reading phase.

The Researcher:So when they're reaeding aloud, do you ask them questions after that?

Teacher 2: Emm, euh, which type of questions exactly? Because what I usually do is I ask them questions before in the pre-reading stage, but questions related- no, maybe some, euh, maybe some questions I want, but generally no. I do correct them from time to time, even students they do that sometimes unconsciously, okay.

The Researcher: Heh, it happened to me a lot. Em, when those questions are related to comprehension-

Teacher 2: Ah.

The Researcher: Did you notice that some students were able to directly answer, and some students had to read the text again-

Teacher 2: **(chuckles)** Yes, yes.

The Researcher: Some students have the ability to answer directly, and some students need to read the text again, or to read the line again in order to-

Teacher 2: Yes, I can even tell you that when I just give them, euh, even silent reading, before starting to read the text, I found some students start answering the questions. This is something I observed in the classes. Euh, after, euh, reading the text, yes, when asking questions, or when I ask them to think of the questions, I already find students raising their hands, yes, means they have the answers on the minds, yes, before even asking them, and while asking them without giving them time to look for the answers, I find students who directly raise their hands because they have the answers. Some students even while answering they check, they can check before

answering and while answering they keep checking the answers from the text. Generally, this is the way.

The Researcher:When they're asked spontaneously, you see the difference.

Teacher 2: Ah yes, definitely, that's it. When I don't give them anytime, that's what I observe.

The Researcher:Okay, emm, concerning the passage, do you provide sometimes long passages?

Teacher 2: Yes

The Researcher: And when they finish reading, you ask a question, and the answer to that question is at the beginning of the text. Some students do remember the information-

Teacher 2: Ah yes, and others they don't

The Researcher: And sometimes they don't even know where it is, and they start looking everywhere.

Teacher 2: Yes, and btw, I always have some kind of question for that when I have a long passage. Some questions, euh, they directly know which paragraph, and some keep struggling.

The Researcher: Do you monitor your students when they're reading?

Teacher 2: In what way?

The Researcher: Do you look at your students? Do you observe em? How they're reading nd all?

Teacher 2: Yes, I do. I just move here and there making sure they're reading. (honestly all nonsense about not using devices and explaining words and shit).

The Researcher: Did you notice some might have some problems in associating information?

Teacher 2: She correlated it with how much read. Also some do a first reading because why not then they do a second analytical- critical one.

The Researcher: Students usually face problems in RC which are related to the implicit meaning, inference making, etc-

Teacher 2: Ah yes. They struggle sometimes., or when they have to draw some logical

conclusions.

The Researcher:Did you associate it with anything specific?

Teacher 2: Maybe as i told you, being exposed to English, to passages, to reading. Euh, this the

first thing, maybe, I can think about. I always tell them that any piece of english is considered to

be reading, not only novels and stories and books etc. Euh, for people, euh, who have critical

thinking, skills or abilities, they can infer meaning, yes. Because someone higher in critical

thinking or with better skills or abilities is not like someone who doesn't have those. This is one.

First year they were not taht much familiar with that because, if we relate that to before, for

example, I said these kind of passages are a bit similar to what you've seen in secondary school

so, euh, they do expect such questions because they think this is university level, but they are not

really familar with them, they ask even about the word 'infer' for example. That's what I can

think of for the moment, those two or three reasons.

The Researcher: We can call them the individual differences, as they call them in the literature.

RC is affected by the INDV DIFFERENCES, which are sometimes conscious and sometimes

not. Like you said, we can view exposure as a "consicous" process but critical thinking as an

uncoscious one.

Teacher 2: Yeah and sometiems they are not aware of that; They'll disocver that they have a

critical eye, and you as a teacher you can discover that.

The Researcher: Just as a last question, the notion of schemata and prior knowledge, do u think

those affect the RC?

Teacher 2: Yes, that's what I observed, yes. Once I bring a topic which they ahve prior

knowledge in, it helps a lot in facilitating, euh, the comprehension. Yes, I do agree that they have

an effect on RC. Though I want to add that Reading is a bit new here so every teacher is teaching

in the way they prefer. And yes, the notion of cognition yes, the teacher should be aware of that

so he could be able to explain some difficulties encountered by students as well as tranferring

this knowledge to them.

Appendix M: Teacher 3 Interview Transcript

The Researcher: So, euh, this is ATHMANI Mohamed Zakaria, and this is the interview with Teacher 3. Euh, this interview falls under the study investigating the correlation between the verbal working memory capacity and L2 reading comprehension. So, Teacher 3, shall we start?

Teacher 3: Yes, of course.

The Researcher: So, euh, first, we'll start with a very simple question, as they to break the ice, and the we'll gradually narrow down the scope of the **(unintelligible).** So, as a first question, how long have you been teaching english as a foreign language?

Teacher 3: Euh, four years.

The Researcher**:** Four years. Since you've been teaching for your years, euh, so i'm not sure whether you know that the reading subject was added recently. I, myself, wasn't taught Reading academically. Were you in favour of this decision?

Teacher 3: Yes.

The Researcher: Would you please explain why? I mean, not in favour like politically speaking, but just a perception.

Teacher 3: Yeah

The Researcher: Do you think it's beneficial **(unintelligible)** ?

Teacher 3: Very beneficiel. Let's talk about reading. As we know reading is one of the four major skills that you need to acquire or to learn in order to be communicatively competent. Let's say for example you need to know how to read, how to write, how to speak and how to listen. We consider reading as the main source, for example, of vocabulary, okay? So, in order to enlarge your vocabulary, you need to know how to read, you need to read, euh, whether intensively or extensively in order, for example, to enlarge your stock of words. if you want to be a good write

you have to read, because a good writer is a good reader, okay? For example, in case if you want to be fluent speaker, you have to read in order to get exposed many words, okay, to use and to use these words in other situations. So, it is very beneficial, and I am so happy because, euh, I got the opportunity to teach that module.

The Researcher: Euh, so, euh, as you've said, reading does affect other skills. So, moving to the next question, that one was just introductory. Would you please explain, if you don't mind of course, how a typical reading session is held? What tasks do you provide, how you organize them?

Teacher 3: My personal experience?

The Researcher: Yes, your personal experience.

Teacher 3: Well, for me, I try to choose an appealing text, okay? A text that is somehow interesting not, for ex, a boring one. I use some, let's say, mmmm, for me,a good topics, okay? I try to use a vocabulary preview.

The Researcher:Would you please elaborate on what is a vocabulary preview?

Teacher 3:Yeah, what does it mean? For example, I try to highlight some words that are included in the text okay? we try, for example, to do,euh, some activities of matching and, for ex, filling the gaps. Sometimes I try to provide definitions, okay? and i ask students to pick or to choose the appropriate words for this definition. I use reading comprehension questions. Questions that are, euuuhh, or related to , euuuh, the text in order to check their understanding, in order to see whether they understand, for example, the text or not. I use , euuh, I highly stress on the use of some, for example, phrasal verbs and idiomatic expressions, so each time I try to provide them with new, for ex, let's say euuh, coming words or expressions that are, euh, important in our daily conversation.Euh, Sometimes, I let them, euh, few lines in order to express, to talk about, for ex, things that are connected or related to the main text.For ex, euh, let's say, euh, I choose for instance

a text about practicing or practice sport. I, for ex, let them or ask them to, for ex, write about certain sports, for ex that they prefer, okay? So as if we are combining many skills in this module, in order to see for example, euh, the effect

The Researcher:So you're trying to cover many aspects in order to improve, euh, not only the reading, but only their writing. So you've mentioned something that is very important, which is the inclusion of reading comprehension. So i'm just going to ask you very directly. The questions that you include in the reading comprehension section, are they about the format of the text? the comprehension of the text? what type of questions? are they a mixture of the two?

Teacher 3: Well, euh, mixture, and I try to, euh, to focus, let's say, on the meaning, let's say, the meaning of text. for ex, not the literal meaning only, okay? I try to do, euh, let's say, euh , how to say it? behind **(unintelligible)** behind the lines in order, euh, to see , for ex, the extent [pause]. Yes, as I have said,em, i try to use some questions in order to check their understanding rather than use, for ex, some quesitons in order to refer to the literal meaning, okay? in order to check whether the students understand, okay?

The Researcher: So just in order to recapitulate, so you said you focus mainly on questions trageting beyond the sentence level. So, it's more regarding the implicit meaning, say maybe the author's intentions etc? **(unintelligible).**

Teacher 3: Yes the implied meaning.

The Researcher: So when this section of reading comprehension takes place. What type of problems do you observe? problems that students encounter **(unintelligible)**

Teacher 3: First of all, I have my own strategies to use. for ex, i ask the students not for example to use the dicitonary whether the electronic ones or the paper-based ones. so i prefer to give them enough time to read silently, and we try, euh, to discuss, euh, the text together, euh, i ask , for ex,

someone to read and we start reading and discussing at the same time, okay? and we try to use many strats in order to understand rather than using dictionaries, so we let the dictionary as a last resort, okay? **(unintelligible)** instead of referring each time to dictionary, we try to guess, to infer, to use some starts in order to,to,to get the meaning. Among the problems that, euh, among the problems i can talk about, euh , for ex the students sometimes are struggling when it comes to unfamiliar words or vague words, okay? they cannot understand some words, they have problems of pronunciation, sometimes even let's say in very ,let's say, trivial words, okay? **(unintelligible)** they do not know the correct pronunciation, sometimes they suffer from, euh, reading multi-syllabic words,okay? if , for ex, euh, they, euh, come across the word 'unstoppable', so they feel,euh, they will struggle in order to read such word. as i have mentioned punctuation, sometimes the problem of punctuation, sometimes they do not stop or they do not make enough time to move to another idea.euh, yes, what else? **(unintelligible)**

The Researcher:Concerning the problem of pronunciation, even with trivial words, have you noticed something that students who have this problem, they tend to ,euh, find it more difficult to understand the text then those who don't, even if it's related to the problem of pronunciation?

Teacher 3: Listen to me, I think those who have, euh, such problems of pronunciation, normally they have,euh, low average comapred to others, okay? because of the lack of practice and etc. so, euh, yes, they, euh, they suffer from problems,for ex, of, euh, they struggle, when it comes, for ex, understanding the text, okay? euh,

The Researcher:So we can say that the others who don't have this problem find it maybe easier or **(unintelligible)** understand faster than those who do

Teacher 3: Yeah, a lil bit.

The Researcher:You did observe-?

Teacher 3: EVEN the others may have other problems but not the problem of pronunciation.

The Researcher:So when they are reading the text, do you, euh, do you ask spontaneously, or do you always have a systematic way?

Teacher 3: No no no. I try to improvise, we try to have some anecdotes, we try to relate some other things, okay? during the session. there is no systematic way to follow.

The Researcher:I mean when **(unintelligible)** a text. They are reading, and then, do you, does it happen to you, or did it happen to you, that you raise a question about reading comprehension before they finish reading ? or while they are reading?

Teacher 3: Would you repeat the question?

The Researcher:So let's say they're taking too long in the reading task, and you ask , for ex, 'what is the main idea of the text'? does it happen to you? or you wait till all of them finished?

Teacher 3: Yeah, i try to give them enough time to read, and after that, after discussing ideas, reading the text together, explaining words, I start asking them some reading comprehension questions.

The Researcher: So you always have time devoted for, say, discussing first- **Teacher:** Something **(unintelligible).** Of course, it happens to you that you, euh, look at your students when they are reading. Did you notice that, even if its a bit difficult to observe, I am aware of that, that sometimes some students, when they're reading a line, you find them re-reading that line again, over and over again.

Teacher 3: Sometimes they highlight, or put a line some words

The Researcher: Sometimes they read that line and they stop and they go to the line before that in order to understand.

Teacher 3: Yeah

The Researcher: So they are not able to directly understand the meaning ot this sentence

Teacher 3: They refer to,let's say, they use the, euh, the context in order to understand. As I have mentioned, euh, it's a good start in order to guess or to infer the meaning from, emm, the other words, okay? rather than asking the teacher or classmate in order, for ex, asking for help. So they, they, emm, they act as, how to say it, autonomous, yeah, autonomous learners. They depend on,em , they rely on themselves.

The Researcher: Euh, so let's say, **(unintelligible)** . When there is a question that raises something that's mentioned in the beginning of the text. Some students maybe are directly able to answer-

Teacher 3: Yeah!

The Researcher: And some students have to go back to the text in order to find it.

Teacher 3: Yeah, because, euh, yeah, because, how to say it, homogenous, yes , we have homogenous classes i.e., you have many levels, okay? in the same class. For example, we have the ones who, for ex, pick the idea directly, another , for ex, euh, ugh, who cannot for ex understand it without referring to text. Others asks, for ex, euh, the other students to maybe to-

The Researcher: To clarify-

Teacher 3: to clarify to help and etc. So , euh, I think it is very normal because as i have mentioned its something personal and we have many levels within the same, euh, group.

The Researcher: As they usually refer to them by scholars those are called 'individual differences'. there are differences each one has

Teacher 3: Yeah, according to the innate capacity-

The Researcher: Exactly, it is, its an innate capacity. So, euh, you've mentioned that at the beginning that you, you, you focus on questions which, euh, revolve around the hidden meaning , and, maybe, inference making as they say, or, euh, -

Teacher 3: Thematic

The Researcher: Thematic meaning. There are also questions that focus on drawing logical relationships between,euh , elements of the text.

Teacher 3: Yes

The Researcher: Do you find that students face more difficulties in those questions than questions which are, which deal with the literal meaning of the text

Teacher 3: Yeah, yeah. As you know we have different types of questions, so, euh, it's very obvious to, for ex, euh, to find students, euh, for ex, yeah, they struggle when it comes to for ex to answer let's say simpl- complex questions compared to simple, euh, questions.

The Researcher: If you allows me to rephrase that, we can say, in a way, that the more the task is demanding, the more difficult it is found by students.

Teacher 3: Absolutely, yes.

The Researcher: Do you associate this with any particular aspect?

Teacher 3: Yeah, I couldn't get the qeustion

The Researcher: So, you know, ofc, you said students face problems with questions of comprehension, say that-

Teacher 3: pronunciation, etc

The Researcher: than questions that deal with the literal meaning, questions that are simpler

Teacher 3: Mhm

The Researcher: What do you think is the reason of that? Why do some students are able to und, to understand and answer those difficult questions, while others, let's say, a little bit less

Teacher 3: Let's say-

The Researcher: Just in your view.

Teacher 3: As we have many levels within the same group, so, euh, when we say that we have many, euh, many levels. We can have for example different types of learner. some learners who are visual, students, other, who are for ex auditory etc. So the way of learning is not the same, for them, okay? Euh, let me talk about, euh, even the background knowledge, okay? the prior knowledge of students. for example, you can find some students who have strong, euh, background about certain topics, euh, it doesn- it doesn't matter in the L2. you can find, for ex, euh prior knowledge or background knowledge in the first language and they translate they think or they recall such types of information and , euh, in the L2.

The Researcher:So just a final question, do you think some cognitive factors, cognitive abilities, euh, can be responsible for this differences?

Teacher 3: Yeah.

The Researcher:Would you elicit any?

Teacher 3: Yeah, because, euh, we don't have for ex mental abilties, and for others they use for example,euh, for some students, or let's say language users, they use for example, euh, some, let's say, language games, some , for ex, they use reading in order to enlarge their words in order to improve their level in general. So, euh, we cannot for example talk about, euh, as, euh, a rule to follow ,okay? we have the best, we have some stragetic learners, we have some let's say, euh, average, within average level. So it's about the way of thinking. Listen to me, sometimes if you are for example aware about the importance of reading, okay? so you try to,to ,to read and read again and read some more, okay? in order for example to facilitate things, not for example only in reading or to be a good reader or to improve for example, euh, the speed, euh, of reading. As we have mentioned reading may affect the other, euh , skills, so it's,euh, it's something, euh, let's say,

euh, refers to individuals, okay? as i have mentioned you can use reading in order to improve the other skills.

The Researcher: Euh, **(stutters)** this is the last question, it's going to be very direct. This is truly the last one. So, euh, as I have mentioned in the beginning our study is about the working memory capacity, which i believe you may not be familiar with. so i'll explain briefly. the working memory is a mental faculty, it's in the brain. What is it responsible for? it's responsible for the association of information. So when you are reading a text , reading a sentence after the other, then other, the WM makes sure that all tthose sentences are related, and are decoded, and it also allows for you to recall prior knowledge-

Teacher 3: Mhm

The Researcher: So this is the WM. and the capacity is if you have a large WM, you're able to understand faster, and to store more information, and if it's low , or if it's limited, ofc you'll have some problems. So based on what we've talked, do you think this mental faculty can affect the reading comprehension?

Teacher 3: Yeah

The Researcher:Based on the definition, which is of course inspired from the definitions of scholars of Baddeley, etc.

Teacher 3: Yeah, for ex, euh, as a student you try to **(stutters)** to read the text for example , euh, intensively or extensively i.e., you are obliged to read or, euh, you read for the pleasure, okay? So, since for example you are practicing , for example, the reading , okay? but you have problems, for ex, euh, in terms, euh, of forgetting things. For example, euh, you have let's say, euh, very bad memory, you will suffer, even if you are practicing, euh,, I, have I have attended , I think,euh, **(trying to recall the word)** a conference with, euh, Chomsoky, okay? ONLINE. He have

mnetioned the idea of, euh , how to improve your memorythrough three things, yeah. The first one is through reading. We can ameliorate or, euh, you can improve your capacity through reading. The second one is through ,euh, learning a language, any language besides you mother language, okay? The third one **(long pause because of inability to recall)** To read, to read **(attempting to remember)** Yes, I couldn't remember the last, or the , euh , the third element in order to improve your memory.

The Researcher:It's fine. I think what you've said was so far very relevant and very helpful. So if you've got any additions, please you're more than welcome, and if you think -

Teacher 3: I prefer to talk about reading, to work on reading okay? because,euh , because **(chuckles)** i wrote a thesis on reading, yes, in relation to vocabulary. So it's very interesting topic, and I wish you all the best

The Researcher:Thank you so much for your collaboration it's really appreciated.

Appendix N: Teacher 4 Interview Transcript

The Researcher: So, good morning, this is Athmani Zakaria, and this is the interview with T4. so this interview is under the study in which we're investigating the correlation between VWMC and L2 RC.

Teacher 4: Okay, but I'm not sure what the working memory

The Researcher: It's okay, I will explain eventually. So, we'll start first with a very introductory question, just to break the ice, and then we'll get into stuff that are more technical.

Teacher 4: Okay

The Researcher: How long have you been teaching EFL?

Teacher 4: Oh, uh, I've been teaching English as a Foreign Language for about, euh, for around five years now. Yeah, five years

The Researcher: Good, moving on to the second question. Knowing that the Reading subject was added recently into the first and second year license levels curricula, were you in favour of this decision? Please elaborate on your stance?

Teacher 4: Ah, yeah, I'm aware that the Reading subject was, uh, added recently to the first and second year. It's a new addition to the curriculum. I think Reading is, euh, of course very beneficial for students, and the decision to add it a module will definitely help students to improve their reading skills, which will be helpful in the future. It can also help them in getting new ideas and learn more about, euh, other **(stutters)** other cultures.. So, yeah, it is a good thing.

The Researcher: Yeah I can see where you're coming from. I agree with that, euh, it helps develop and gain more ideas that might be used later on in, for example, in their assignments.

Teacher 4: Yes

The Researcher: Okay so since you're a teacher of Reading subject ,would you, please, explain how you usually hold a typical reading session, including the preparations you make, the factors on which you rely when choosing a text for example, etc.?

Teacher 4: You mean what I prepare, preparations, or what I give in class?

The Researcher: Hmm, I'd appreciate if you can talk about both

Teacher 4: Okay. I usually, euh, I always try to choose a text that is fun for the students but beneficial at the same time-

The Researcher: What do you mean by a "fun" text?

Teacher 4: What I mean by this is that, euh, a text that is good for them in terms of their level and vocabulary and all and also it should be interesting so they don't get bored.

The Researcher: I see. So your main concern when choosing the text is, euh, is focusing on providing something of the same interest as your students?

Teacher 4: Yes, but, euh, I also try to, euh, make sure that it is suitable for their level because, for example, I don't want to make them unable to understand or, euh, or make them stressed. For example, euh, text that are about general activities like, euh, sports and, euh, food and all are easy for them because, euh, because they are familiar with them.

The Researcher: Fair enough. Those topics are easier to understand indeed. So, would you please tell me what are the problems that your students usually encounter in reading comprehension?

Teacher 4: They complain of unfamiliar words and sometimes idioms. It mainly about words they, euh, can't understand or are confusing to them. Uh, they sometimes, uh, say that they cannot understand the context of the text because for example it is strange to them like, for

example, when a text is about other fields like, uh, medicine or architecture, they find difficulties

in understanding the ideas. And also there is the problem of, uh, **(tries to recall the word)** of

culture difference because, uh, for example, they cannot understand some events that are in

Europe or the USA. Like Christmas for example or, uh, Halloween etc.

The Researcher: Yeah, sometimes it is difficult to, as we say, to relate to those events if they are

part of your culture

Teacher 4: Mhm yeah that's what I mean

The Researcher: Good so far, so since you've been teaching Reading, do you think reading

comprehension is influence by any cognitive factors? –

Teacher 4: I am not really sure about which cognitive abilities are there, but maybe critical

thinking can have an effect on reading comprehension. I think, uh, I think critical thinking is

very important. For example, uh, like students with better critical thinking can see beyond the

lines and, uh, can understand the hidden or implicit meaning of the text. Uh, for me, critical

thinking is very important.

The Researcher: I see, but do you think any actual mental abilities are in-play? Of-

Teacher 4: No-

The Researcher: Of course apart from critical thinking which you've just talked about.

Teacher 4: So as I said I don't know much about cognitive factors or abilities in this, uh, in this

case because my specialty is literature.

The Researcher: Mhm I understand. So just to make sure, critical thinking is the only cognitive,

uh, for you, the only cognitive factor involved?

Teacher 4: yes, that's all what I know

The researcher: Okay, when your students are reading or doing a reading task, do you observe them?

Teacher 4: How? I don't, didn't, understand your question

The researcher: I mean, for example when they're reading a text, I'm sure you happen to look at them or just observe what they are doing.

Teacher 4: yes, sometimes I do that.

The Researcher: so, have you noticed any difficulties, or maybe differences in the students' ability to understand and process information? For example some students will take longer time to understand what is going on in the text.

Teacher 4: Ah yes –

The Researcher: Or for example others will find it difficulty to remember a piece of information that is written at the beginning, I mean they easily forget it.

Teacher 4: Yes, sometimes, uh, sometimes for example students are able to quickly understand the ideas of the text, especially when they are familiar with it. I mean sometimes some students, uh, they take a long time to process what's going on in the text; however, a small number do it quickly and they can, uh, easily get it. For example some students will answer directly when I ask a question so, uh, I think they can remember all the ideas and I think they are better, but other, uh, they, they don't do this. They have to read again or, uh, sometimes I have to show them where it is, uh, otherwise they will not find it.

The Researcher: Yeah, and so you have noticed differences in the capacity to do so?

Teacher 4: Yes, of course, I have just , as I said some can do it quickly and others need time and ,uh, sometimes until I intervene.

The Researcher: thank you for this insight. Uh, I will move on to the next question, Given your experience, do students find more difficulties in tasks that are more cognitively demanding.

Teacher 4: Like what?

The researcher: What I mean is some types of questions are require more efforts from the students than tan others, do you –

Teacher 4: Okay, I understand. As you know we have different types of questions, so it's very obvious to, for example, to find students struggling when it comes to, for example, to answer, let's say, complex questions compared to simple questions.

The Researcher: Can you please provide types of questions that are "complex" ?

Teacher 4: Questions like questions about reflection or implied meaning. Uh, for example, uh those questions require more work because , uh, you need more knowledge and , uh, not all students are able to answer them correctly, uh, like they should be answered. I- I think this makes sense because the levels are different, and also maybe, uh, maybe because of the critical thinking as I said.

The Researcher: So, hmm, so you associate this difficulty with differences in critical thinking ability?

Teacher 4: I think so yes, but also because other factors like the different, uh, the levels and , etc.

The Researcher: I understand. Okay so as a reminder, our study seeks to investigate the relationship of reading comprehension and a certain cognitive ability called working memory –

Teacher 4: Mhm

The researcher: I know you are not familiar with the, the working memory, so I'll explain. It is a, like, a cognitive faculty that is responsible for two things: the storage and the processing of information. When you are reading, for example, you store information and you try to understand it. This is the job of the WM, at least partially.

Teacher 4: okay I understand

The researcher: So, given this brief definition, do you think it can have an influence on reading comprehension? Because it's "power" differs from one person to another

Teacher4: Well, uh, I mean, from what you said I think it does. I think yes, uh, it makes sense to me based on the definition you provided. Because as I said ,uh , there are always differences in students' answers and I think this , uh, could be a reason, uh, why not all of them give the same answer.

The researcher: thank you. Lastly, please if you have any additions or if you feel like providing other insights, please do so

Teacher 4: No I don't think I have any to add

The researcher: Okay, thank you so much for your insightful answers.

Appendix O: NDRT Form E Sample

COMPREHENSION TEST (Cont.)

PASSAGE TWO

Marketing is the performance of those business activities that direct the flow of goods and services from producer to consumer or user. Marketing is the connecting link between the producer and the consumer or user. The marketing system brings production and consumption together.

Approximately one in every six gainfully employed persons is engaged directly in wholesaling or retailing activities. This ratio does not take into account other persons who are serving marketing through transportation, communication, and office jobs.

Marketing provides opportunities for many kinds of jobs requiring a wide range of skills and abilities. Although we naturally think of selling as being the primary occupation in marketing, there are opportunities in management, advertising, market and product research, and buying.

The economic well-being of our country is determined largely by productivity, consumption, and employment. The efficiency of the marketing process affects all three. If marketing stimulates demand, people will consume goods at a high rate. High consumption requires high productivity to meet the wants of people, and high productivity and high-level activity in marketing combined result in high employment. Indirectly, marketing is a key to a high level of economic living for the people.

9. Our economic well-being is determined largely by how many factors?
   A. One
   B. Two
   C. Three
   D. Four
   E. Five

10. One major factor mentioned as affecting our economic well-being was
    A. high wages.
    B. low interest rates.
    C. technology.
    D. employment.
    E. foreign trade.

11. The purpose of this passage is to
    A. persuade.
    B. guide.
    C. evaluate.
    D. inform.
    E. interest.

12. The chief emphasis is on
    A. defining marketing.
    B. principles of marketing.
    C. opportunities in marketing.
    D. kinds of jobs in marketing.
    E. the economic significance of marketing.

PASSAGE THREE

Atomic energy is the energy that holds the nucleus of an atom together.

The sun's energy is believed to originate from atomic reactions in which nuclei of helium are built up from nuclei of hydrogen. It has been found that the mass of an atomic nucleus is less than the total mass of the separate particles that make it up. The reason is that when a nucleus forms, part of the mass of the component particles is changed into energy, which is then radiated away. The quantity of energy released in reactions of this kind is almost inconceivably greater than the quantity released by any other type of reaction involving similar quantities of material. Every second, the sun sends into space a million times as much energy as is stored in all our coal, petroleum, and natural gas fields. If we could duplicate the method by which this energy is released, we could revolutionize the world. And the possibility of doing just this is no more fantastic today than the concept of an atomic bomb was in 1900. The time may come when the hydrogen from a cubic mile of sea water will provide enough energy to satisfy our needs at the 1960 rate for 300 centuries.

13. How much sea water was mentioned?
    A. One ton
    B. A cubic acre
    C. A cubic mile
    D. A thousand gallons
    E. A hundred tons

14. The quantity of energy released in an atomic reaction is spoken of as how much greater than with other types of reactions?
    A. Far greater
    B. Unbelievably greater
    C. A thousand times greater
    D. Inconceivably greater
    E. Tremendously greater

15. The primary focus is on
    A. how energy is released.
    B. where energy is found.
    C. the energy from atomic reactions.
    D. what happens in an atomic explosion.
    E. the energy present in sunshine.

16. This passage is best described as
    A. objective.
    B. skeptical.
    C. cautious.
    D. conservative.
    E. optimistic.

PASSAGE FOUR

Even most skeptics, because they seem to share the hope that there is life on Mars, try hard not to discount the possibility. But it was a comedown in the mid-1960's when scientists involved in the Mars exploration studied photos taken by some of the early Mariner space flights. No canals. No seas. No busy Martian engineers. No menacing warlike Martians as huge as skyscrapers. Just mountains, craters, cold winds, and dust storms. It was almost as if scouts for Columbus had returned to Isabella's court with the news that the world had turned out to be flat after all.

Hopeful astronomers reminded us that the Mariner IV had photographed a mere one percent of the Martian surface from 2,000 miles away. And they pointed out that the Earth-orbiting Tiros weather satellite shot over 20,000 pictures before uncovering any evidence of life on Earth. But still, public enthusiasm for Martian exploration wilted.

By the time Viking I touched down on the Plain of Chryse in August, few seemed to care at all. J. Richard Keefe, one of the Viking scientists, declared himself "disgusted" at what he called the "blase . . . apathetic" public response and the skimpy television coverage of what was certainly one of the magnificent scientific and technical accomplishments in human history.

17. One weather satellite was named
    A. Latos.
    B. Tiros.
    C. Prometheus.
    D. Sonar.
    E. Satelos.

18. One of the Mariners photographed how much of the surface of Mars?
    A. One percent
    B. Two percent
    C. Three percent
    D. Four percent
    E. Five percent

19. Interest in Mars diminished largely because
    A. no Martians were found.
    B. the TV coverage was poor.
    C. the photos were all black and white.
    D. nothing was brought back to earth.
    E. the media did not appreciate the accomplishment.

20. Mention of the flat world was used to point up
    A. the flatness of Mars.
    B. the lack of canals.
    C. the lack of seas.
    D. the lack of Martians.
    E. the lack of mountains.

PASSAGE FIVE

Fungi give cheese the flavor, odor, and character so highly prized by the gourmet. One such mold was first found in caves near the French village of Roquefort. Legend has it that a peasant boy left his lunch, a mild fresh piece of goat cheese, in one of these caves and on returning found it marbled, tart, and redolent. Only cheeses from the area around these particular caves are permitted to bear the name of Roquefort.

As early as the seventeenth century, ergot, the fungus of rye, was used to facilitate childbirth. One of its effects is the contraction of the involuntary muscles, particularly of the uterus. In the twentieth century, ergot has once more attracted interest as the source of the chemical from which the hallucinogenic drug LSD is derived. Most of the modern antibiotics are produced by fungi. The first of these was discovered by Alexander Fleming, who noted that a mold of the genus *Penicillium* which had contaminated a culture of staphylococcus growing on a nutrient agar plate had completely halted the growth of the bacteria. Antibiotics, of which many hundreds have now been discovered, are substances produced by a living organism that injure another living organism.

21. A fungus was used as medicine as early as what century?
    A. Sixteenth
    B. Seventeenth
    C. Eighteenth
    D. Nineteenth
    E. Twentieth

22. How many antibiotics have been discovered?
    A. Ninety-six
    B. Many hundreds
    C. Thousands
    D. Millions
    E. An unspecified number

23. This passage is mainly about
    A. ergot.
    B. drugs.
    C. fungi.
    D. antibiotics.
    E. cheese.

24. LSD is specifically mentioned to show that ergot
    A. needs to be further controlled.
    B. needs further research.
    C. has medicinal value.
    D. is of current interest.
    E. is dangerous.

PASSAGE SIX

Local governments were our first governments. The primitive tribe that chose the strongest man to be its chief and the oldest men to form a council was establishing local government. It was seeking a better, safer life.

In the same way, the first English settlers who landed at Jamestown, Virginia, in 1607 soon realized that they needed rules and leaders. At first, the settlers at Jamestown had to look out for themselves. They searched for gold, and had to find their own food and provide their own shelter. As food supplies began to run low, and as the colonists faced hunger and disease, they saw that they needed to work together if the colony was to survive. The colonists formed a council to make laws for the colony. They chose Captain John Smith as president of the council to see that the laws were carried out. This government at Jamestown was the first local government in America.

Today, local government is still the first and most important government in our lives. It protects our lives, our safety, and our homes, and it helps to keep our environment clean. Local government provides us with schools, libraries, and other important services.

25. The first colonial government was
    A. tribal.
    B. city.
    C. county.
    D. local.
    E. federal.

26. The Jamestown colonists formed a government because of
    A. pride.
    B. greed.
    C. necessity.
    D. togetherness.
    E. public spirit.

27. The best title for this selection would be
    A. John Smith.
    B. The First Government.
    C. Jamestown.
    D. Local Government.
    E. American Government.

28. The overall goal of local government seems to be public
    A. regulation.
    B. wealth.
    C. growth.
    D. welfare.
    E. protection.

PASSAGE SEVEN

Once in a while you will hear about an artist who was recognized as a master during his own lifetime but who was then almost forgotten soon after his death. A good example is the painter Domenicos Theotocopoulos, known because of his Greek ancestry as El Greco. After pursuing his early career in Italy, El Greco settled in the Spanish city of Toledo, where he prospered for the rest of his life. But after his death history forgot El Greco for nearly three hundred years, until he was rediscovered by artists and critics of the twentieth century. The power of El Greco's intensely emotional style can be felt most strongly in his later canvases, such as the famous *View of Toledo* which he painted in 1610, only a few years before his death. One notices in this strange landscape how the eerie, silvery buildings take on a ghostlike stillness next to the explosive light of the sky and the writhing forms of the countryside below.

Curiously enough, another important artist of about this same time was scorned even by many of his own contemporaries. This artist was Caravaggio, a self-taught painter who had come to Rome around 1590 from a small town in Lombardy. Caravaggio's critics complained that he treated exalted religious subjects in a low, vulgar style, because he included in his paintings the faces and figures of common people from the streets. By using stark contrasts of light and shadow, Caravaggio managed to conjure up unforgettable scenes of dramatic realism.

29. In his paintings, Caravaggio included
    A. common people.
    B. strange landscapes.
    C. eerie, silvery buildings.
    D. ghosts.
    E. corpses

30. El Greco pursued his early career in
    A. Italy.
    B. Greece.
    C. Lombardy.
    D. Rome.
    E. Toledo.

31. Apparently a major technique of Caravaggio's was
    A. using exalted religious subjects.
    B. using stark contrasts.
    C. using cadavers.
    D. using ghostlike stillness.
    E. none of the above.

32. The principal idea discussed in this passage concern
    A. El Greco.
    B. Caravaggio.
    C. contemporary approval of artists.
    D. the travels of painters.
    E. the prosperity of artists.

PASSAGE EIGHT

The key to the design called experimental is *random* assignment of subjects to conditions. By random assignment we insure against the influence on the results of some extraneous variable that is tied to or correlated with the variable under investigation. By contrast with experimental designs, correlational designs allow subjects, in a sense, to assign themselves to conditions. Thus, in the cancer studies as they have been done, only people who are four-pack-a-day smokers — *by their own "choice"* — get into a four-pack-a-day condition. What-ever the factors are that contribute to a person's being a heavy smoker surely must also make him different from the typical nonsmoker in other ways. Hence the ambiguity of interpretation in correlational designs, and hence the virtue of experimental designs. In the latter case, if assignment to conditions is truly random then prevailing differences among individual subjects cannot *systematically* confound the results. Put another way, the experimenter has under his control all the variables that can influence the results. Whether he can exactly identify these variables is another question. Thus, experimental designs do not yield entirely unambiguous results, merely results that are less ambiguous than those associated with correlational designs.

33. Specific mention is made of
    A. psychogenesis.
    B. psychodynamics.
    C. psychobiology.
    D. psychotherapy.
    E. none of the above.

34. How many research design patterns were discussed?
    A. One only
    B. Two
    C. Three
    D. Four
    E. Five

35. As used in this passage, the phrase *put another way* means
    A. rephrasing.
    B. enumeration.
    C. using details.
    D. reasoning.
    E. illustration.

36. In this passage the authors imply that heavy smoking is probably caused by
    A. tension.
    B. nervousness.
    C. habit.
    D. social pressure.
    E. all the above and more.

STOP

End of test. If time permits, you may recheck this part of the test. Do not go back to the Vocabulary test.

TUVWXYZ-CSP-9987

ملخص الدراسة

تُعتبر القراءة ركناً أساسياً يلزم تحسينه وتطويره لتحقيق مستويات أعلى من إتقان اللغة. ومع ذلك، يُطلب من متعلمي اللغة الإنجليزية كلغة أجنبية أن يتمتعوا بإتقان كافٍ في الفهم القرائي. وقد لوحظ أن هذا الأمر يسبب قلقًا متكررًا لمعظم طلاب اللغة الإنجليزية كلغة أجنبية في جامعة بسكرة. في محاولة لعزل أحد العوامل المحتملة المتعلقة بهذه المسألة، قامت هذه الدراسة بتحقيق الترابط المحتمل بين سعة الذاكرة اللفظية العاملة و فهم القرائي لدى عينة تتكون من 30 طالباً. من حيث الأسس المنهجية، استندت الدراسة على نهج متباين الطرق يتضمن تصميم دراسة حالة بالإضافة إلى تصميم توازن متقابل يسمح بتفسير البيانات بشكل متزامن. من أجل جمع البيانات اللازمة، تم تنفيذ اختبار للذاكرة اللفظية العاملة واختبار لفهم القراءة، بالإضافة إلى استبيان للعينة المختارة وأربعة مقابلات مع معلمي القراءة. بينما تم تحليل التحليل الموضوعي، الذي تم تنفيذه باستخدام MAXQDA 2022، في التحليل النوعي، تم تحليل التحليل الكمي من خلال قياسات التكرار ومعامل سبيرمان للترابط. في النهاية، كشفت النتائج وجود ترابط إيجابي متوسط بين سعة الذاكرة اللفظية العاملة للعينة المحددة وفهم القراءة لديهم. وانعكس هذا الترابط بالتساوي في نتائج المقابلات والاستبيانات, حيث تم الوصول الى نتائج مشابهة من خلال الإستبيان و المقابلات أين صرح الأساتذة المعنيين بصعوبة تعامل الطلاب مع الأسئلة التي تتطلب سعة ذاكرة لفظية عاملة أكبر.