UNIVERSIDAD DE MURCIA

ESCUELA INTERNACIONAL DE DOCTORADO

TESIS DOCTORAL

Cognitive and Affective/Motivational Individual Differences, L2 Proficiency, and Task Complexity: Interaction Effects on L2 Written Performance

Diferencias Individuales Cognitivas y Afectivas/Motivacionales, Dominio de la Segunda Lengua, y Complejidad de la Tarea: Efecto de la Interacción en la Producción Escrita en la Segunda Lengua

María Dolores Mellado Martínez

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To my loving parents and sister

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COGNITIVE AND AFFECTIVE/MOTIVATIONAL INDIVIDUAL DIFFERENCES, L2 PROFICIENCY, AND TASK COMPLEXITY: INTERACTION EFFECTS ON L2 WRITTEN PERFORMANCE

María Dolores Mellado Martínez
Thesis supervisors: Dr Rosa María Manchón and Dr Olena Vasylets.

ABSTRACT

The study of individual differences (IDs) has been and still is a central area of theoretical and empirical interest in second language acquisition (SLA) studies (see Li et al., 2022a, for a recent comprehensive state of the art account), especially regarding their implication in second language (L2) processing and learning. However, as noted in several seminal publications (see, for instance, recent contributions to Manchón and Sanz, 2023a), the way in which IDs may influence second language (L2) writing processes and products is a more recent addition to IDs research agendas. Work in this area has investigated the potential impact of a range of cognitive (aptitude, working memory, and strategies), affective and motivational (anxiety, beliefs, emotions, motivation) IDs on (i) writing processes and behaviors involved in writing and in the processing of feedback, and (ii) the characteristics of the texts produced (Manchón & Sanz, 2023b for a review).

The present PhD attempted to contribute to the expanding body of research on the role of IDs in the domain of L2 writing by shedding further light on (a) how cognitive (working memory and aptitude) and affective/motivational (writing anxiety, self-efficacy, and motivation) IDs are implicated in written language use (we focused on writing products, not writing processes), and (b) whether learner language proficiency and task complexity moderate any potential ID effects. The motivation for these global aims -and thus the focus on the independent and interactive effects of working memory, language aptitude, writing anxiety, self-efficacy, motivation, L2 proficiency, and task complexity- derives from the consideration of theoretical accounts of the role of IDs in models of writing (especially Hayes, 2012; Kellogg, 1996, 2001. See also Olive 2022) as well as from previous SLA empirical evidence and empirical questions on (a) the role of task complexity in L2 performance in general and in L2 written performance in particular (e.g., Vasylets et al., 2017; Zalbidea, 2017); (b) the growing -although at times limited and contradictory- empirical evidence on the role of cognitive and affective/motivational variables on written output (as reviewed in Ahmadian & Vasylets, 2022; Kormos, 2023; Li, 2023b; Papi et al., 2022; (c) the proficiency-dependency of task complexity effects in writing (e.g., Ishikawa, 2007; Kuiken et al., 2005; Kuiken & Vedder, 2008); (d) the limited research and (at times contradictory) available empirical findings on the interaction between ID effects and task complexity (e.g., Kormos & Trebits, 2011, 2012; Michel et al., 2019; Rahimi & Zhang, 2019; Yang et al., 2019; Zalbidea, 2017) in writing; and (e) the L2 proficiency-dependency of ID effects (Kormos & Sáfár, 2008; Lu, 2015; Vasylets & Marín, 2021) in the writing domain.

This research evidences several important specific gaps that future research ought to fill. First, working memory (WM) effects have been observed in the case of writing processes, although the effects on writing products are less clear or consistent. Additionally, open questions exist as to whether WM effects are independent of proficiency, task-related variables, or affective factors. Research on language aptitude and

writing is limited as compared to the research on aptitude effects on feedback processing and use. The available research insights point to a positive effect of language aptitude on the quality of L2 texts, especially regarding the aptitude component of language analytic ability, but further research is needed. As for affective and motivational factors, the body of empirical work is limited and, importantly, few studies have looked into potential interaction of the effects of cognitive and affective variables on the texts written by L2 writers.

Bearing in mind these research insights and open questions in the field, the present PhD, as advanced above, aimed to provide new empirical data on, first, the effects of cognitive, affective, and motivational factors on L2 written texts, and, second, the potential mediation of task-related factors (task complexity) and language-related factors (L2 proficiency) on any observed effects. Accordingly, the research reported in this PhD sought to answer the following research questions (RQs):

RQ 1: What are the potential independent and interactive effects of working memory, L2 proficiency, and task complexity on L2 written performance in terms of CAF measures?
1.1. To what extent does working memory affect L2 written performance, operationalised in terms of complexity, accuracy, and fluency indices?
1.2. Do any observed working memory effects on L2 written performance vary as a function of writers' L2 proficiency?
1.3. Do any observed working memory effects on L2 written performance vary as a function of the cognitive complexity of the writing task?

RQ 2: What are the potential independent and interactive effects of language aptitude, L2 proficiency, and task complexity on L2 written performance in terms of CAF measures?
2.1. To what extent does language aptitude affect L2 written performance, operationalised in terms of complexity, accuracy, and fluency indices?
2.2. Do any observed language aptitude effects on L2 written performance vary as a function of writers' L2 proficiency?
2.3. Do any observed language aptitude effects on L2 written performance vary as a function of the cognitive complexity of the writing task?

RQ 3: What are the potential independent and interactive effects of writing anxiety, L2 proficiency, and task complexity on L2 written performance in terms of CAF measures?
3.1. To what extent does writing anxiety affect L2 written performance, operationalised in terms of complexity, accuracy, and fluency indices?
3.2. Do any observed writing anxiety effects on L2 written performance vary as a function of writers' L2 proficiency?
3.3. Do any observed writing anxiety effects on L2 written performance vary as a function of the cognitive complexity of the writing task?

RQ 4: What are the potential independent and interactive effects of writing self-efficacy, L2 proficiency, and task complexity on L2 written performance in terms of CAF measures?
4.1. To what extent does writing self-efficacy affect L2 written performance, operationalised in terms of complexity, accuracy, and fluency indices?
4.2. Do any observed writing self-efficacy effects on L2 written performance vary as a function of writers' L2 proficiency?

4.3. Do any observed writing self-efficacy effects on L2 written performance vary as a function of the cognitive complexity of the writing task?

RQ 5: What are the potential independent and interactive effects of writing motivation, L2 proficiency, and task complexity on L2 written performance in terms of CAF measures?
5.1. To what extent does writing motivation affect L2 written performance, operationalised in terms of complexity, accuracy, and fluency indices?
5.2. Do any observed writing motivation effects on L2 written performance vary as a function of writers' L2 proficiency?
5.3. Do any observed writing motivation effects on L2 written performance vary as a function of the cognitive complexity of the writing task?

To answer these questions, the study followed a within–between-participant factorial design, with two levels of task complexity as the within-participant variable, and L2 proficiency, working memory, language aptitude, writing anxiety, self-efficacy and motivation as between-participants variables. The outcome measure was L2 writing performance as measured by CAF indices. Seventy six college EFL learners from a degree in English studies with different L2 proficiency levels ranging from upper-intermediate to advanced were invited to complete the previously validated simple and complex versions of the "Fire-Chief" task (Gilabert, 2007), which asked the participants to explain (a) what actions they would take in order to save as many people as possible from the burning building, (b) in what order they would rescue these people, and (c) why they would take these actions. Task complexity was operationalised in terms of reasoning demands, and tasks were counterbalanced to avoid unwanted order effects. Additionally, participants also completed the Oxford Placement Test, the LLAMA tests (Meara, 2005), the N-back WM test (Kane et al., 2007), and they took questionnaires assessing writing anxiety (Cheng, 2004), motivation (Waller & Papi, 2017) and self-efficacy (Sanders-Reio, 2010). L2 written production was assessed in terms of the CAF measures, and both correlations and regressions were used to analyse potential effects of the predictor variables.

Results show that working memory (WM) did not have an effect on L2 writing performance. Nevertheless, for the measures of error ratio, lexical density, lexical variety, lexical sophistication, coordination, and total number of words, the size and nature of the correlations with WM score were different in the simple and complex tasks. In contrast, L2 proficiency was the variable most connected to various dimensions of the text produced, especially in the areas of accuracy and fluency, followed by language aptitude (LA). LA contributed to L2 written performance less as compared to L2 proficiency, but the contribution of this cognitive ID variable was not negligible. Some notable findings were for the LLAMA E component of LA, which contributed significantly to writing accuracy; notably, the size of this contribution was similar in simple and complex task conditions and did not vary across different proficiency levels. LLAMA E, B and F contributed to lexical diversity, but only in the simple task condition. LLAMA E contributed to lexical sophistication, but only in the simple task. LLAMA E contributed to writing fluency (measured as the total number of words) to a higher degree in the simple task condition; conversely, the contribution of LLAMA F to writing fluency was more prominent in the complex task condition. Concerning affective variables, no significant correlations were observed between writing anxiety, writing self-efficacy, writing motivation and the accuracy and both lexical and syntactic complexity measures of L2 writing production for any of the two task conditions. The only significant correlations were found between writing self-efficacy and fluency (words per minute and total number of words) and writing anxiety and fluency (words per minute) in the simple version of the task. No significant correlations were found between writing motivation and L2 writing performance (in any of the CAF measures) in the simple task. In the complex task, no significant correlations were found between writing anxiety, self-efficacy, motivation and CAF measures.

These findings are relevant in task complexity studies as well as research on IDs in SLA in general, and L2 writing in particular. Regarding the former, the study adds further empirical evidence on the interaction between task complexity and learner-related factors, a finding that is discussed in terms of theorising on task complexity and previous empirical findings on task complexity effects. Regarding the effects of cognitive and affective/motivational IDs, our results are interpreted as suggesting (i) a greater role for cognition rather than affect/motivation in L2 writing as proficiency increases; and (ii) the key role played by proficiency in L2 writing, as L2 proficiency emerged as the main predictor of L2 written performance at both levels of task complexity. These findings are discussed from the perspective of what they add to previous empirical research, as well as from the perspective of relevant theorising on the role of IDs in L1 writing (Kellogg, 1996, 2001), and Kormos's (2023) task-mediated cognitive model of L2 writing and writing to learn, which constitutes the most recent and comprehensive theoretical proposal of how IDs may mediate writing processes and products as well as L2 learning through writing.

DIFERENCIAS INDIVIDUALES COGNITIVAS Y AFECTIVAS/MOTIVACIONALES, DOMINIO DE LA SEGUNDA LENGUA, Y COMPLEJIDAD DE LA TAREA: EFECTO DE LA INTERACCIÓN EN LA PRODUCCIÓN ESCRITA EN LA SEGUNDA LENGUA

María Dolores Mellado Martínez
Directoras de tesis: Dra. Rosa María Manchón y Dra. Olena Vasylets.

RESUMEN

El estudio de las diferencias individuales (DIs) ha sido y sigue siendo un área central de interés teórico y empírico en los estudios de adquisición de segundas lenguas (ASL) (véase Li et al., 2022a, para un reciente estado de la cuestión), especialmente en lo relativo a su implicación en el procesamiento y aprendizaje de una segunda lengua (L2). Sin embargo, como se indica en varias publicaciones fundamentales (por ejemplo, véanse contribuciones recientes a Manchón y Sanz, 2023a), el posible efecto de las DIs en procesos y productos de escritura en L2 es un problema de investigación más reciente en las agendas de investigación. La investigación en el área ha investigado el posible efecto de una serie de diferencias individuales de orden cognitivo (aptitud, memoria de trabajo, y estrategias), afectivas y motivacionales (ansiedad, creencias, emociones, motivación) en (i) los procesos implicados en la escritura y en el procesamiento de la retroalimentación, y (ii) las características de los textos producidos (Manchón & Sanz, 2023b para una revisión reciente).

La presente tesis doctoral intenta contribuir al creciente volumen de investigación sobre el papel de las diferencias individuales en el ámbito de la escritura en L2 arrojando luz sobre (a) cómo las diferencias individuales de orden cognitivo (memoria de trabajo y aptitud) y afectivas/motivacionales (ansiedad, autoeficacia, y motivación) están implicadas en el uso de la lengua escrita (nos centramos en los productos de escritura, no en los procesos de escritura), y (b) si el dominio de la lengua que posee el aprendiz y la complejidad de la tarea condicionan cualquier posible efecto de las diferencias individuales. La justificación de estos objetivos globales -y, por lo tanto, el enfoque en los efectos independientes e interactivos de la memoria de trabajo, la aptitud lingüística, la ansiedad, autoeficacia, motivación, el dominio de la L2 y la complejidad de la tarea- deriva de una serie de premisas teóricas sobre el papel de las diferencias individuales en modelos de escritura (especialmente Hayes, 2012; Kellogg, 1996, 2001. Véase también Olive 2022), así como de la evidencia empírica previa de ASL y preguntas abiertas sobre (a) el papel de la complejidad de la tarea en el uso de la L2 en general y, en menor medida, en la producción escrita en la L2 en particular (por ejemplo, Vasylets et al., 2017; Zalbidea, 2017); (b) la creciente -aunque a veces limitada y contradictoria- evidencia empírica sobre el papel de las DIs cognitivas y afectivas/motivacionales en la producción escrita (como se describe en los trabajos de Ahmadian & Vasylets, 2022; Kormos, 2023; Li, 2023b; Papi et al., 2022); (c) la interacción entre dominio de la L2 y complejidad de la tarea en la producción escrita (por ejemplo, Ishikawa, 2007; Kuiken et al., 2005; Kuiken & Vedder, 2008); (d) la investigación sobre la interacción entre los efectos de las DIs y la complejidad de la tarea (por ejemplo, Kormos & Trebits, 2011, 2012; Michel et al., 2019; Rahimi & Zhang, 2019; Yang et al., 2019; Zalbidea, 2017); y (e) la investigación sobre la interacción entre DIs y dominio de la L2 (Kormos & Sáfár, 2008; Lu, 2015; Vasylets & Marín, 2021)

en el ámbito de la escritura.

Esta investigación pone de manifiesto varias lagunas importantes que futuras investigaciones deberían llenar. En primer lugar, se han observado efectos de la memoria de trabajo (MT) en el caso de los procesos de escritura, aunque los efectos en los productos de escritura son menos claros o consistentes. Además, existen preguntas abiertas sobre si los efectos de la memoria de trabajo son independientes del dominio que se posea de la L2, variables relacionadas con la tarea, o factores afectivos. La investigación sobre aptitud lingüística y escritura es limitada en comparación con la investigación sobre los efectos de la aptitud en el procesamiento y uso de la retroalimentación. La investigación hasta la fecha apunta a un efecto positivo de la aptitud lingüística en la calidad de los textos, especialmente en lo que respecta al efecto del componente de aptitud de la capacidad lingüística analítica, si bien es necesaria más investigación. En cuanto a los factores afectivos y motivacionales, el conjunto de trabajos empíricos es limitado y, lo que es más importante, pocos estudios han analizado la posible interacción de los efectos de las variables cognitivas y afectivas en los textos producidos.

Teniendo en cuenta estas hallazgos y preguntas abiertas en el campo, la presente tesis doctoral, como se ha avanzado anteriormente, tiene como objetivo proporcionar nuevos datos empíricos sobre, primero, los efectos de los factores cognitivos, afectivos y motivacionales en los textos escritos en L2 y, segundo, la posible mediación de factores relacionados con la tarea (complejidad de la tarea) y factores relacionados con la lengua (dominio de la L2) en los posibles efectos observados. En consecuencia, la investigación presentada en esta tesis doctoral trató de responder a las siguientes preguntas de investigación:

RQ.1: ¿Cuáles son los posibles efectos independientes e interactivos de la memoria de trabajo, el dominio de la L2 y la complejidad de la tarea sobre las características de los textos escritos en L2 en términos de medidas de complejidad, corrección, y fluidez?
1.1. ¿En qué medida la memoria de trabajo afecta las características de los textos escritos en L2, operacionalizadas en términos de medidas de complejidad, corrección y fluidez?
1.2. ¿Varían los posibles efectos de la memoria de trabajo en función del dominio de la L2 de los escritores?
1.3. ¿Varían los posibles efectos de la memoria de trabajo en función de la complejidad cognitiva de la tarea de escritura?

RQ.2: ¿Cuáles son los posibles efectos independientes e interactivos de la aptitud lingüística, el dominio de la L2 y la complejidad de la tarea sobre las características de los textos escritos en L2 en términos de medidas de complejidad, corrección, y fluidez?
2.1. ¿En qué medida la aptitud lingüística afecta las características de los textos escritos en L2, operacionalizadas en términos de medidas de complejidad, corrección y fluidez?
2.2. ¿Varían los posibles efectos observados de la aptitud lingüística en función del dominio de la L2 de los escritores?
2.3. ¿Varían los posibles efectos observados de la aptitud lingüística en función de la complejidad cognitiva de la tarea de escritura?

RQ.3: ¿Cuáles son los posibles efectos independientes e interactivos de la ansiedad en la escritura, el dominio de la L2 y la complejidad de la tarea sobre las características de los textos escritos en L2 en términos de medidas de complejidad, corrección, y fluidez?

3.1. ¿En qué medida la ansiedad en la escritura afecta las características de los textos escritos en L2, operacionalizadas en términos de medidas de complejidad, corrección y fluidez?
3.2. ¿Varían los posibles efectos observados de la ansiedad en la escritura en función del dominio de la L2 de los escritores?
3.3. ¿Varían los posibles efectos observados de la ansiedad en la escritura en función de la complejidad cognitiva de la tarea de escritura?

RQ.4: ¿Cuáles son los posibles efectos independientes e interactivos de la autoeficacia en la escritura, el dominio de la L2 y la complejidad de la tarea sobre las características de los textos escritos en L2 en términos de medidas de complejidad, corrección, y fluidez?
4.1. ¿En qué medida la autoeficacia en la escritura afecta las características de los textos escritos en L2, operacionalizadas en términos de medidas de complejidad, corrección y fluidez?
4.2. ¿Varían los posibles efectos observados de la autoeficacia en la escritura en función del dominio de la L2 de los escritores?
4.3. ¿Varían los posibles efectos observados de la autoeficacia en la escritura en función de la complejidad cognitiva de la tarea de escritura?

RQ.5: ¿Cuáles son los posibles efectos independientes e interactivos de la motivación en la escritura, el dominio de la L2 y la complejidad de la tarea sobre las características de los textos escritos en L2 en términos de medidas de complejidad, corrección, y fluidez?
5.1. ¿En qué medida la motivación en la escritura afecta las características de los textos escritos en L2, operacionalizadas en términos de medidas de complejidad, corrección y fluidez?
5.2. ¿Varían los posibles efectos observados de la motivación en la escritura en función del dominio de la L2 de los escritores?
5.3. ¿Varían los posibles efectos observados de la motivación en la escritura en función de la complejidad cognitiva de la tarea de escritura?

Para responder a estas preguntas, el estudio siguió un diseño factorial intra- e inter-sujetos, con dos niveles de complejidad de la tarea como variable intra-sujetos, y el dominio de la L2, la memoria de trabajo, la aptitud lingüística, la ansiedad en la escritura, la autoeficacia y la motivación como variables inter-sujetos. La variable dependiente fue las características de los textos producidos operacionalizadas en términos de las medidas de complejidad, corrección y fluidez. Se invitó a setenta y seis estudiantes universitarios de inglés como lengua extranjera de grado en estudios ingleses con diferentes niveles de dominio de la L2, desde intermedio alto hasta avanzado, a completar las (previamente validadas) versiones simple y compleja de la tarea "Fire-Chief" (Gilabert, 2007), en la que se pedía a los participantes que explicaran (a) qué acciones llevarían a cabo para salvar al mayor número posible de personas del edificio en llamas, (b) en qué orden rescatarían a estas personas, y (c) por qué llevarían a cabo estas acciones. La complejidad de la tarea se operacionalizó en términos de demandas de razonamiento, y las tareas se realizaron en orden simultáneo por parte de los participantes ("counterbalance") para evitar efectos de orden no deseados. Además, los participantes también completaron el Oxford Placement Test, las pruebas LLAMA (Meara, 2005), la prueba N-back WM (Kane et al., 2007), y respondieron a cuestionarios que evaluaban la ansiedad en la escritura (Cheng, 2004), la motivación en la escritura (Waller & Papi, 2017) y la autoeficacia en la escritura (Sanders-Reio, 2010). La producción escrita en L2 se evaluó en términos de las medidas de complejidad, corrección y fluidez. Se utilizaron tanto correlaciones como regresiones en los cómputos estadísticos.

Los resultados muestran ausencia de efecto de la memoria de trabajo (MT) sobre las características de los textos. Sin embargo, para las medidas de proporción de errores, densidad léxica, variedad léxica, sofisticación léxica, coordinación, y número total de palabras, el tamaño y la naturaleza de las correlaciones con la puntuación de la memoria de trabajo (MT) fueron diferentes en las tareas simples y complejas. Por el contrario, el dominio de la L2 fue la variable más relacionada con varias dimensiones del texto producido, especialmente en las áreas de corrección y fluidez, seguida de la aptitud lingüística (AL). La AL tuvo un menor efecto en las características de los textos en comparación con el dominio de la L2, si bien la contribución de esta diferencia individual cognitiva no fue insignificante. Algunos hallazgos notables se relacionan con el componente LLAMA E, que contribuyó significativamente a la corrección de los textos. De forma más concreta, el efecto observado fue similar en las dos condiciones de escritura (tarea simple y compleja) y no varió en función del dominio de la L2. LLAMA E, B y F contribuyeron a la diversidad léxica, pero sólo en la condición de tarea simple. LLAMA E contribuyó a la sofisticación léxica, pero sólo en la tarea simple. LLAMA E contribuyó a la fluidez de la escritura (medida en términos de número total de palabras) en mayor medida en la condición de tarea simple; por el contrario, la contribución de LLAMA F a la fluidez fue más prominente en la condición de tarea compleja. En cuanto a las variables afectivas, no se observaron correlaciones significativas entre la ansiedad en la escritura, la autoeficacia en la escritura, la motivación en la escritura y las medidas de corrección y complejidad léxica y sintáctica de la producción escrita en L2 para ninguna de las dos condiciones de la tarea. Las únicas correlaciones significativas se observaron entre la autoeficacia en la escritura y la fluidez (palabras por minuto y número total de palabras) y la ansiedad en la escritura y la fluidez (palabras por minuto) en la versión simple de la tarea. No se encontraron correlaciones significativas entre la motivación en la escritura y el rendimiento escrito en la L2 (en ninguna de las medidas CAF) en la tarea simple. En la tarea compleja, no se encontraron correlaciones significativas entre la ansiedad en la escritura, la autoeficacia en la escritura, la motivación en la escritura y las medidas CAF.

Estos resultados son relevantes en los estudios sobre la complejidad de la tarea así como en investigaciones sobre diferencias individuales en ASL en general, y en la escritura en L2 en particular. Con respecto al primer ámbito de investigación, el estudio aporta evidencia empírica adicional sobre la interacción entre la complejidad de la tarea y los factores relacionados con el aprendiz, un hallazgo que se discute en términos de teorización sobre la complejidad de la tarea y los resultados empíricos previos sobre los efectos de la complejidad de la tarea. Con respecto a los efectos de las diferencias individuales cognitivas y afectivas/motivacionales, nuestros resultados se interpretan en el sentido de que sugieren (i) un mayor papel de la cognición que del afecto/motivación en la escritura en L2 a medida que aumenta el dominio de la L2; y (ii) el papel clave que desempeña el dominio en la escritura en L2, ya que esta variable resultó ser el principal predictor de las características de los textos producidos en ambos niveles de complejidad de la tarea. Estos hallazgos se discuten desde la perspectiva de lo que aportan a investigaciones empíricas previas, así como desde la perspectiva de la teorización relevante sobre el papel de las DIs en la escritura en L1 (Kellogg, 1996, 2001), y el modelo cognitivo mediado por tareas de

Kormos (2023) sobre la escritura en L2 y la escritura para aprender, que constituye la propuesta teórica más reciente y completa sobre cómo las DIs pueden mediar los procesos y productos de escritura, así como el aprendizaje de L2 a través de la escritura.

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CHAPTER I. OVERVIEW OF THE DISSERTATION

I.1. INTRODUCTION

The study of individual differences (hereafter IDs) has been a featured area of research that has received considerable attention in the field of second language acquisition (hereafter SLA) for a long time (e.g., Dörnyei & Ryan, 2015; Granena et al., 2016; Li et al., 2022a; Schwieter & Benati, 2019; Schwieter & Wen, 2022; Wen et al., 2017). Much of SLA-oriented IDs research has shown that IDs account for the variation not only in the rate of progress, but also in the level of ultimate attainment in SLA (Dörnyei, 2014). Yet, the influence of IDs on L2 writing is a more recent inclusion in SLA IDs research agendas (see, for instance, comprehensive syntheses of the available research in Ahmadian & Vasylets, 2022; Granena, 2023; Kormos, 2023; Li, 2023b; Manchón & Sanz, 2023a; Papi et al., 2022). This body of L2 writing research framed in SLA studies has shown the important role that IDs (both cognitive and affective/motivational) may play in writing, suggesting that there is a scarcity of research on the role of IDs in L2 writing as well as in the study of how IDs may influence students' learning of the L2 through writing (*writing-to-learn* perspective) (Kormos, 2012, 2023). This neglect of the study of IDs in L2 writing products and processes is surprising as these cognitive and affective/motivational ID factors may influence how L2 learners exploit the language learning potential (hereafter LLP) of writing tasks and may explain variations in the process of L2 writing (Kormos, 2012). Writing represents potential language learning opportunities for L2 learners (Manchón, 2011, 2020, 2023; Manchón & Williams, 2016; Williams, 2012), thus the significance of examining language learning related to writing tasks and the role that IDs may play. The research reported in this PhD aimed to add to the existing body of empirical work on the effects of IDs on written texts.

This doctoral dissertation also aims to contribute to the strand of research on IDs, tasks, and writing. In this respect, recent efforts made in the field of task-based learning and teaching (hereafter TBLT) to investigate TBLT in L2 writing have stressed the need for more task-based L2 writing research (Johnson, 2017, 2022; Vasylets et al., 2017), as compared to the more prevalent focus on the effects of cognitive task complexity on L2 oral production (Byrnes & Manchón, 2014a, 2014b; Trade-Off Hypothesis, Skehan, 2009, 2014; Cognition Hypothesis, Robinson, 2001, 2011). Although several studies have been conducted on task complexity and L2 writing production (e.g., Vasylets et al., 2017), cognitive and affective/motivational IDs have not been examined so much in these investigations (but see Michel et al., 2019; Zalbidea, 2017, for cognitive IDs, task complexity and L2 writing; and Rahimi & Zhang, 2019, for affective/motivational IDs, task complexity, and L2 writing). As more fully discussed in later chapters, in line with Robinson's (2001, 2011) Cognition Hypothesis, we set out to investigate whether cognitive and affective/motivational IDs play a more significant role in a more complex writing task due to its higher cognitive demands and increased cognitively problem-solving nature.

Finally, the research reported in this doctoral dissertation could also be considered an attempt to attend Kormos's (2012, 2023) call for more SLA-oriented L2 writing empirical work on the role of IDs in the writing domain, as well as the potential moderating effects of task complexity and L2 proficiency. We did so with an SLA-oriented L2 writing study that analysed the effects of a range of cognitive and affective/motivational IDs (language aptitude, working memory, writing anxiety, writing self-efficacy, and writing motivation) on L2 written performance as mediated by L2 proficiency and task complexity.

I.2. INTENDED CONTRIBUTION OF THE CURRENT DOCTORAL DISSERTATION

The ultimate intended contribution of this PhD is envisaged as being theoretical and empirical in nature. From the theoretical perspective, the aims pursued (as outlined in the previous section) are closely linked to Kormos's (2023) recent theoretical framework "Task-Mediated Cognitive Model of L2 Writing and Writing to Learn" given its aim of investigating the independent and interactive effects of cognitive, affective and motivational IDs, L2 proficiency and task complexity. In this sense, it is important to note that the key tenet in Kormos's 2023 model is:

> The *Task-Mediated Cognitive Model of L2 Writing and Writing to Learn*, highlights that the foundational role of cognitive factors in writing might vary as a function of L2 proficiency and relevant L1 literacy skills. It also shows that the task environment […] such as the cognitive, linguistic, and genre-based demands of the task, the time allotted for writing, and the transcribing technology (handwritten vs. typed), may also mediate the effect of WM capacity and aptitude on L2 writing processes and outcomes. (Kormos, 2023, p. 639, emphasis in original)

From the empirical perspective, the research conducted for this PhD is thought to be scientifically relevant in two fields of study. On the one hand, although there is abundant research on the role of cognitive and affective/motivational IDs in SLA studies (e.g., Dörnyei & Ryan, 2015; Granena et al., 2016; Li et al., 2022a; Schwieter & Benati, 2019; Schwieter & Wen, 2022; Wen et al., 2017), this research has focused primarily on the facet of "learning", with much less research interest in the dimension of language use. Thus, the study in this doctoral dissertation attempts to fill this gap with a study on the role of cognitive and affective/motivational IDs in the dimension of written language use, that is, in the use of a second language (L2) in the written modality. On the other hand, until recently, very limited attention has been devoted in L2 writing studies to the role of IDs in the quality of the texts produced. Thus, the empirical contribution of the present SLA-oriented L2 writing study is threefold. Firstly, it adds new empirical evidence to the existing research studies on IDs and

L2 writing. Secondly, it expands the IDs analysed so far by including a wider range of IDs, both cognitive and affective/motivational together, and by attempting to fill important gaps. Thus, regarding aptitude, the research focused on all components of language aptitude (LA) in contrast to the prevalent focus on just the component of language analytic ability (e.g., Benson & DeKeyser, 2019; Stefanou & Révész, 2015). Additionally, our research adds to previous empirical work on LA given that the effects of aptitude in writing have until recently received little attention (Kormos & Trebits, 2012; Vasylets et al., 2022; Yang et al., 2019) as compared to the research on aptitude effects on feedback processing and use (e.g., Benson & DeKeyser, 2019; Ishikawa & Révész, 2023; Ishikawa & Suzuki, 2023). Regarding working memory, previous research evidenced WM effects on writing processes (Michel et al., 2019; Révész et al., 2017, 2023; Torres, 2023), but contradictory findings were observed in the case of WM effects on writing products (e.g., Kormos & Sáfar, 2008; Manchón et al., 2023; Mavrou, 2020; Michel et al., 2019; Mujtaba et al., 2021; Vasylets & Marín, 2021; Zalbidea, 2017). Regarding affective and motivational factors (writing anxiety, self-efficacy, and motivation), the body of empirical work is limited (but see, for instance, Jang & Lee, 2019; Rahimi & Zhang, 2019; Tahmouresi & Papi, 2021; Zabihi, 2018). Thirdly, our research combines in one and the same study an inquiry into the potential interactions of learner-related variables (i.e., language aptitude, working memory, writing anxiety, writing motivation, writing self-efficacy, L2 proficiency) and task-related variables (i.e., task complexity) that have hitherto been addressed separately.

I.3. SUMMARY OF CHAPTERS IN THE CURRENT DOCTORAL DISSERTATION

This doctoral dissertation is divided into two main parts, comprising a total of ten chapters.

Part I consists of the theoretical background to the study and includes four chapters. As the necessary background for our own study, the literature review starts with a chapter (Chapter II) that provides a synthesis of the role of cognitive and affective/motivational IDs in SLA. It also presents the research on task complexity studies in SLA, as well as the role of IDs and task complexity in the field of SLA. Chapter III is a central chapter in the literature review as it provides a synthesis of current theorising and empirical research on the focus of our research, that is, cognitive and affective/motivational IDs in L2 writing, and the moderating role of L2 proficiency and task complexity in such ID effects on writing. Chapter IV reviews the research conducted on task complexity and L2 writing, as well as previous research on IDs, writing, and task complexity. Together, these three chapters (II, III and IV) offer the necessary background for the empirical study reported in Part II.

Part II includes chapters V to IX. Chapter V presents the aims, motivation, and the five research questions and hypotheses that guided the study. Chapter VI provides a detailed description of the methodology of the study, focusing on the participants and context, the instruments employed for data collection, the data collection procedures undertaken, and the data coding and data analysis procedures implemented. Chapter VII presents the results obtained for each of the research questions guiding the study. Chapter VIII provides a detailed discussion of the results, divided according to the research questions of the study. Finally, Chapter IX provides the general conclusions, limitations, and implications of the present study. Suggestions for further research agendas are also provided in this final and concluding chapter.

PART I. THEORETICAL BACKGROUND

CHAPTER II. INDIVIDUAL DIFFERENCES IN SECOND LANGUAGE ACQUISITION

As mentioned in the previous chapter, the current chapter provides an account of the role of individual differences (IDs) in SLA as the necessary global background in which to situate the research on IDs and writing presented in Chapter III.

We begin by providing the rationale and significance of the role of IDs in the field of SLA and subsequently describe the general conceptual bases of IDs and their theoretical underpinnings by describing the 'classic' perspective on the concept of IDs as well as more recent perspectives on it. This section is followed by a description of taxonomies of IDs in the field of SLA. After that we focus on the main lines of IDs research in SLA. This section is divided into two parts. The first part provides the conceptualisations and taxonomies of the cognitive IDs in focus in this doctoral dissertation (i.e., language aptitude and working memory), as well as a review of previous research carried out on these IDs in L2 studies. The second part provides the conceptualisations and taxonomies of the affective and motivational IDs targeted in our own study (i.e., writing anxiety, writing self-efficacy, and writing motivation), as well as a review of previous research on these IDs in L2 studies. The chapter will end with a section devoted to the role of task complexity studies in SLA, and to the role of IDs and task complexity in SLA.

II.1. INDIVIDUAL DIFFERENCES IN SLA. CONCEPTUALISATIONS AND TAXONOMIES

II.1.1. Introduction

IDs have traditionally been and still are theoretically and empirically investigated in SLA studies (e.g., Dörnyei & Ryan, 2015; Granena et al., 2016; Li et al., 2022a; Schwieter & Benati, 2019; Schwieter & Wen, 2022; Wen et al., 2015, 2017, 2019; Wen & Li, 2019). Additionally, there is no doubt that ID factors such as language aptitude (LA) or language learning motivation are fundamental contributors to success in mastering an L2 (Dörnyei, 2005), and they have traditionally been seen as the primary IDs in the study of an L2 (Dörnyei, 2009a). Second language (L2) learners' IDs (both cognitive and affective/motivational) are thought to be significant factors that account for the variation in the rate of progress and in the level of ultimate attainment in SLA (Dörnyei, 2014).

ID research is concerned with understanding those traits that make subjects differ from each other and exploring how and why these differences emerge (Dörnyei & Ryan, 2015). Although various IDs had been researched earlier, studying IDs within SLA started to gain real momentum in the mid-1970s (Naiman et al., 1978; Rubin, 1975) as a result of the influential research on the good language learner. The findings of this line of investigation not only showed in general that IDs were significant key factors that make L2 learners excel, but also showed in particular that, in addition to language aptitude and language learning motivation -which were learner variables known to affect success when learning an L2-, there were further important ID variables fostering L2 attainment, such as language learning strategies and learning styles, which were therefore also included in the list of important L2 learner characteristics in language learning. Moreover, Dörnyei and Ryan (2015) argue that the initial wave of ID research in SLA (centred around Skehan's views) may be considered as an attempt to first determine those ID factors that have the most significant effect on learning outcomes and then to analyse the specific effects of particular IDs. This consideration was supported by Dewaele (2013), who stated that "some hidden internal characteristic of the L2 learner predetermines a more or a less successful outcome" (p. 159).

It was also claimed that IDs “were powerful background learner variables with potential make-or-break quality” (Dörnyei & Ryan, 2015, p. 5) that influenced different aspects of the process of L2 acquisition. In this respect, LA was seen to be related to the capacity and quality of learning, whereas motivation was seen as the basis of the direction and magnitude of learning behaviour considering the L2 learner’s choice, intensity, and duration of learning.

Furthermore, there is a wide variation among learners with regard to their ultimate success in mastering an L2. In this sense, IDs are an important feature of SLA due to the fact that “a great deal of the variation in language learning outcomes is attributable, either directly or indirectly, to various [language] learner characteristics” (Dörnyei, 2006, p. 42), particularly in adult learners (Andringa & Dabrowska, 2019), as will be mentioned later in this section. In the same vein, adult learners have also been shown to rarely, if ever, attain native-like competence in the L2 (Andringa & Dabrowska, 2019).

In light of this, numerous studies (for reviews, see e.g., Cooper 2002; De Raad 2000; Eysenck, 1994) have shown that IDs significantly affect human thinking and behaviour (Dörnyei, 2006) and this effect has also been established in the field of education (e.g., Snow et al., 1996). Research in SLA has shown that these many ID factors play a significant role in the success of acquiring an L2. According to Dörnyei (2005), IDs have been found to be the most consistent predictors of L2 learning success (i.e., in SLA), producing “multiple correlations with language attainment in instructed settings within the range of 0.50 and above (cf. Dörnyei & Skehan 2003; Sawyer & Ranta 2001)” (Dörnyei, 2005, p. 2). It is a fact that research in the field of SLA has long been concerned with the question of why students show great variation in their language learning success. For healthy individuals, learning a native language is natural and effortless. Nevertheless, this is not the case for learning an L2, especially for adults who normally show great variability in the speed of learning and in the levels of L2 proficiency they are able to attain (García-Mayo & García-Lecumberri, 2003). Hence, the “wide variation among language learners in terms of their ultimate success in mastering an L2” (Dörnyei & Ryan, 2015, p. 4). Dörnyei and Ryan (2015) stated that despite the fact that bilingualism is the norm in many, if not most parts of the world, when it comes to consider the acquisition of an L2, it should be noted that the ability to acquire a high level of proficiency in an L2 is not considered universal. For instance, Schumann (2013) stated that given that “almost everybody masters a first language [(L1)] with little difficulty” (as cited in Dörnyei & Ryan, 2015, p. 5), we can make the assumption that “there must have been some evolutionary advantage associated with the acquisition of language, and as a result, the ability to master a first language was genetically transmitted to future generations, ultimately becoming a universal human characteristic” (as cited in Dörnyei & Ryan, 2015, p. 5). In this respect, it is interesting to quote here Segalowitz’s (1997) own words:

> Why do individuals differ so much in second language (L2) attainment success? After all, every healthy human being in an intact social environment masters a first language to a degree of fluency that, in other skill domains, would be recognized as elite or near elite levels. (p. 85)

Given how variable L2 learning is, a basic research question pursued in SLA is what factors can contribute to this variability. For instance, Li et al. (2022b) recently stated that ID factors, such as age, motivation, aptitude, anxiety and working memory (WM) are essential to determine L2 achievement, with these ID variables being found to be significantly predictive of L2 achievement. Furthermore, Li et al. (2022b) also acknowledged the relevance of the access to and availability of (high-quality) instruction, and the availability of resources as two factors contributing to L2 achievement. Similarly, Granena (2013a, as cited in Li et al., 2022b) emphasised the importance of examining the associations between learners’ ID factors and L2 attainment in order to determine how different early and late bilinguals learn an L2. Hamrick (2015) also acknowledged the relevance of exploring the implications of ID factors such as declarative and procedural memory for different stages of learning (as cited in Li et al., 2022b) in order to better understand how learning occurs at initial and later stages of learning. In addition to this, studies on L2 oral production (Dörnyei & Kormos, 2000; Kormos & Trebits, 2012) or on L2 reading (for a review see Graber, 2009) have convincingly demonstrated that a host of learner-related factors, such as age, gender, cognitive abilities or affective states, can determine rate and level of ultimate attainment in SLA (Dörnyei & Skehan, 2003).

In short, IDs are thought to play a crucial role in SLA. As we will see in the following sections, the research in the field is abundant in terms of conceptualisations and taxonomies, on the one hand, and empirical work, on the other.

II.1.2. Conceptualisations of Individual Differences: From Classic to More Contemporary Perspectives

In the field of psychology, individual difference (ID) research -traditionally termed differential psychology- is a well-developed strand that aims to explore "the uniqueness of the individual mind" (Dörnyei, 2006, p. 42). Regarding the classic ID construct, as the term itself suggests, IDs are enduring psychological personal characteristics or traits which are supposed to apply to everybody, but which vary among them in the degree with which the characteristic may distinguish one individual from another, thus helping each person's individuality (Dörnyei & Ryan, 2015). That is, people differ from one another but also have things in common with each other (Kluckhohn & Murray, 1948, as cited in Dörnyei & Ryan, 2015), with the classic ID paradigm focusing "on inter-individual differences but only in those [characteristics or] aspects that were *common* to all people, and the canonical ID factors were treated both as being trait-like and at the same time subject to contextual and temporal variation" (Dörnyei & Ryan, 2015, p. 13).

More specifically, Dörnyei (2005) defines IDs as "characteristics or traits in respect of which individuals may be shown to differ from each other" (p. 1). IDs "concern anything that marks a person as a distinct and unique human being" (Dörnyei, 2005, p. 3). Dörnyei (2005) continues to state that "people differ from each other in respect of a vast number of traits, of which ID research has traditionally focused only on those personal characteristics that are enduring, that are assumed to apply to everybody, and on which people differ by degree" (p. 3). In light of this, Dörnyei (2009a) argued that the classic ID paradigm assumes that IDs are distinctly definable psychological constructs, relatively stable attributes, that form monolithic components that refer to different aspects of human functioning, thus being only moderately related to each other; and are learner-internal (as cited in Dörnyei & Ryan, 2015). Nevertheless, the new emerging ID paradigm views IDs as learner variables that are not monolithic and distinct but that "involve, instead, complex constellations made up of different parts [i.e., of a number of constituent components] that [dynamically] interact with each other and the environment" (Dörnyei & Ryan, 2015, p. 6). Moreover, individual learner characteristics are not stable but show variation in terms of time and context. This current ID research agenda is described as one that portrays ID factors as "socially interdependent, malleable states developing over time" (Murphey & Falout, 2013, p. 6, as cited in Dörnyei & Ryan, 2015), that is, they are seen as evolving and dynamic constructs rather than as stable and static learner ID traits.

Under the classic perspective on IDs, it should be noted that all definitions of IDs consider the importance of the notion of stability. Differential psychology, in contrast, puts the emphasis on the variation among people and the continuity of such variation over time (Cervone & Pervin, 2013, as cited in Dörnyei & Ryan, 2015). Nevertheless, great variability exists in how individuals differ from each other on account of such numerous influences as heredity and environment that interact throughout an individual's lifetime (Dörnyei & Ryan, 2015). Differential psychology focuses on broad dimensions which are applicable to everyone and discriminate among people (Snow et al., 1996, as cited in Dörnyei & Ryan, 2015).

Pawlak (2020) acknowledged that IDs significantly influence both the process and the product of learning. Recently, Pawlak and Kruk (2022) acknowledged the dynamic interplay between various ID variables in a situated manner (micro-perspective), and investigated constellations of ID factors aiming at obtaining an overall individual learner profiles, which can be adjusted to learning conditions and can supersede the effect of external influences. Pawlak and Kruk (2022) explored such ID factors as age, gender/sex, aptitude and working memory, personality, grit, learning styles, learning strategies and self-regulation, beliefs, motivation, willingness to communicate, engagement, and emotions.

To sum up, there has been a shift in the way in which IDs are perceived, from a classic perspective that regarded IDs as variables being "clearly definable, stable, monolithic and internal" (Pawlak & Kruk, 2022, p. 696), to a more contemporary perspective that considers ID as being malleable, non-monolithic, context dependent and dynamic. As noted by Pawlak and Kruk (2022), this change has been driven by such relevant theories as the Complex Dynamic Systems Theory (Hiver et al., 2022) and the Sociocultural Theory (Lantolf et al., 2018).

II.1.3. Taxonomies of Individual Differences in SLA

The set of individual learner ID factors thought and found to influence L2 learning outcomes is well-established (Ellis, 2012), being traditionally divided into cognitive, affective, and motivational IDs, thus providing a schematic means for systematically examining how individual learner factors mediate L2 learning (Ellis, 2012). Gardner (1985) divided IDs into cognitive, affective, and personality-related factors. The taxonomy proposed by Robinson (2002) included two broad dimensions: cognitive (e.g., working memory) and conative/affective (e.g., anxiety). Cognitive IDs were regarded as being more stable, whereas conative/affective IDs were considered to be more malleable (as cited in Li et al., 2022b). Accordingly, affective ID variables include anxiety, self-confidence, attitude, and motivation, while cognitive ID variables include aptitude, strategies, and intelligence (MacIntyre, 2002).

Another taxonomy of IDs was proposed by Cronbach (2002), who divided ID factors into affective, conative, and cognitive dimensions: "Affective has to do with feelings and emotions. Conative has to do with goal setting and the will. And cognitive refers to analysis and interpretation. It includes reasoning, remembering, and using symbols" (Cronbach, 2002, as cited in Li et al., 2022b, p. 4). Some time later, Dörnyei (2010) conceptualised IDs in SLA research and acknowledged the inter-related and dynamic nature of cognitive, affective and personality-related factors, which were found to interact with each other. Dörnyei (2010) stated that the traditional modular view of IDs is untenable. However, despite the untenability of the traditional modular view of ID characteristics, Dörnyei (2010) acknowledged the usefulness of maintaining the distinction between cognition, emotion (affect), and motivation "as a broad, phenomenologically validated framework" (p. 262), therefore with IDs traditionally being divided into cognitive, affective, and motivational factors.

However, Dörnyei (2009a) acknowledged the difficulty of making such a clear division of the types of ID variables (i.e., cognitive, affective, and motivational IDs) "especially if one takes a neuropsychological approach as there is no evidence of their separation in neural functioning" (as cited in Ellis, 2012, p. 308). Higher-order human functioning is characterised as being complex and interlocking in nature, and it is due to this that IDs in mental functions involve cognitive, affective and motivational components. As mentioned above, however, if we consider the level of neural networks, at this level it is difficult to maintain the traditional separation of the three different areas of mental functioning (that is, cognition, motivation and affect).

Nevertheless, as Dörnyei (2009a) also acknowledged, and in line with the phenomenological view, "it is still useful to view these learner factors as separate because they 'feel' different" (as cited in Ellis, 2012, p. 308). It should be noted that this distinction of cognition, motivation and affect (emotions) corresponds to the "trilogy of the mind" (Mayer et al., 1997), a traditional division that has its origins in Greek philosophy and which reflects the interrelation but conceptually distinction between these three mental systems (which have continuous dynamic interaction with each other and do not exist in isolation from one another but in conjunction), and also the maintenance of the highly integrated nature of the human mind. This dynamic conception emphasises the contextually grounded and mutually interacting IDs, with a focus on the individual and their various individual attributes in terms of a complex dynamic system (Cervone & Pervin, 2013; Dörnyei et al., 2015, as cited in Dörnyei & Ryan, 2015). This complex dynamic systems perspective, which "positions *change* [and growth] rather than *stability* as the norm" (Dörnyei & Ryan, 2015, p. 11), in contrast to the classic and static ID conceptualisation, views human beings as "a product of the constant [and dynamic] interactions" (Dörnyei & Ryan, 2015, p. 11) between the context and the various characteristics within the individual, with these traits themselves being "multicomponential in nature and mak[ing] up a holistic dynamic framework" (Dörnyei & Ryan, 2015, p. 11).

More recently, and drawing on Cronbach's (2002) taxonomy, Li et al. (2022b) have proposed another taxonomy of ID factors, which included four dimensions: cognitive, conative, affective, and sociocultural/demographic differences. Language aptitude, working memory declarative/procedural memory, learning strategies, cognitive styles, and metacognition are part of cognitive IDs; motivation, mindsets, goal complexes, and willingness to communicate are conative IDs; anxiety, enjoyment, self-efficacy, and learner beliefs are affective IDs; whereas age and identity are viewed as sociodemographic IDs.

Drawing on Dörnyei's (2010) taxonomy, we divided the ID factors covered in this doctoral dissertation into three categories: cognitive, affective, and motivational. Thus, the ID factors that have been considered are the following: language aptitude and working memory, for cognitive IDs; writing anxiety and writing self-efficacy, for affective IDs; and writing motivation, for motivational ID factors.

The following section synthesises previous research on the IDs in focus in our own research, starting with cognitive IDs (language aptitude and working memory) and following with the role of affective/motivational individual differences (i.e., writing anxiety, writing self-efficacy and writing motivation) in SLA.

II.2. COGNITIVE INDIVIDUAL DIFFERENCES: LANGUAGE APTITUDE

II.2.1. Cognitive Individual Differences in SLA: Preliminary Observations

As mentioned in the previous section, the cognitive ID factors considered in this doctoral dissertation are language aptitude (LA) and working memory (WM), which have been treated separately because different instruments have been used to investigate them. Nonetheless, "it is not clear that these two factors are really separate, with some researchers (e.g., Miyake and Friedman, 1998) arguing that working memory is in fact an essential component of language aptitude" (Ellis, 2012, p. 312). Miyake and Friedman (1998) stated that "WM may be one (if not the) component of language aptitude" (p. 340) and argued that working memory (as a cognitive device responsible for information storage and processing) is where all three components of traditional aptitude (i.e., phonetic coding, language analytic ability, and rote memory; Li, 2015, 2016) converge.

Based on existing research (e.g., Hummel, 2009; Sáfár & Kormos, 2008; Yalçın et al., 2016) and as also pointed out in Li's (2017) research synthesis and in Kormos's (2023) contribution to the special issue edited by Manchón and Sanz (2023a), LA and WM have been found to be separate constructs on account of the involvement of WM in language learning, but it should not be regarded as a component of language aptitude "because its role is not restricted to language learning" (Li, 2019, p. 86). In theoretical terms, WM is a domain-general cognitive variable which is relevant for academic learning in general, and thus it is supposed to be dissimilar to LA, which is a domain-specific variable (Li, 2019). However, more theory and empirical research are needed to explore how WM relates to aptitude components. In this sense, as discussed in Kormos (2013), some empirical research (e.g., Robinson, 2002; Sáfár & Kormos, 2008) found that WM (as measured by a reading span test and a backward digit span test, respectively) had a moderately strong correlation with total LA scores. Concerning the correlation between the different LA components and WM, Sáfár and Kormos (2008) found a significant correlation between WM scores and the inductive ability LA test, but no significant correlation was found between phonological short-term memory (PSTM) capacity and the total LA test score and LA subcomponents.

II.2.2. Language Aptitude and SLA. Introduction

Language aptitude (LA) is regarded as one of the main cognitive abilities in language learning (Curcic et al., 2019; Dabrowska, 2019; DeKeyser, 2013; Doughty, 2019; Granena, 2013b; Granena & Yilmaz, 2019a; Li, 2022; Olive, 2022; Skehan, 1991; Wen et al., 2017, 2019). Importantly, as discussed in Ahmadian and Vasylets (2022), LA research has focused on many dimensions of L2 learning and use, including ultimate L2 attainment (Granena & Long, 2013), written corrective feedback (Benson & DeKeyser, 2019), and the effectiveness of instruction (Erlam, 2005). Moreover, the construct of LA has been regarded as being multicomponential (Dörnyei, 2005), and it is assumed to be the most reliable predictor of success in SLA (Dörnyei & Ryan, 2015), i.e., of language learning outcomes, as also established by Carroll (1969) in his early research. Recent conceptualisations of LA in SLA research consider that different cognitive aptitudes might be relevant or implicated in different language learning phases and processes (Skehan, 2002, as cited in Kormos & Trebits, 2011), and it is also stated that L2 learners with various aptitude profiles are more likely to benefit from different types of learning tasks (and other task-related factors, such as TC, for instance) and instruction (Robinson, 2005, as cited in Kormos & Trebits, 2011).

II.2.3. Language Aptitude: Conceptualisations

In SLA, LA is generally considered as a cognitive construct defined as a flair or "a specific [and special] talent for learning a foreign or second language" (Wen et al., 2017, p. 1). According to Ortega (2009), LA is conceptualised as "the psychological formulation behind the intuition that some people have a gift for additional language learning while others seem to struggle" (p. 164). Also, according to Dörnyei (2005), the concept of LA "is related to the broader concept of human abilities, covering a variety of cognitively-based learner differences" (p. 31).

Accordingly, LA is defined as “a combination of different cognitive and perceptual abilities” (Granena, 2013a, p. 1) which are beneficial in L2 learning (Carroll, 1981; Doughty et al., 2007), and which refer to “the learner’s overall capacity to master a foreign language” (Dörnyei, 2006, p. 46). Carroll (1993) conceptualised this complex of abilities as “aptitudes” (p. 675), being “partly innate, fairly stable [and relatively enduring] traits (Carroll, 1993, as cited in Granena, 2013a, p. 1). More recently, Wen et al. (2017) stated that LA “has consistently been seen as a complex of [cognitive] abilities that together constitute aptitude for learning a second or foreign language” (as cited in Andringa & Dabrowska, 2019, p. 7). Importantly, these cognitive abilities are predictive of learning rate and ultimate attainment in an L2 (Li, 2020) and, as noted in Dörnyei (2005), “not […] of whether an individual can learn a foreign language or not” (p. 43). In this respect, LA is recognised as a capacity that contributes positively to the rate and ease of learning, and not a necessary precondition for L2 acquisition.

LA has been found to be a consistent and powerful predictor of success in SLA, as well as facilitative of learning (Granena, 2013a). As noted by Ahmadian and Vasylets (2022), LA has traditionally been regarded as one of the major cognitive determinants of success in SLA (Ehrman & Oxford, 1995), just after Age of Onset (Long, 2013). DeGraaf (1997) stated the relevance of aptitude for predicting L2 learning success both in explicit and implicit conditions, and Robinson’s (1995) empirical study on aptitude and acquisition found that aptitude was relevant for acquisition-rich and acquisition-poor contexts. Yet, Carroll (1981) predicted in his traditional LA conceptualisation that this cognitive construct was “a predictor of the rate of learning and not the actual success or outcome of second language acquisition” (as cited in Kormos, 2023, pp. 626-627).

More recently it has been posited that “different components of aptitude [e.g., WM, grammatical sensitivity, inductive learning ability, restructuring capacity, retrieval processes] are related to the four macro-stages of the [L2] acquisition process [including noticing, patterning, controlling, and lexicalizing]” (Skehan, 2002, as cited in Ellis, 2012, p. 312). Phonemic coding and working memory are posited to be relevant for the initial stage of learning (noticing); language analytic ability is relevant for the second stage of learning (patterning); no aptitude components were relevant for the third stage of learning (controlling), but Skehan mentioned the concept of cumulative learning which is measurable by the York aptitude test and the CANAL-F (Grigorenko et al., 2000); and the memory component of aptitude, especially the ability for information retrieval, is relevant and responsible for the final stage of learning (lexicalising).

As mentioned above, LA is thought to predict success both in explicit and implicit learning contexts (Granena, 2013a). In this respect, explicit (conscious and intentional) learning is strongly associated with explicit abilities (for a review, see Granena & Yilmaz, 2019a), including rote learning ability, explicit inductive learning ability, and grammatical sensitivity, with WM playing a beneficial role in explicit learning (Granena, 2013a, as cited in Kormos, 2023). On the other hand, implicit (unconscious and incidental) learning is associated with implicit abilities, including implicit inductive learning abilities and implicit memory (Granena, 2013a; Yilmaz & Granena, 2021, as cited in Kormos, 2023). Furthermore, implicit LA has been found to be more beneficial for higher-level L2 learners in incidental learning conditions, "particularly in incidental learning conditions that involve exemplar-based, associative learning processes" (cf. Morgan-Short et al., 2014, as cited in Kormos, 2023, p. 627). In the same vein, DeKeyser (2015) also highlighted the pivotal role of implicit LA in the acquisition and learning of complex syntactic structures, whereas explicit LA is more associated with the acquisition and learning of simple syntactic structures (as cited in Kormos, 2023). In this respect, Sasayama (2018) stated that learners with high LA, especially in the sub-component of grammatical sensitivity, are prone to benefit more from implicit instruction and from a communication-oriented learning environment; and that learners differ in terms of their levels and types of LA, with this variation having an effect on the degree of L2 learning success. Robinson (2013) highlighted that:

> Higher aptitude for second or foreign-language learning predicts more successful adaptation to instructed, or naturalistic exposure to the second language (L2), as measured by demonstrably faster progress in learning, and in higher levels of ultimate attainment in proficiency at the end of a course of instruction, or following a period of naturalistic exposure to the L2. (p. 1)

In a nutshell, LA emerges as a strong predictor of success in an L2 (Granena, 2013a; Li, 2019), as compared to other ID variables. Li (2019) also acknowledged that in LA research, LA appears to be a stronger predictor of language learning outcomes at early stages than at more advanced stages of learning, as well as a stronger predictor of adult language learning (as compared with child language learning).

An important tenet in LA research is that L2 learners with various aptitude profiles are more prone to gain benefits from different types of learning tasks (and other task-related factors, such as TC, for instance) and instruction (Robinson, 2005, as cited in Kormos & Trebits, 2011). Hence, the relevance of interpreting LA as a situated construct (Robinson, 2005, 2012; Snow, 1992). Snow's (1992) view of aptitude is that this construct is "a conglomerate of individual characteristics that interact […] [in a dynamic way] with the situation in which learning takes place" (Snow, 1992, as cited in Kormos, 2013, p. 132), rather than an inherent and unchanging ability. Therefore, "different sets of abilities can enhance learning under various learning conditions" (Kormos, 2013, p. 132). Importantly, it is relevant to be mindful that to account for the effectiveness of instructional interventions, the various abilities and cognitive resources of L2 learners have to be related to such instructional interventions (Robinson, 2012, as cited in Ahmadian & Vasylets, 2022).

Traditionally, LA has been conceptualised as consisting of four different and independent components (Carroll, 1981, p. 105): (i) phonetic coding ability, which is the "ability to identify distinct sounds, […] [and] form [and retain] associations between these sounds and symbols representing them", (ii) grammatical sensitivity, defined as "the ability to recognise the grammatical functions of […] [linguistic units (such as] words […] in sentence structures", (iii) rote learning ability (associative memory), which is the capacity to "learn [and retain] associations between sounds and meanings rapidly and efficiently", and (iv) inductive language learning, which represents "the ability to infer or induce the rules governing […] [the language on the basis of] […] samples of language material". See Table 1. Carroll's four factor aptitude model (based on Dörnyei & Skehan, 2003). Carroll's (1981) conceptualisation of LA was established when audiolingualism was the predominant teaching methodology, as well as when linguistic competence was equated with grammatical knowledge (Granena, 2013a). Later, new language teaching methodologies (for instance, communicative-oriented and task-based approaches) focused on communicative competence, thus enhancing not only learners' linguistic competence, but also their communicative abilities and skills, and knowledge (Kormos & Trebits, 2011). Accordingly, these developments concerning competence and language teaching methodology have involved revising and broadening the LA conceptualisation, as stated by Kormos and Trebits (2011).

Table 1. Carroll's four factor aptitude model (based on Dörnyei & Skehan, 2003). Source: Wen et al. (2017).

Aptitude components	**Definitions**
Phonetic coding ability	Capacity to code unfamiliar sound so that it can be retained
Grammatical sensitivity	Capacity to identify the functions that words fulfil in sentences
Inductive language learning ability	Capacity to extrapolate from a given corpus to create new sentences (not measures in the MLAT)
Associative memory	Capacity to form associative links in memory

In this sense, Skehan (1998, 2002) updated the LA construct by proposing a new LA conceptualisation consisting of three components: (i) phonetic coding ability, which is the same component that Carroll (1981) had proposed; (ii) language analytic ability (capacity for pattern-recognition in language and the subsequent production of new language chunks; Skehan, 1998) which included grammatical sensitivity and inductive language learning analytic ability originally proposed by Carroll in 1981 (Artieda & Muñoz, 2016) and (iii) memory. Skehan (1998) also theorised the contribution of each of the subcomponents of LA at different levels of L2 development, and he suggested that "language aptitude operates differently during the course of adult language learning" (1998, as cited in Ellis, 2012, p. 312). In Skehan's (1998) view, phonemic coding ability would play a crucial role at the initial stages of proficiency and it decreases significantly after reaching a threshold, while both language analytic ability and memory were posited to be equally important at all proficiency levels (as cited in Artieda & Muñoz, 2016). Memory has also been found to play a fundamental role at more advanced stages of proficiency; hence, when a threshold level has been reached, memory is of greatest importance for learners' acquisition of native-like proficiency level (Skehan, 1998, as cited in Artieda & Muñoz, 2016). As cited in Li (2019), out of the three components of aptitude, phonetic coding ability emerges as the most predictive of vocabulary learning; language analytic ability appears to be a stronger predictor of grammar learning; and rote memory emerges as a weak predictor of language learning outcomes.

Similarly, Robinson (2005) suggested clusters of abilities which could be relevant at all L2 developmental stages (Artieda & Muñoz, 2016). Thus, he proposed ten basic cognitive abilities (e.g., processing speed, pattern recognition, phonological WM capacity, phonological WM speed, semantic priming, lexical inferencing, text WM capacity, text WM speed, grammatical sensitivity, and rote memory) that would enhance learners' input processing capacity at the initial levels of L2 development (Artieda & Muñoz, 2016). Furthermore, such abilities as interactional intelligence, openness to experience, and pragmatic ability would also contribute to learners' input processing and task-related factors (including task demands) in more advanced stages of L2 development (Artieda & Muñoz, 2016). However, the current LA tests that have been developed to date have not taken into account the different LA subcomponents and their relation to the different beginning, intermediate and advanced L2 developmental stages (Robinson, 2005, 2013, as cited in Artieda & Muñoz, 2016).

In short, as regards the characteristics of traditional (explicit) aptitude, Li (2015, 2016) contends that aptitude (i) is not easily changeable but may be subject to experience; (ii) increases with age; (iii) is not correlated with motivation; (iv) is negatively correlated with anxiety; (v) is distinct from working memory; and (vi) overlaps with but is dissociable from intelligence (as cited in Li, 2022). In turn, implicit aptitude, which has emerged as a recent and cutting-edge development, is thought to be (i) componential (not a unitary construct), (ii) domain-general and domain-specific, (iii) developmental, as it increases with age (Hodel et al., 2014; Saffran, 2001) and does not decline significantly (Ward et al., 2013), and (iv) subject to experience (Granena, 2013a; Potter et al., 2017) (as cited in Li & DeKeyser, 2021).

In what follows we account for the main taxonomies of language aptitude that have been proposed over the years, describing them in more detail.

II.2.4. Language Aptitude: Taxonomies

Over the past six decades there has been a considerable amount of research on LA, with most LA research investigating the relationship between LA and L2 achievement, and with several theories of aptitude emerging. The Carrollian approach (described above) was represented by the MLAT (Carroll, 1981), was based on a Behaviouristic approach to language learning (Audiolingualism), was product-oriented (learning outcomes), and aptitude was viewed as a unitary construct. In contrast, the Aptitude-Treatment Interaction approach regarded aptitude as being componential and dynamic, and as a construct that interacts with instruction type, i.e., with learning conditions (Li, 2022).

In addition, in response to the Carrollian construct of LA, Robinson (2005) proposed a dynamic aptitude construct in which cognitive resources and abilities are combined into aptitude complexes, as noted in the previous section. Thus, the Aptitude Complexes Hypothesis (Robinson, 2005) -fundamentally based on Richard Snow's (1994) Aptitude Complexes Hypothesis- emerged, in which clusters of cognitive abilities exist in a hierarchy (i.e., in terms of acquisition processes, some of which are similar to those proposed by Skehan in 2002) and "different learning conditions draw on different clusters of cognitive abilities" (Li, 2019, p. 81). Robinson's (2005) Aptitude Complexes Hypothesis provides a more nuanced analysis of the processes of acquisition involved in the initial stages of L2 acquisition (Ahmadian & Vasylets, 2022). As noted in Ahmadian and Vasylets (2022), in Robinson's (2005) model (see Figure 1) there was a distinction between ten 'primary cognitive abilities' which correspond to LA and WM, including perceptual speed, pattern recognition, speed of processing in phonological working memory (PWM), PWM capacity, memory and speed of memory for text, the capacity to infer word meaning (inference ability), analogies, rote memory capacity, and grammatical sensitivity; and ‘second order abilities’ which are specific to language learning and broadly correspond to cognitive processes, including noticing the gap (underpinned by perceptual speed and pattern recognition), memory for contingent speech (underpinned by PWM capacity and speed of processing in PWM), deep semantic processing, memory for contingent text, and metalinguistic rule rehearsal.

Robinson (2005) grouped such abilities into aptitude ‘complexes’ which constitute a composite of aptitude variables and have an effect on the learning that takes place in responding to particular learning conditions (as cited in Ellis, 2012). In this sense, LA is not viewed as a monolithic construct, but as a set of different abilities mediating and moderating all aspects of SLA and processing (Ahmadian & Vasylets, 2022). For example, Robinson (2005) suggests that “learners who are ‘high’ in both ‘memory for contingent speech’ and ‘noticing-the-gap’ may be better able to benefit from corrective feedback in the form of recasts than those who are ‘low’ in such [cognitive] abilities” (as cited in Ellis, 2012, p. 311). Robinson (2005) emphasised that these particular aptitudinal complexes are associated with different learning contexts (as cited in Skehan, 2012). Hence, “the context of learning from recasting […] [is underpinned by] the ability factors of noticing and memory for contingent speech” (Robinson, 2007a, as cited in Skehan, 2012, p. 389). Also, as noted by Robinson (2007a, as cited in Skehan, 2012), incidental learning (oral mode) draws upon the ability factors of memory for contingent speech and deep semantic processing, whereas incidental learning (written mode) draws upon memory for contingent text and deep semantic processing. Finally, the context of explicit rule learning is underpinned by the ability factors of memory for contingent text and metalinguistic rule rehearsal (Robinson, 2007a, as cited in Skehan, 2012). In this respect, these interactions that occur in learning account for the variability of performance depending on the context in which learning takes place (Skehan, 2012).

Aptitude complex	Aptitude for focus on form		Aptitude for incidental learning via written content	
	↗	↖	↗	↖
Ability factors	Noticing the gap	Memory for contingent speech	Deep semantic processing	Memory for contingent text
	↑	↑	↑	↑
Primary cognitive ability	Perceptual speed Pattern recognition	Phonol. WM capacity Speed of PWM	Analogies Inferring word meaning	WM for text Speed of WM for text

Figure 1. Primary and second order abilities and aptitude complexes in Robinson's model (based on Robinson, 2007). Source: Wen et al. (2017).

Note. Phonol. WM, PWM = Phonological working memory; WM = Working memory.

In line with Robinson (2002, 2005), Skehan (2002) also views aptitude as a componential construct rather than a unitary one (as cited in Li, 2019). In this regard, Skehan (2002) argued that "different aspects of language aptitude are potentially relevant to different aspects of L2 learning" (as cited in Ellis, 2012, p. 312), with the implication that different components of aptitude might be different predictors of the learning outcomes at different levels of proficiency. Robinson (2002) stated that LA is measurable, differs in degree between learners in any population, and must be inferred from performance on different psychological tests designed to measure the LA construct. Under the staged model proposed by Skehan (2002, 2012; the Stages Approach, 2016, 2019), in Skehan's (2002) proposal on the role of LA in L2 acquisition, it was posited that "different components of aptitude are related to the four macro-stages of the [L2] acquisition process [i.e., noticing, patterning, controlling, and lexicalizing]" (Skehan, 2002, as cited in Ellis, 2012, p. 312). See Table 2 below. Thus, phonemic coding and WM are relevant for the initial stage of learning (noticing); language analytic ability is relevant for the second stage of learning (patterning);

no aptitude components were relevant for the third stage of learning (controlling), but Skehan referred to the concept of cumulative learning as assessed by the York aptitude test (Green, 1975) and the CANAL-F (Grigorenko et al., 2000); and the memory component of aptitude, especially the ability for information retrieval, is relevant and responsible for the final stage of learning (lexicalising).

Table 2. Skehan's Macro SLA aptitude model (based on Skehan, 2016). Source: Wen et al. (2017).

SLA stages	L2 cognitive processes	Aptitude constructs
Language input	Input processing (segmentation)	*Attentional control*
General processing		*Working memory*
Language output		
	Noticing	Phonetic coding ability
		Working memory
	Pattern recognition	Phonetic coding ability
		Working memory
		Language analysis ability
	Complexification	Language analysis ability
		Working memory
	Handling feedback	Language analysis ability
		Working memory
	Error avoidance	*Working memory*
		Retrieval memory
	Automatization	*Retrieval memory*
	Creating a repertoire	*Retrieval memory*
		Chunking
	Lexicalization	*Chunking*

Note. Aptitude constructs in italics are new components as opposed to John Carroll's classic model.

In short, LA research has sought to capture the cognitive abilities underpinning this special talent for the learning of a foreign or second language, starting with Carroll's work and the development of the Modern Language Aptitude Test (MLAT; Carroll, 1981; Carroll, 1993; Carroll & Sapon, 1959, as cited in Andringa & Dabrowska, 2019). It has been since Carroll's seminal work and the production of the MLAT (the most influential aptitude test dominating aptitude research in the past six decades) that LA has continually been viewed "as a complex [or combination] of abilities that together constitute aptitude for learning a second or foreign language" (Wen et al., 2017, as cited in Andringa & Dabrowska, 2019). Emerging trends in research on L2 aptitude have been found to have a positive influence on the development of LA tests to measure LA (rather than explaining the construct) as well as on the understanding of the LA construct in relation to recent developments in the cognitive domain of SLA. While there is agreement that LA is a combination of cognitive abilities, this construct has been conceptualised (as mentioned above) and operationalised in a variety of ways in the SLA field. It is the comparison of the first and the latest LA test batteries in SLA that shows how the conceptualisation of LA has evolved over the years, with a variety of LA tests being developed for various purposes, as more fully discussed in the next section.

II.2.5. Main Trends in Research on Language Aptitude

In what follows we account for two main trends in language aptitude (LA) research as the necessary background for the operationalisation and measurement of language attitude in our own study. We do not provide a detailed analysis of research findings to expand the synthesis of such findings referred to in the previous sections. Instead, in Chapter III we will present a detailed analysis of relevant research findings in the area of aptitude in L2 writing.

II.2.5.1. Trend 1: Developing tests to measure language aptitude

LA research was initiated in the USA in the 1920s (Dörnyei, 2010), being the primary objective of "the pioneering language aptitude tests to increase the cost-effectiveness of language education in the public school system by identifying slow L2 learners" (Dörnyei, 2010, p. 249) and identifying learners who could learn a foreign language within a short period in these public language programs. With the passing of time, an important interest in research in the area has been the search for instruments to measure it (Bokander & Bylund, 2020). Given the theoretical developments in the field referred to above, it has been important to distinguish between explicit and implicit aptitude in the measurement of the construct. Implicit aptitude has been measured by sequence learning (serial reaction time and LLAMA_D), process control (procedural memory) and syntactic priming (Li & Qian, 2021).

As a result, numerous LA test batteries have been developed over the years to measure explicit aptitude (see Li, 2016; Wen et al., 2017), but the Modern Language Aptitude Test (MLAT; Carroll & Sapon, 1959) and the PLAB (Pimsleur Language Aptitude Battery; Pimsleur, 1966), developed in the 1950s and 1960s respectively and being easily available at the time of their development (and still being available and used today in research studies), have traditionally been among the most frequently used, accessible, and comprehensive test batteries for measuring LA. In line with this, the MLAT, whose initial motive was to select elite learners (targeting adults and high-school students), has been regarded as "the best overall instrument for predicting language learning success" (Parry & Child, 1990, p. 52) on the basis of Carroll's view of LA as a cognitive ID construct that is distinct from other cognitive abilities, fairly stable in nature and componential being also dominant since the late 1950s. Robinson (2005) stated that "the focus in this test is on achieving predictive power, rather than explanation" (as cited in Skehan, 2012, p. 382). The MLAT (Carroll & Sapon, 1959) contains five sub-tests, including Number Learning (which measures both phonemic coding ability and associative memory), Phonetic Script, Hidden Words, Words in Sentences, and Paired Associates. Both LA tests (MLAT and PLAB) measure similar abilities and are comparable in validity, with the only difference being on the fact that the PLAB (which is intended for younger school-age learners, that is, high school students, for grades 7-12) puts the emphasis on more auditory stimuli, and includes sections for GPA (grade point average) and motivation, but omits route learning.

Other LA tests that were subsequently developed are the following: the DLAB (Defense Language Aptitude Battery; Peterson & Al-Haik, 1976), which was developed by the US military and targets learners with a high level of LA, being more discriminating than the MLAT with high LA learners; the VORD (Parry & Child, 1990), which is intended for the learning of challenging languages, and less comprehensive LA tests, such as the York Language Aptitude Test (Green, 1975); and the CANAL-F (Cognitive Ability for Novelty in Acquisition of Language-Foreign; Grigorenko et al., 2000), the hi-LAB (Linck et al., 2013), and the LLAMA tests (Meara, 2005) as more recent LA test batteries being developed in LA testing. The CANAL-F test (Grigorenko et al., 2000) was more restricted, as it was developed in a military context, along with awareness of cognitive psychology and of attentional function. Moreover, this LA test considers the language levels of processing, the modes of input (oral versus visual), and the encoding, storage and retrieval of information, addressing the need to have immediate and delayed recall (Grigorenko et al., 2002, as cited in Skehan, 2012). As an integrated test, it contains five sections, including learning meanings of neologisms from context, understanding the meaning of passages, continuous paired associates learning, sentential inference, and learning language rules (Grigorenko et al., 2002, as cited in Skehan, 2012). A correlation is found between the CANAL-F scores and the ones obtained in the MLAT, but they are distinct from them, and higher correlations are found between the CANAL-F scores and instructors' ratings on a language course than did the scores obtained in the MLAT test (Grigorenko et al., 2002, as cited in Skehan, 2012).

The hi-LAB test (Linck et al., 2013) aims to assess cognitive abilities essential for advanced L2 proficiency (it was developed for high proficiency learners), and it consists of a conglomerate of tests emphasising WM and implicit learning; and the language-independent LLAMA test (Meara, 2005), which has been recently employed by SLA researchers (Artieda & Muñoz, 2016; Granena, 2011, 2012) as a measure of LA, and which is the most popular LA test in current research. According to Bokander and Bylund (2020), over the past decade, the LLAMA LA test has emerged as an important LA instruments and, as such, has become increasingly popular among scholars (e.g., Artieda, & Muñoz, 2016; Granena, 2019; Rogers et al., 2017; Yalçın et al., 2016). It is precisely the test used in our own study.

This four-part test has been modelled on the MLAT and has become an attractive candidate for measuring LA due to the fact that it is freeware (as it is available for free download), short, language-neutral and relatively quick to administer (it is user-friendly and computer-based). As noted by Skehan (2012), the LLAMA test (Meara, 2005) includes sub-tests assessing paired associates learning, sound-symbol association, grammatical inferencing and sound recognition. Particularly, subjects are tested on four sub-components of LA, including vocabulary learning (LLAMA_B), sound recognition (LLAMA_D), sound-symbol correspondence (LLAMA_E), and grammatical inference (LLAMA_F). The first test (LLAMA_B), a vocabulary learning task which measures rote memory, asks participants to memorise the associations between shapes and sound combinations. The second test (LLAMA_D), a sound recognition task which measures phonetic recognition (sound recognition), invites participants to listen to some syllables and then they have to discriminate between old and new syllables. The third test (LLAMA_E), a sound-symbol correspondence task which measures sound-symbol associations, asks participants to memorise symbols and their corresponding pronunciations, and they have to connect the spoken syllables to alphabet-like symbols. Finally, the fourth test (LLAMA_F), a grammatical inferencing task which measures inductive language learning ability/language analytic ability, asks participants to see pictures and sentences describing these pictures and learn grammar rules.

In this respect, Bokander and Bylund (2020) stated that since the production of the LLAMA test (Meara, 2005), the LA studies employing such LA test as a measure of this construct have increased. As compared to the LLAMA test (Meara, 2005), the MLAT (Carroll & Sapon, 1959) has been found to be more restrictive in terms of coverage in the sense that it focuses on phonetic coding ability, grammatical sensitivity and paired associates, but it avoids Carroll's inductive language learning factor. The LLAMA test (Meara, 2005) is broader than the MLAT, and it also focuses on phonetic coding ability and paired associates. Nonetheless, it avoids grammatical sensitivity, but adds inductive language learning as well as WM. Finally, it is relevant to mention that the CANAL-F (Grigorenko et al., 2000) is the broadest LA test battery. It focuses on inductive language learning, paired associates, attentional processing and working memory to long-term memory connections (but without an overt concern for WM). However, this LA test omits phonetic coding ability (in the sense that this test minimises the importance of sound) and grammatical sensitivity.

Nevertheless, despite being “a serious competitor to the MLAT” test (Bokander & Bylund, 2020, p. 2), a potentially serious problem is that the LLAMA test battery has not yet been carefully validated. Bokander and Bylund (2020) addressed this issue by examining the internal validity of the LLAMA. Nevertheless, Meara (2005) cautioned against using LLAMA tests in high-stakes situations because these tests have not been standardised. A validation study by Granena (2013b) yielded an acceptable level of reliability of this test, paving way for the empirically-grounded use of LLAMA as a test of LA.

II.2.5.2. Trend 2: Understanding the language aptitude construct in relation to recent developments in the cognitive domain of SLA

As later developments, the scope of the LA construct has been expanded, thus including learning in more naturalistic settings (Andringa & Dabrowska, 2019). Moreover, another important advancement has been the fact that “different cognitive abilities may be at play in different stages of language learning, for different components of the language, and for different tasks or settings” (Robinson, 2005, 2007; Wen et al., 2017, as cited in Andringa & Dabrowska, 2019, p. 7). Traditionally it was believed that LA tests (e.g., MLAT) predict success in L2 academic classrooms (i.e., in instructed language learning contexts), with that need to predict initial foreign language attainment in intensive instructed conditions as measured by course or exam grades. Nevertheless, since the creation of the MLAT in the 1950s, later developments on LA have emerged in both the study of SLA and in the cognitive psychology, such as WM and implicit learning ability (DeKeyser, 2013), as well as in language teaching methodology and in understanding how second languages are learned (Long & Doughty, 2009). These developments are incorporated by the LLAMA and Hi-LAB tests, which are the two latest LA test batteries in the field of SLA. Thus, this reflects how the SLA field has moved to predict not only initial, but also high-level proficiency under various learning conditions, such as naturalistic settings, study abroad contexts, as well as instructed contexts which put an emphasis on interactive communication rather than the study of language structure (Granena, 2013a). Moreover, Sasayama (2018) stated that learners with high LA, especially in the sub-component of grammatical sensitivity, are prone to benefit more from implicit instruction and from a communication-oriented learning environment. Sasayama (2018) also acknowledged that learners differ in terms of their levels and types of LA, and this variation has an effect on the degree of L2 learning success.

Doughty (2019) also attempted to link LA components (LA components of the MLAT and the Hi-LAB) with overall L2 attainment at different proficiency levels. The results revealed that the MLAT predicted low-level proficiency better, while the hi-LAB was more predictive for language learning success at higher levels (Andringa & Dabrowska, 2019). Moreover, LA was found to be strongly predictive of proficiency as compared to other factors such as demographic characteristics or learners' language learning histories (Andringa & Dabrowska, 2019).

The studies by Curcic et al. (2019) and Granena and Yilmaz (2019b) also explored the role of aptitude in L2 acquisition, but their focus was not on the link between LA components and overall attainment. Instead, Curcic et al.'s (2019) study explored the relation between particular LA components and the acquisition of grammar-based predictive processing, and they found no links between aptitude and predictive processing. Nevertheless, it was found that prediction is associated with self-developed awareness for the target structure in the input, and self-developed awareness is also related to L2 learners' analytical skills and rote memory (Andringa & Dabrowska, 2019). The study by Granena and Yilmaz (2019b) investigated the link between particular components of LA (i.e., implicit learning ability as measured by a serial reaction-time task [SRT]) and the processing of explicit and implicit corrective feedback, and the evidence suggests that there is only a relation between SRT and performance on the implicit corrective feedback condition. Importantly, as can be observed, it should be noted that in the studies by Curcic et al. (2019) and Granena and Yilmaz (2019b) the LA construct is seen as a cognitive resource that makes it possible for a language feature to be learned (Andringa & Dabrowska, 2019). In contrast, Dabrowska (2019) and Doughty (2019) considered that LA is "a stable trait that can […] [be a predictor of] long-term gain and successfully link aptitude to long-term success using more holistic measures of attainment" (as cited in Andringa & Dabrowska, 2019, p. 9). In line with this, Robinson (2013) highlighted that:

> Higher aptitude for second or foreign-language learning predicts more successful adaptation to instructed, or naturalistic exposure to the second language (L2), as measured by demonstrably faster progress in learning, and in higher levels of ultimate attainment in proficiency at the end of a course of instruction, or following a period of naturalistic exposure to the L2. (p. 1)

Robinson (2013) stated that recent attempts to conceptualise and measure LA are addressing the extent to which LA tests predict SLA phenomena, such as the extent of successful incidental L2 learning (Robinson, 2005), metalinguistic awareness of the L2 (Roehr, 2008), and the influence of each LA test on the levels of ultimate attainment -also considering aptitude and the critical period for language development- (Abrahamsson & Hyltenstam, 2008), with successful SLA occurring as a result. The study by Abrahamsson and Hyltenstam (2008) (with a total of 42 near-native speakers of Swedish) tested the effect of L2 proficiency and LA in L2 acquisition. Findings revealed that (i) a high degree of LA is necessary if adult learners are to attain an L2 proficiency that is indistinguishable from the L2 proficiency of native speakers, and that (ii) LA had a significant effect on child SLA.

II.3. COGNITIVE INDIVIDUAL DIFFERENCES: WORKING MEMORY AND SLA

II.3.1. Working Memory: Conceptualisations and Taxonomies

Working memory (WM) refers to a limited-capacity cognitive system which is involved in the manipulation and maintenance of task-relevant information and the inhibition of task-irrelevant information in active attention (i.e., temporary maintenance) (Baddeley, 2003). More recently, Li (2023a) has defined WM as "a cognitive system for simultaneous information manipulation, retention, and storage in ongoing tasks" (as cited in Li, 2023b, p. 648). That is, WM is a limited capacity mechanism which coordinates attentional resources and is responsible for the temporary storage and processing of information (WM capacity is limited). WM capacity is crucial in predicting the success of complex cognitive activities, involving note-taking, reasoning, and writing (Engle et al., 1999, as cited in Kormos, 2012). Moreover, the implication of WM is crucial in learning, as this construct is responsible for the processing of all information before this is stored in long-term memory (Kormos, 2012). In other words, "working memory is not simply a workspace to facilitate ongoing processing: it is also the gateway to long term memory" (Chan et al., 2011, p. 54). That is, WM is the component that is necessary for current noticing to result in change and subsequent interlanguage development, and it is obvious that the more effective WM operation, the more likely it is that the formation of such connections with existing structures in long term memory will be made (Chan et al., 2011). Baddeley and Hitch (1974) defined WM as a short-duration, limited-capacity memory system which stores and processes information in the service of complex cognition.

Importantly, as reviewed in Schwieter et al. (2022), WM has been empirically shown to be related to general intelligence (Kyllonen, 1996), fluid intelligence (Kane & Engle, 2002), mathematical ability (Ashcraft & Krause, 2007), academic attainment (Alloway, 2009), language disorders, interventions and instruction (see contributions to Schweiter & Wen, 2022; Wen, 2016) and L1 language acquisition, processing and use (Atkins & Baddeley, 1998; Daneman & Hannon, 2007; Engle, 2001; Gathercole & Baddeley, 1993; Kim, 2022; Olive, 2022; Pérez Muñoz & Bajo, 2022; Swets & Ivanova, 2022; Zahn et al., 2022). Furthermore, WM is now regarded as a cornerstone of the field of cognitive psychology due to its association with fluid intelligence (i.e., the capacity to think about and solve reasoning problems) (Shipstead et al., 2015, as cited in Ahmadian & Vasylets, 2022).

Moreover, as discussed in Schwieter et al. (2022), WM has also been found to be implicated in various aspects of L2 acquisition, processing and use, such as the acquisition of formulaic language, L2 vocabulary, L2 grammar development in children and among adults, reading comprehension, sentence processing and comprehension, speaking, interaction, or the acquisition of L2 pragmatics (see contributions to Schwieter & Wen, 2022; Wen & Jackson, 2022; Wen et al., 2017). In this respect, when observing the correlations and effects between WM and L2 acquisition and processing, it is relevant to mention that those learners with greater WM capacities are prone to maintain relevant pieces of information in their WM storage and disengage from irrelevant information more efficiently in comparison with their low-WM counterparts (Shipstead et al., 2015, as cited in Ahmadian & Vasylets, 2022).

Furthermore, the importance of the role of WM in L2 acquisition and processing lies in the fact that WM is considered to be one of the subcomponents of foreign LA (Linck et al., 2013; Robinson, 2005; Skehan, 2012). This is why the third component in Skehan's (1998) conceptualisation of LA is memory. The memory concept, which Skehan holds in his theorising, is close to what is known as working memory (WM). In 1982, Skehan argued that the ability to memorise material which lacks familiarity, and the ability to analyse larger quantities of material so that it can be retained more effectively are of relevance to aptitude (as cited in Skehan, 2012), and the importance attached to WM as a cognitive construct has been the most significant development in the area of memory (Baddeley, 2007; Miyake & Shah, 1999, as cited in Skehan, 2012). Similarly, Sawyer and Ranta (2001) also argued that WM could constitute one of the main components of LA. In the same vein, Miyake and Friedman (1998, p. 340) stated that "WM may be one (if not the central) component of language aptitude", and also a relevant construct in current conceptualisations and LA test batteries (Kormos, 2013; Skehan, 2002; Robinson, 2005; Wen, 2019). Thus, as stated by Kormos (2012), there is a theoretical rationale to postulate that "ID variations in WM would contribute to ID variations in language aptitude" (as cited in Ahmadian & Vasylets, 2022, p. 142). In this respect, the relevance of WM for foreign language aptitude (LA) can be justified by the fact that the different WM components have been measured by different procedures. For instance, span tasks tend to be used to measure the central executive WM component (Waters & Caplan, 2003), whereas nonword repetition tasks tend to be employed to measure the phonological buffer (Gathercole, 2006).

Importantly, WM as a fundamental component of LA is also relevant due to the fact that the potential involvement of WM is linked to the different SLA processing stages (i.e., noticing, patterning, controlling, and lexicalising) proposed by Skehan (2002), with WM playing a crucial role in such stages. Thus, the rationale for regarding WM as a component of LA lies in its cognitive functioning within (potential) L2 acquisitional processes, therefore being likely that L2 learners will vary in WM. That is, as pointed out by Chan et al.'s (2011), "if an area of cognitive functioning is important and there are individual differences in that area then potentially we have an aptitude component where differences between learners in the cognitive capacity concerned can connect with differences in level of second language learning success" (p. 55). Importantly, WM supports most of the SLA processes (i.e., input processing, noticing, pattern recognition, complexification, handling feedback, and error avoidance) in Skehan's (2016) Macro-SLA aptitude model (as cited in Wen et al., 2017), with Skehan's model aligning with the proposal by Wen et al. (2019) for considering WM as language aptitude. Nevertheless, it is worth mentioning that other processes in Skehan's (2016) Macro-SLA aptitude model (that is, automatisation, creating a repertoire, and lexicalisation) are not necessarily supported by WM, but by other aptitude constructs, including memory retrieval and chunking. Moreover, phonetic coding ability and language analytic ability, which are aptitude constructs in Skehan's (2016) framework, complement the functioning of WM. Also, several empirical studies (e.g., Ellis, 1996; Ellis & Sinclair, 1996; French & O'Brien, 2008; Kormos & Sáfár, 2008; O'Brien et al., 2006; Williams & Lovatt, 2005) have obtained consistent and significant correlations between (phonological) WM measures and language development measures (e.g., vocabulary, grammar and morphology learning). One additional reason for the relevance of WM and its central role in LA (Miyake & Friedman, 1998) concerns Chan et al.'s (2011) proposal that the LA component of phonemic coding ability and the phonological WM component can be brought closely together so as to serve as the basis for the production of more effective measures. Importantly, Chan et al. (2011) pointed out that the acquisition of the syllable structure of the target language, which is an important task in L2 learning, represents the capacity of L2 learners not only to memorise but also to handle the specific sound sequences of the L2. In this respect, the use of nonwords for repetition which clearly reflect the syllable structure of the target language is crucial for a more effective production of phonological WM tests. Thus, the relevance of looking at WM and its centrality in LA (Miyake & Friedman, 1998).

As regards the taxonomies of WM components, there are four main components of WM, including verbal WM (both storage and processing functions), phonological short-term memory, visual-spatial WM, and the three executive functions of WM (i.e., inhibition, shifting/switching, and updating) (Li, 2023b). As regards the operationalisation of WM, Li (2023b) noted that the WM construct has been operationalised and measured using simple and complex tasks. Simple tasks measure only the storage functions of WM, whereas complex tasks measure both the storage and processing functions of WM. More specifically, verbal working memory has been measured by using operation span tests, reading span tests, backward digit tests, listening span tests, conceptual span tests, and rhyming tests. Phonological short-term memory has been gauged via nonword recall tests and forward digit span tests. Visual-spatial working memory has been assessed via symmetry tasks, Corsi block backward tasks, visual matrix, and mapping and directions. Finally, as regards the three different executive functions, inhibition has been measured via stop signal, Flanker and Stroop tasks; shifting has been measured via letter-digit switching tasks, for instance; and updating has been assessed via running memory (*n*-back) tests. Importantly, Shin and Hu's (2020) recent methodological synthesis of WM tasks in L2 research in L2 acquisition and processing provides evidence of the important role of WM for learning, as well as of the relevance of methodological considerations, such as the tasks to be employed in order to measure WM. Hence, contributing to "promoting methodological rigor", as noted by Shin and Hu (2020, p. 723).

II.3.2. Working Memory and Language Learning: Baddeley's (2015) Model

The seminal WM model developed by Baddeley and Hitch (1974) -and then further developed by Baddeley (2000, 2015)- is regarded today as the most widely accepted conceptualisation of short-term memory in SLA research (Baddeley, 1986, as cited in Kormos, 2012). It combines the storage function of memory with the processing and manipulation of information, with WM playing a great role in complex cognitive activities, such as comprehension, reasoning, and learning (Baddeley, 2003; see also Baddeley, 2022, Olive, 2022; Schwieter et al., 2022).

In Baddeley and Hitch's (1974) traditional WM model, WM is conceptualised as a multicomponential system consisting of the central executive and two slave systems: (a) the visuo-spatial sketchpad, and (b) the phonological loop. Later, the episodic buffer was added into the WM model (Baddeley, 2000). See Figure 2. Baddeley's working memory model (2000, 2015).

Baddeley's (2015) recent WM model is considered as the key model in L1 and L2 writing research, and it is used as the most frequent theoretical basis of SLA research on WM and L2 learning "due to the detailed conceptualization and empirically testable hypotheses of the role of WM proposed in Kellogg's (1996) Componential Model of Working Memory in Writing" (Kormos, 2023, p. 626).

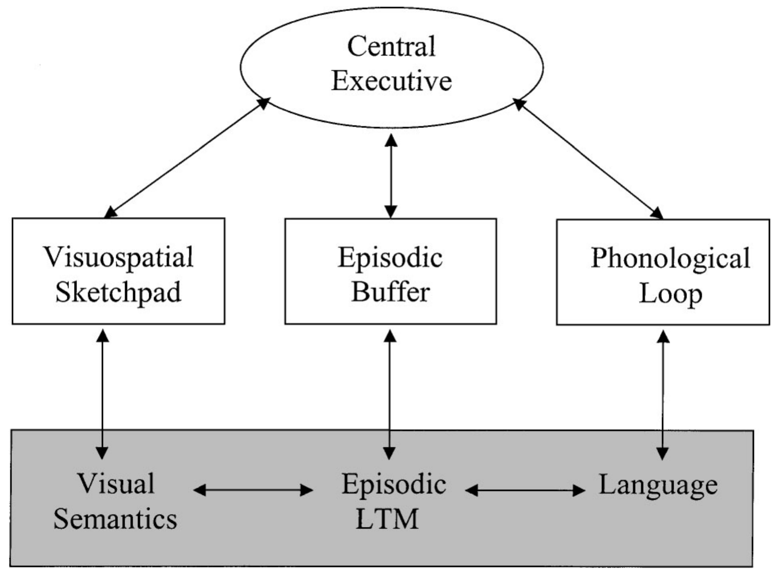

Figure 2. Baddeley's working memory model (2000, 2015). Source: Baddeley (2000)

Baddeley's (2015) multicomponent model of WM explores the links between short-term memory (STM) and long-term memory (LTM) (Schwieter et al., 2022), and it stresses the relevance of keeping mental representations temporarily active during the process of writing, as in Cowan's (2005) WM model (Olive, 2022). As seen in Figure 2, the WM model proposed by Baddeley (2000, 2015) consists of four processing components: the central executive, the phonological loop and the visuospatial sketchpad (as the two slave systems) and the episodic buffer. The central executive refers to the control (active and transformative) mechanism, as it is responsible for attention control for monitoring complex cognitive tasks, for the coordination of the phonological and visuospatial memory systems, and for permitting the recovery of information from LTM (Baddeley, 1996, 2007, as cited in Olive, 2022). Furthermore, the central executive is responsible for the regulation of the switching of attention between different tasks and it is also responsible for controlling encoding and retrieval strategies (Baddeley, 2015, as cited in Kormos, 2023). The phonological loop is a subsystem that allows for the temporary storage and processing of verbal and/or acoustic information, i.e., phonological information. It consists of a phonological store and an articulatory rehearsal process, with the first holding information for a few seconds, and the later restoring decaying information (Kormos, 2012). The visuo-spatial sketchpad is a subsystem responsible for the storage and process of visual and spatial information, such as images, colors, shapes, and locations. The episodic buffer is a temporary store which is responsible for the integration of information from the other WM components so as to form episodes, uses multi-dimensional coding, and maintains a sense of time so that events occur in a continuing sequence, thus being in communication with long-term memory (Baddeley, 2000, as cited in Kormos, 2012). In other words, the episodic buffer is responsible for holding and integrating information.

In light of this, Baddeley (2015) stated that "it seems likely that different components of the model will be relevant to different aspects of the task of language learning" (p. 24). Moreover, he continued to acknowledge that, with respect to the central executive, "one might expect to influence L2 learning" (p .25). The central executive WM component is regarded as "the most important but least understood component of working memory" (Baddeley, 2003, p. 835) and has among its functions those of controlling attention, planning, and directing the flow of information through the WM system (as cited in Kormos, 2012). Regarding the visuospatial sketchpad, Baddeley (2003) emphasised that "at a purely speculative level, it might conceivably play a role in the acquisition of novel script…or in visually complex orthographies" (p. 25). Finally, with respect to the phonological loop, he acknowledged that it is important, but not necessarily essential. Nevertheless, the phonological loop is the most widely researched WM component, and it is often gauged by immediate serial recall tasks in which learners are presented with a series of numbers (digit span) or words which must be remembered in the correct order (Baddeley, 2003). In sum, the central executive is heavily involved; and the visual and spatial components of WM may be at times needed (Kellogg et al., 2013; Olive et al., 2008; Olive, 2011, 2022).

In her contribution to Manchón and Sanz's (2023) volume, Kormos (2023) provided evidence of additional WM models that were also developed in the SLA literature. What follows is based on Kormos' (2023) analysis.

Kormos (2023) mentioned Cowan's (2005) unitary and embedded-process WM model. Cowan's (2005) model conceptualises WM as "a temporary activated subset of long-term memory" which maintains information accessible for further processing" (Olive, 2022, p. 518). As a unitary model, WM integrates the processing and storage components (which compete for the allocation of resources), as compared to Baddeley's (2015) componential model in which WM components "draw on different pools of resources and are independent of each other" (Li, 2023b, p. 648). In Cowan's (2005) model, the subset of information in LTM is short-lived and it needs to be kept active by verbal rehearsal and sustained attention.

Furthermore, Kormos (2023) also referred to Engle and Kane's (2004) unitary attention control WM model, which views WM as a global construct, that is, as domain-general executive attention. This model emphasises the relevance of the WM component of the central executive, as it is responsible for the regulation of attention control. In this model, variation in WM capacity relates to attention control (i.e., to the central executive) (Engle, 2002).

Finally, another unitary WM model noted by Kormos (2023) is Ericsson and Kintsch's (1995) long-term working memory (LT-WM) model, which emphasises that LT-WM is responsible for holding units of information activated in short-term WM and for containing retrieval cues which permit access to effective information in LTM (Kormos, 2023). Therefore, end products which are stored and kept in long-term memory can be immediately available in LT-WM, and others can be easily accessed using effective retrieval cues in short-term memory (Ericsson & Kintsch, 1995, as cited in Kormos, 2023).

II.3.3. Main Trends in Research on Working Memory in SLA

Previous SLA research has suggested that WM capacity may play a role in different areas such as in the learning of grammar (e.g., McDonald, 2008), L2 speech (O'Brien et al., 2006) or reading comprehension (e.g., Harrington & Sawyer, 1992). Importantly, the findings in Linck et al.'s (2014) recent meta-analysis (*n* = 79 studies, *n* = 3707 participants) also reported an overall positive correlation between WM and L2 outcomes -moderate effects of WM in

L2 writing-. In this respect, however, it is worth mentioning that "the relationship between WMC and L2 processing and learning [i.e., between WM and SLA processes and outcomes] is far more complex and nuanced than originally envisaged" (Williams, 2015, p. 301), as also pointed out by Juffs and Harrington (2011), Linck et al. (2014), and Wen et al. (2015). In line with this, Baddeley (2015) also emphasised the nuanced involvement of this cognitive resource of WM in SLA production and performance and stated that further research is needed in order to arrive at a more detailed understanding of the role of WM in SLA. In line with the findings in Vasylets and Marín's (2021) study, recent theoretical proposals and empirical findings have suggested that the role of WM (effects) in SLA is nuanced and may depend on other moderating factors (e.g., Baddeley, 2015; Olive, 2011, 2022), such as age, the task, the linguistic area, the performance dimension which is analysed, and especially the level of L2 proficiency in the case of WM effects on L2 use (Dussias & Pinar, 2010; Gilabert & Muñoz, 2010; Hopp, 2014; Hummel, 2009; Jon & Plakans, 2017; Juffs & Harrington, 2011; Serafini & Sanz, 2016). Table 3 synthesises a number of studies exploring the role of WM and L2 proficiency in L2 learning. These empirical studies have been selected as they clearly synthesise the mixed (albeit positive) findings on WM effects on L2 learning, as potentially moderated by L2 proficiency.

Table 3. Previous studies exploring the role of working memory and L2 proficiency in L2 learning.

Empirical study	**Focus of the study**	**Number of participants, L1, L2 and age**	**Findings on the relationship between WM, L2 proficiency and L2 area**
Gilabert & Muñoz (2010)	Complex WM, and L2 oral production as measured by CAF indices	*n* =59 L1: Catalan/Spanish L2: English age: 22.9	Positive for higher proficiency learners (dimension: lexical complexity)
Hummel (2009)	PSTM, L2 vocabulary knowledge, L2 grammar knowledge, and L2 reading knowledge	*n* =77 L1: French L2: English age: 21.5	Positive for lower proficiency learners
Jon & Plakans (2017)	Complex WM, and L2 reading comprehension	*n* =80 L1: Korean L2: English age: 21	Positive for higher proficiency learners
Serafini & Sanz (2016)	Complex WM, PWM, and L2 morphosyntactic development	*n* =87 L1: English L2: Spanish age: 19	Positive for lower proficiency learners (particularly for PWM)

As observed in Table 3, the findings of the empirical studies have reported a positive (albeit mixed in terms of L2 proficiency level) effect of WM on L2 outcomes, thus providing support to the "more is better" hypothesis (Miyake & Friedman, 1998) which assumes that higher WMC may confer advantage in (i) noticing and learning from oral feedback (Mackey et al., 2002; Mackey & Sachs, 2012); (ii) ability to learn from recasts (Goo, 2012); (iii) ability to produce modified output following corrective feedback (Mackey et al., 2010); and (iv) vocabulary and grammar learning (Martin & Ellis, 2012; Serafini & Sanz, 2016). On the other hand, the "more is better" hypothesis assumes that there is a positive relation between WMC and L2 outcomes.

In this sense, as discussed in Vasylets and Marín (2021), "the complexity of the overall picture of the role of WM in SLA could be due, at least in part, to the moderating influences of other factors, such as the level of L2 proficiency" (Wen et al., 2015, as cited Vasylets & Marín, 2021, p. 2). Some research (e.g., Dussias & Pinar, 2010; Gilabert & Muñoz, 2010; Havik et al., 2009; Hopp, 2014; Hummel, 2009; Jon & Plakans, 2017; Serafini & Sanz, 2016) has been conducted on the moderating role of proficiency on the effects of WM on L2 performance and L2 processing. For instance, the study by Jon and Plakans (2017) showed that WM significantly predicted better L2 text comprehension only for the higher-proficiency participants. Along the same lines, Gilabert and Muñoz (2010) found positive and significant (albeit weak) WM effects on the lexical complexity of L2 oral production, but only for higher proficiency learners. No correlation was observed between WM and L2 proficiency, and a weak correlation was found between WM and the fluency and lexical complexity measures. Moderate and high correlations were found between proficiency and lexical complexity, accuracy and fluency measures of L2 oral production. WM was measured by an L1 reading span task, and L2 oral production was assessed by means of a film retelling task. Also, Mitchell et al. (2015) investigated the effects of the interaction between proficiency and WM on L2 processing and development. They used an operation span task and forward-digit span tasks in L1 (i.e., Chinese) and L2 (i.e., English) to measure WM, and elicited imitation and reading tasks in English were used as measures of L2 proficiency. The results in this study indicated that WM (as measured by L2 digit span scores) was a strong predictor of L2 processing and development, only for the higher-proficiency participants.

However, Serafini and Sanz (2016) examined morphosyntactic development in Spanish as L2 (L1 English) (*n* =87; age: 19) over the course of a semester and found that, while some WM components did have an effect on performance for the participants in their study who had lower proficiency levels, WM effects diminished as proficiency levels increased. These findings are consistent with Hummel (2009), who found that phonological short-term memory (PSTM) had an effect on performance for lower proficiency learners. Importantly, the idea that the effects of cognitive ability on L2 outcomes may be contingent on the level of L2 proficiency is not new and has its genesis in the studies of language aptitude (LA) (Robinson, 2005). For example, the meta-analysis by Li (2015) showed that the role of language aptitude in L2 outcomes was more critical at lower levels of L2 proficiency. Finally, it is relevant to mention that there exist great difficulties and challenges in the definition, testing and design of WM (Wen et al., 2015).

Regarding the moderating role of proficiency on the effects of WM on L2 performance, some evidence exists for a role for phonological WM in advanced (Winke, 2005) and highly advanced learners (Linck et al., 2013). For instance, Linck et al.'s (2013) study aimed to investigate the potential cognitive predictors of successful high-level learning (i.e., of the rate of acquisition) to advanced levels of proficiency. In this study conducted with a total of 476 participants (adults with different degrees of success in L2 learning, and the presence of a critical group with high proficiency level), HI-LAB reported an advantage in working memory (including phonological short-term memory [PSTM] and task set switching) for high-attainment learners, apart from the advantages found in associative learning and implicit learning. More specifically, associative memory, implicit learning, phonological short-term memory, and task set switching all positively distinguished those learners with high-level attainment, who were those who attained better performance. Clearly, implicit and explicit learning mechanisms along with memory storage and retrieval processes play a role in achieving high-level proficiency.

Therefore, we can find evidence of the "rich-get-richer" hypothesis which states that learners with high WMC are expected to benefit more from pre-existing knowledge in a given domain (Hambrick & Engle, 2002).

II.4. AFFECTIVE DIFFERENCES IN SLA: ANXIETY

II.4.1. Anxiety in SLA: Conceptualisations and Taxonomies

Anxiety is an affective variable that has been of particular interest in the field of language acquisition and learning over the last decades, as evidenced in the recent volume of ARAL (2023) devoted entirely to language anxiety. It is a construct that has long been recognised as an obstacle in L2 learning, and its possible detrimental impact on academic attainment/achievement is one of the main reasons for concern, especially among educators and administrators (Ehrman & Oxford, 1995; Gardner, 1985; MacIntyre et al., 1997, as cited in Atay & Kurt, 2006). Accordingly, extensive research evidences that learners experience anxiety when learning an L2 (Ellis, 2012). Also, Pavlenko (2002) stated the inherently emotional affair characteristic of language learning (as cited in Ellis, 2012). For instance, classroom learners sometimes face difficulty when they have to speak in the L2 in front of their classmates or when they have to undertake a language test. Nevertheless, it should be noted that anxiety does not always need to be a negative factor, as discussed later in this section. L2 anxiety refers to those self-perceptions, feelings, behaviours and negative emotional reactions aroused when learning or using an L2 (Horwitz et al., 1986; MacIntyre, 1999). Likewise, according to MacIntyre and Gardner (1994), L2 anxiety refers to "the feeling of tension and apprehension specially associated with second language contexts, including speaking, listening, and writing" (p. 284).

Regarding the anxiety construct, Arnold and Brown (1999) stated that "anxiety is quite possibly the affective factor that most pervasively obstructs the learning process" (p. 8). There is an overall uncertainty about the basic category of L2 anxiety, that is, about whether it is a motivational component, a personality trait, or an emotion. In this respect, as noted by Teimouri et al. (2019), early research on L2 anxiety has generally defined this construct "as either a relatively stable personality trait across various situations, or as a transient emotional state which manifests itself in a particular moment in time" (p. 2), for instance, during high-stakes situations. Nevertheless, over the last decades, a situation-specific definition of anxiety has been increasingly adopted in L2 research (Teimouri et al., 2019), leading SLA researchers to postulate that anxiety "occur[s] consistently over time within a given situation" (MacIntyre & Gardner, 1991, as cited in Teimouri et al., 2019, p. 2), for instance, in a classroom setting or when L2 learners use their target language. Researchers have distinguished this situation-specific type of anxiety from more general types of anxiety (Teimouri et al., 2019).

Furthermore, anxiety is usually not seen as a unitary factor, but a complex made up of constituents that have different characteristics. An important anxiety distinction is that between beneficial or facilitating and inhibitory or debilitating anxiety. Scovel (1978) pointed out that "anxiety can be facilitative [i.e., it has a positive effect on L2 acquisition] as well as debilitative [i.e., it has a negative effect]" (as cited in Ellis, 2012, p. 318). For example, a learner who is anxious about a test may revise harder. In SLA, it has been observed that anxiety does not necessarily inhibit performance but in some cases it can actually promote it. In this sense, 'worry', which is considered the cognitive component of anxiety, has been shown to have a negative/detrimental impact on performance, whereas the affective/emotional component, that is, 'emotionality', does not necessarily have detrimental effects (MacIntyre, 2017). Also, it appears that even the harmful 'worry' component of anxiety does not always result in an impairment of general performance but it hinders only certain tasks, for instance those tasks that require the involvement of intensive working memory (WM). Another anxiety distinction is that between trait and state anxiety. Trait anxiety refers to a stable learner's predisposition to become anxious in a cross-section of situations. Ellis (2012) defines trait anxiety as "a characteristic of a learner's personality" (p. 309) or a personality variable. On the other hand, state anxiety refers to the learner's transient and moment-to-moment experience of anxiety as an emotional reaction to a current situation. Ellis (2012) defines state anxiety as the "apprehension that is experienced at a particular moment in response to a definite situation" (p. 309). Finally, situation-specific anxiety is another anxiety type that refers to "the anxiety aroused by a particular type of situation" (Ellis, 2012, p., 309), being language anxiety an example of this type of anxiety.

In this respect, regarding the conceptualisation of language anxiety, in a seminal paper in 1986, Horwitz and her colleagues conceptualised a situation-specific anxiety construct that they called foreign language anxiety, which stems from the inherent linguistic deficit of L2 learners. As MacIntyre (1999) defines language anxiety, it involves "the worry and negative emotional reaction aroused when learning or using a second language" (MacIntyre, 1999, as cited in Zheng, 2008, p. 2). And this anxiety construct is categorised as a situation-specific anxiety, which is similar in type to other familiar manifestations of anxiety such as stage fright or test anxiety. Moreover, in 1986, Horwitz and her colleagues introduced the Foreign Language Classroom Anxiety Scale, which is a questionnaire which measures foreign language classroom anxiety during L2 learning, and it consists of 33 items which are scored on a 5-point Likert scale which ranges from 1 (meaning strongly agree) to 5 (meaning strongly disagree).

II.4.2. Anxiety in SLA: Research Trends

Concerning anxiety effects in the field of SLA, research has found a negative correlation between anxiety and achievement (as reported in MacIntyre & Wang, 2022; recent meta-analyses by Botes et al., 2020; Teimouri et al., 2019; Zhang, 2019; and literature reviews by Horwitz, 2001; MacIntyre, 2017; MacIntyre & Gardner, 1991). MacIntyre and Wang (2022) reviewed previous empirical evidence on anxiety in relation to L2 learning outcomes in terms of achievement, specific language skills and cognitive processing. This empirical evidence showed that language anxiety was negatively associated with achievement or performance. Regarding specific language skills, MacIntyre and Wang (2022) stated that listening was the most challenging skill and negatively affected anxious learners, As regards cognitive processing, it was generally found that anxiety impaired cognitive performance. Some research has also explored the associations between anxiety and other ID factors, including personality (e.g., Dewaele, 2002), gender (Dewaele, 2013) and motivation (Papi, 2010), with mixed results being found in research (as cited in MacIntyre & Wang, 2022).

Along the same lines, as Teimouri et al. (2019) also noted, it has been shown that anxiety can impair (i) L2 achievement (MacIntyre, 2017) in the sense that "L2 anxiety accounts for approximately 13% of variance on average in students' L2 achievement" (Teimouri et al., 2019, p. 15), medium to moderate effect $r = -.36$, (ii) cognitive processing (MacIntyre & Gardner, 1994), (iii) motivation (Papi, 2010; Teimouri, 2017), and (iv) willingness to communicate (Khajavy et al., 2018). Zhang's (2019) recent meta-analysis on language anxiety and language achievement did look at proficiency, age and language distance as moderators of the main relationship. Language anxiety correlated negatively with language performance ($r = -.34$), operationalised in terms of course grades and language performance tests. Also, it was found that it was age (but not proficiency) the factor that may mediate the relationship between L2 anxiety and SLA outcomes (Zhang, 2019). Zhang (2019) also revealed in his meta-analysis that writing anxiety research did not receive as much attention in SLA, as compared to listening and reading anxieties; the results showed that L2 anxiety had the strongest negative effects on listening (Zhang, 2019).

The results in Zhang (2019) are consistent with the findings obtained in Botes et al.'s (2020) study, which also found a moderate and negative correlation between language anxiety and academic achievement, and L2 anxiety had the strongest negative effects on listening. Teimouri et al.'s (2019) meta-analysis also looked at the association between L2 anxiety and language achievement in SLA and it was found that L2 anxiety had the strongest negative effects on listening and on L2 learners' subjective evaluation of their own L2 proficiency. This latter finding can be explained by the anxious learners' underestimation of their language proficiency, as revealed by findings of previous research (e.g., MacIntyre et al., 1997) which showed that anxious learners are more likely to underestimate their language proficiency than less anxious learners. Teimouri et al.'s (2019) meta-analysis also revealed that L2 anxiety had the lowest negative effects on reading. Moreover, existing empirical research has shown that anxiety has profound effects on cognition, such as (i) increased sensitivity to punishment (Corr et al., 1997), (ii) heightened perception of threat (Shepperd et al., 2005); (iii) avoid risk-taking behaviors (Maner & Schmidt, 2006), and (iv) interference with attention & memory (Eysenck, 1979; MacIntyre & Gardner, 1991, 1994). Finally, the literature reviews by Horwitz (2001), MacIntyre (2017) and MacIntyre and Gardner (1991) concluded that there is a negative relationship between language anxiety and language achievement. For instance, more specifically, in his review of research on L2 anxiety, MacIntyre (2017) stated that (a) L2 anxiety generally affects negatively L2 learning, (b) L2 anxiety is not only a cause, but also a consequence of negative performance, and (c) L2 anxiety has social and internal dimensions (as cited in Teimouri et al., 2019). Thus, as observed in the literature, negative effects on learning have been evidenced on anxiety research in SLA.

II.5. AFFECTIVE DIFFERENCES IN SLA: SELF-EFFICACY AND SLA

II.5.1. Self-Efficacy in SLA: Conceptualisations and Taxonomies

In the field of SLA, self-efficacy refers to individuals' beliefs in their capabilities to perform a given task (Chen & Lin, 2009; Williams & Burden, 1997) rather than what they are actually capable of doing. According to Bandura (1986), self-efficacy refers to individuals' "judgment of their capabilities to organize and execute courses of action required to attain designated types of performances" (Bandura, 1986, p. 391). Self-efficacy determines what learners want to do with the knowledge and skill(s) they have, how much time and effort they will invest in the process of learning, and how much interest they will have in learning (Bandura, 1997). Self-efficacy beliefs are directly related to the control dimension of motivation. Learners are responsible for their confidence to accomplish a goal, without which learners may not put sufficient effort in that pursuit (Papi, 2022).

Self-efficacy is viewed as a multicomponential and dynamic construct which is comprised of personal factors (including motivation, learning strategies, goal setting, and attribution) and social factors (including the sociocultural system) in different learning environments (Teng & Wang, 2022). Accordingly, self-efficacy has also been found to have an effect on emotional reactions, such as individuals' anxiety or stress (Pajares & Valiante, 2006, as cited in Teng & Wang, 2022). Importantly, positive self-efficacy beliefs might determine the L2 learners' learning effort and persistence in a given activity (Kormos, 2012), and this self-efficacy ID factor has been found to motivate L2 learners to pursue learning in several academic contexts, including writing. Bandura (1984) indicated that students' self-efficacy beliefs in performing academic tasks predict their capability to accomplish such tasks. In fact, those students with a higher level of self-efficacy are confident about what they can achieve, set themselves some challenges and commit themselves to accomplish them, and expend a lot of effort working hard in order to avoid failure (Ching, 2002).

II.5.2. Self-Efficacy in SLA: Research Trends

Bandura (1977) introduced the self-efficacy theory more than three decades ago, and since then the construct of self-efficacy has received attention in many fields of knowledge, such as in the field of educational psychology (e.g., Lane et al., 2004; Pajares & Valiante, 1999; Shell et al., 1995). Therefore, it has been since social cognitive theorists (Bandura, 1997, 2006) stated the importance of self-efficacy beliefs in learning that a large amount of research examined the construct of self-efficacy for language learning and identified its relationship with successful learning outcomes (see, for instance, recent contribution by Wyatt, 2022, in Li et al., 2022a; Schwieter & Benati, 2019). According to Bandura's (1986) Social Cognitive Theory, the self-efficacy construct has been attested "the most consistent and reliable predictor of students' task performance" (Bandura, as cited in Hetthong & Teo, 2013, p. 157). Bandura (1994) stated that those people who strongly believe in their capabilities will try even difficult tasks, in contrast to those people with a low belief in their capabilities who will suffer from depression and anxiety. In 1977, Bandura pointed out that any research study on self-efficacy should consider three main dimensions, which are the following: magnitude, generality and strength. Thus, according to Bandura (1977), magnitude refers to the task complexity and difficulty, generality means whether the task under performance is related to a general or specific sense of efficacy, and strength refers to intensity of a person's efficacy, i.e., how weak or strong his/her efficacy is.

Along these lines, research into L2 self-efficacy has gained momentum in the 21st century, being influenced by research conducted on self-efficacy in L1 academic settings (Pajares, 1996). As discussed by Wyatt (2022) in his recent review of L2 self-efficacy research, significant progress has been made in research into L2 self-efficacy, with this ID construct being examined in relation to gender (e.g., Mills et al., 2006; Rivers & Ross, 2020), with mixed findings being reported; personality traits, including emotional stability, agreeableness, extraversion, conscientiousness, and openness to experience (e.g., Rivers & Ross, 2020), with positive correlations being found between personality, self-efficacy and L2 learning; anxiety (e.g., Han & Hiver, 2018; Woodrow, 2011; Zhang & Ardasheva, 2019), with mixed results being reported in the literature; learning strategies (e.g., Kim et al., 2015), with positive and significant associations being found between learning strategies and L2 self-efficacy; and the four language skills, i.e., listening (e.g., Wang et al., 2013), reading (e.g., McLean & Poulshock, 2018), writing (e.g., Ho, 2016), and speaking (e.g., Leeming, 2017). Overall, as reported in the literature, L2 self-efficacy played a beneficial role in all language skills, with greater gains made in oral skills (Wyatt, 2022).

II.6. MOTIVATION IN SLA

In this section we first introduce the concept of motivation and an overview of the different approaches that have been taken in order to understand motivation in the field of SLA. We subsequently provide a review of the motivation research that has been carried out both in educational psychology and in the field of SLA.

II.6.1. Motivation in SLA: Conceptualisations and Taxonomies

In the field of educational psychology, motivation is defined as the set of processes involved in the activation, direction and maintenance of behaviour (Beltrán, 1993; Beltrán et al., 1987). In SLA, motivation explains "*why* people decide to do something, *how long* they are willing to sustain the activity, and *how hard* they are going to pursue it" (Dörnyei & Skehan, 2003, p. 614). Also, motivation "is usually defined as a psychological trait which leads people to achieve some goal. In language learning, the goal may be the mastery of the language or achievement of some lesser aim" (Johnson & Johnson, 1998, pp. 219-220). Motivation can be defined as a phenomenon that explains why learners do or do not take a certain course of action instead of others (direction), the intensity at which they pursue the action (vigour), and the length of time in which learners stay involved in that action (persistence) (Papi & Hiver, 2022).

According to Ortega (2009), "motivation is usually understood to refer to the desire to initiate L2 learning and the effort employed to sustain it" (p. 168). Richards and Schmidt (2011) also defined the construct of L2 motivation, and stated that motivation refers to "a combination of the learner's attitudes, desires and willingness to expend effort in order to learn the second language" (p. 377). Thus, L2 motivation is the result of (i) a desire to learn (i.e., how much personal investment in succeeding in the language people claim for themselves), (ii) the effort learners spend in learning the language (i.e., motivational intensity), and (iii) the positive L2 learning attitudes (i.e., how much enjoyment learners report feeling when they learn the language). Higgins (2012) classified the different motivational constructs under three dimensions, including control (managing what happens), value (having desired outcomes), and truth (establishing what is real) (as cited in Papi, 2022). That is, as stated by Papi (2022), motivation emerges from the desire to engage in a given activity that one enjoys or is good at doing (control), the desire to achieve desirable end-states and avoid those which are undesirable (value), and the learner's curiosity for discovering and learning the truth of different matters (truth).

L2 motivation has been conceptualised in many different ways in the field of SLA, being regarded as a "multi-faceted construct" (Dörnyei, 2006, p. 50) that consists of different components that influence learning behaviour and outcomes. In the socio-educational model of SLA, motivation was assessed in terms of the three components just mentioned above, that is, the desire to learn the L2, the attitudes towards learning the L2, and the motivational intensity (that is, the effort extended to learn the L2) (Gardner, 2010). In fact, there is no doubt that learners' self-efficacy beliefs in what they are capable of doing affect motivation. Importantly, as stated by Dörnyei (2001), motivation is responsible for "why people select a particular activity, how long they are willing to persist at it, and what effort they invest in it" (as cited in Kormos, 2012, p. 394). Later, Dörnyei (2005) also stated that motivation is of great importance in SLA. According to Dörnyei and Ryan (2015), motivation "provides the primary impetus to initiate L2 learning and later the driving force to sustain the long, often tedious learning process" (p. 72).

In the past fifty years, most of the L2 motivation research has been more concerned about what motivation is than about how this knowledge can be used to motivate learners and find out whether the proposed motivational strategies worked in L2 classrooms (Dörnyei & Csizér, 1998). Nevertheless, over the past two decades, there has been a marked change and interest has increased in the study of motivational strategies and motivational applications to increase learners' motivation in the L2 classroom in both L2 motivation research (e.g., Chambers, 1999; Dörnyei, 1994, 2001; Williams & Burden, 1997) and educational psychological research (e.g., Alderman, 2007; Brophy, 2004; McCombs & Pope, 1994; Schunk et al., 2008).

Traditionally, four types of L2 motivation have been identified: (1) intrinsic motivation with which learners perform an activity for its own sake, for interest or for enjoyment; (2) extrinsic motivation with which learners perform an activity for external rewards, including grades or recognition from others (Deci & Ryan, 1985); (3) integrative motivation with which learners wish to identify with the L2 community culture (Ellis, 2012); and (4) instrumental motivation with which learners aim to pursue a functional aim, such as getting a job or passing an exam (Ellis, 2012). In what follows we present a detailed description of these four types of L2 motivation.

In this respect, an important distinction is that between integrative and instrumental motivation. Gardner and Lambert (1972, as cited in Dörnyei & Kubanyiova, 2014) proposed two kinds of motivational orientation in language learning: (i) an integrative orientation, referring to the interest in learning an L2 of a valued community so that "one can communicate with members of the community and even become like them" (p. 21), thus emphasising the personal interest in learning a language which reflects "a sincere personal interest in the people and culture represented by the other group" (Gardner & Lambert, 1972, p. 132), in learning a language which reflects a sincere and personal interest in the L2 people and culture; and (ii) an instrumental orientation, referring to the benefits and practical value of learning a new language (Gardner & Lambert, 1972, as cited in Dörnyei, 2010). The instrumental orientation emphasises the personal interest in learning a language which reflects the personal appreciation of the value and advantage of knowing a language. For instance, getting a better job or pursuing a higher level of education in the L2. Therefore, Papi (2022) stated that constructs such as intrinsic interest in learning foreign languages or positive attitudes towards or curiosity about the target language community, and culture have been found to represent the truth aspect of L2 motivation.

Another important distinction is that between intrinsic and extrinsic motivation, considered as factors that initiate motivation. Intrinsic motivation is when the reasons to perform the action lie within the activity itself (choice and personal causation). Ortega (2009) stated that individuals are said to be intrinsically motivated when they undertake an activity self-initiated by choice and for its inherent satisfaction, enjoyment or pleasure. On the other hand, extrinsic motivation is when the reason to perform a given action is to gain something outside the activity itself. Individuals are said to be extrinsically motivated when they interpret "their behaviour as structured by a means-end, pragmatic-instrumental causation that is imposed from the outside" (Ortega, 2009, p. 176). This sense of personal causation and autonomy is low, as individuals undertake an activity because they want to earn extrinsic rewards or avoid punishment (externally regulated actions). On the other hand, within the factors that maintain motivation, a distinction is made between internal and external factors. Internal factors refer to learners' perceptions of their own capabilities and degree of control over what they do. On the other hand, external factors refer to agents in the learning context, such as institutional or curricular objectives, teachers -behaviours or strategies-, learners' parents, peer groups, learning tasks, examinations, and the environmental conditions.

II.6.2. Motivation in SLA: Research Trends

Second language (L2) motivation is a language learner individual difference that has been a featured area of research in SLA studies, expanding rapidly in recent years and attracting scholars from diverse educational contexts and theoretical perspectives (Papi & Hiver, 2022; Ryan, 2019; Schwieter & Benati, 2019). For instance, Papi and Hiver (2022) provide evidence of how motivation theories, models, and constructs have contributed to our understanding of the different aspects of the complex and multidimensional notion of motivation. L2 motivation and language aptitude have traditionally been regarded as the two primary ID variables in the study of an L2 (Dörnyei, 2010), and motivation is considered the primary affective factor that shapes L2 learning. Within the field of SLA, research on motivation has focused on (i) what reasons motivate people to learn languages, (ii) why some people are more motivated to learn languages than others, and (iii) what types of motivation are more effective in the learning of a language (Ushioda, 2013). Nevertheless, since the turn of the 21st century, motivation research in SLA started to pay attention to how motivation develops and emerges in interaction with the social learning environment. Over the past forty years, a large body of research on motivation has arisen in the SLA field and L2 motivation research has thrived (Boo et al., 2015), including recent edited volumes, articles appearing in leading journals, monographs, handbooks and special issues (e.g., Dörnyei & Ushioda, 2021;

Lamb et al., 2019; Schwieter & Benati, 2019), being driven by (ii) the social purposes and values of L2 motivation research, and also by (ii) the academic purposes and values of theorising L2 motivation and its fundamental role in successful language learning. This emphasises the move towards a more learner-centred approach in language education as well as the learners' interest in all the contributions they make to their own learning, thus moving the study of L2 motivation into a prominent position on the recent research agenda (Ryan, 2019).

It is widely agreed that L2 motivation plays a significant role in the L2 learning process (e.g., Dörnyei, 2001, 2005; Gardner, 1979, 1985; Ushioda, 2009). As a major ID variable, motivation has been found to significantly influence the degree of success in L2 learning, alongside other ID variables such as aptitude, cognitive style, or personality. For instance, Reece and Walker (1997, as cited in Anjomshoa & Sadighi, 2015) emphasised that "a less able student who is highly motivated can achieve greater success in learning an L2 than the more intelligent student who is not well motivated" (p. 135). Students may sometimes come highly motivated to the L2 classroom and the teacher's task is to maintain the motivation of the students through the creation of a positive affective climate. Dörnyei (2005) stated that "without sufficient motivation, even individuals with the most remarkable abilities cannot accomplish long-term goals, and neither are appropriate curricula and good teaching enough on their own to ensure student achievement" (p. 65). According to the self-determination theory (Deci & Ryan, 1985), well-known in social and educational psychology, the more self-determined a learner's goal is for task completion, the higher the learner's motivation, enjoyment and engagement would be during the completion of the task at hand (Papi, 2022).

In what follows we present a detailed description of the two main trends in motivation research that have been developed over the years, corresponding to the work done before and after the 90's, respectively.

II.6.2.1. Trend 1: Gardner and Lambert’s social-psychological perspective

The first trend in L2 motivation research corresponds to Gardner and Lambert’s social-psychological perspective.

The origins of motivation research in SLA (founded in the bilingual social context of Canada) date back to the work conducted by Gardner and Lambert (1959, 1972), two Canadian social psychologists who were the first to work with the idea of motivation and its relation with SLA. Gardner and Lambert (1972) theorised that motivation was a significant cause of variability in SLA, as well as independent of cognitive factors, including ability or language aptitude (Ushioda, 2013). Moreover, Gardner and Lambert (1972) stated that learning an L2 had important social and psychological dimensions that made the motivation to learn an L2 distinguishable from other types of learning motivation, as “learners are expected not simply to acquire knowledge of the language but to identify with the target language community and adopt their distinctive speech behaviours and styles” (Ushioda, 2012, p. 59). Learners’ attitudes toward the target community and orientations, as well as the influence of such attitudes and orientations on learners’ learning behaviour (Ushioda & Dörnyei (2012) led Gardner and Lambert (1972) to propose the two kinds of motivational orientation in language learning (i.e., an integrative orientation and an instrumental orientation), described in the previous section.

Thus, the early L2 motivation research was influenced by the work of Gardner and Lambert (1959, 1972), and originated in a social psychological approach (1959-1990) interested in the relationship between the SLA social context and the learners’ relations and attitudes between different L2 communities (Ushioda & Dörnyei, 2012). In this respect, L2 motivation research conducted within the social perspective differed from that research on L2 motivation conducted within cognitive perspectives predominant in mainstream motivational psychology (Ushioda, 2013). This social psychological approach (Gardner & Lanbert, 1959, 1972) reflected an interest in foreign languages and attitudes toward the L2 community, attitudes toward the learning situation (including teachers and curriculum, for instance) and motivation toward L2 learning by integrating the social and individual psychology of learners. In this sense, this approach was based on Gardner's (1985) main principle that "students' attitudes toward the specific language group are bound to influence how successful they will be in incorporating aspects of that language" (p. 6). Therefore, Gardner and Lambert (1972, as cited in Dörnyei, 2005) regarded the motivation to learn the language of the other community as "a primary force responsible for enhancing or hindering intercultural communication and affiliation" (p. 67). Gardner and Lambert's (1972) conceptualisation of motivation (addressed in the previous section) focuses on the socioeducational model, with the motivation to learn emerging as a result of learners' attitudes toward the L2 community (Sasayama, 2018). Finally, it is within the social-psychological perspective that Gardner and Lambert (1972) proposed the integrative and instrumental orientations in language learning.

II.6.2.2. Trend 2: Trends in psychology, the process-oriented approach to L2 motivation and The L2 Motivation Self-System (Dörnyei, 2005)

The second trend in L2 motivation research corresponds to developments in psychology, the process-oriented approach to L2 motivation, and The L2 Motivation Self-System (Dörnyei, 2005).

- ***A situated approach to the study of motivation***

A significant development in L2 motivation research occurred during the 1990s and the turn of the century when research in this field (e.g., Noels et al., 1999; Ushioda, 1996) incorporated a cognitive and educational view of L2 motivation and was more in line with cognitive theories of motivation, focusing on the classroom setting, and on relationships among individual motivational cognitions (e.g., goals, perceptions of competence, beliefs), learner behaviours (e.g., task engagement or avoidance, effort), learning process and experience (e.g., success, failure), and characteristics of the learning situation (e.g., teaching methods, materials, competitive versus collaborative learning environments, interpersonal relations) (Ushioda, 2013). At this stage, research into L2 motivation highlighted the teacher's role in motivating students in L2 classrooms as well as the importance of the learning environment (a 'situated approach' to the study of motivation). Furthermore, Dörnyei (1994) suggested strategies to be used by teachers to motivate their students in L2 classrooms. The best-known concepts stemming from this approach are intrinsic and extrinsic motivation (e.g., the performance of a behaviour for its own sake or as a means to an end), attributions (e.g., how one explains past successes and failures), self-confidence/efficacy and situation-specific motives related to the L2 course, the L2 teachers or the learner's peer group (Dörnyei & Kubanyiova, 2014).

- ***Study of the dynamics of motivation***

A further development in L2 motivation research emerged when a more process-oriented approach to the analysis of L2 motivation was adopted. Williams and Burden's (1997) and Dörnyei and Ottó's (1998) motivational process models put emphasis on the unstable, and hence dynamic, nature of L2 motivation. Additionally, this more process-oriented approach regards L2 motivation as being more dynamic and changeable over time. As stated by Sasayama (2018), motivation is not a static ID variable (unlike some ID variables, such as age or language aptitude), but it changes over the course of language learning or even during a language lesson. Therefore, regarding the dynamic nature of motivation, it has been postulated that, instead of being considered a stable characteristic of the individual learner, motivation should be seen as a dynamic characteristic that changes over time (Manchón & Roca de Larios, 2007). The findings of the study by Ma (2009) revealed that those L2 learners with similar levels of motivation to learn English showed a distinct situation-specific motivation when performing different types of classroom tasks (as cited in Sasayama, 2018), thus representing the fluid (and not static) nature of some aspects of the construct of learners' motivation. In this respect, designing classroom activities is relevant to increase learners' motivation, and some features of classroom activities or tasks can be manipulated in order to generate learners' motivation (Sasayama, 2018).

Because of this new view of L2 motivation, a comprehensive framework of motivational strategies that teachers could use in L2 classrooms to enhance students' motivation during the L2 learning process was developed by Dörnyei (2001). Dörnyei and Ottó (1998) differentiated three stages of the motivation process in language learning: (i) the preactional stage, in which the motivation to accomplish a goal is generated; (ii) the actional stage, in which the initial motivation has to be maintained and protected; and (iii) the postactional stage, which involves some kind of evaluation of the learning process. Moreover, Williams and Burden (1998) also stated that motivation consists of three main components: (i) having reasons to do something; (ii) deciding to engage in the required behaviour (this is the central component of motivation); and (iii) investing and sustaining the effort required. The first two components focus on undertaking the effort, and the last component focuses on persevering in pursuing the goals set. From this perspective, this threefold distinction indicated that there are factors that initiate motivation and factors that maintain motivation. Within the factors that initiate motivation, a distinction is made between intrinsic and extrinsic motivation. This distinction has been addressed in the previous section.

❖ ***The L2 Motivational Self-System (Dörnyei, 2005)***

During the first decade of the twenty-first century, L2 motivation research was broadened and marked a shift toward the current new socio-dynamic approach, interested in motivational change and evolution, and in the effects of identity and motivation in particular social contexts (Dörnyei & Kubanyiova, 2014). This recent development involved the introduction of the role of the self and context in understanding L2 motivation, particularly Dörnyei's (2005) model of the L2 Motivational Self-System (L2MSS; Dörnyei, 2005), a recent conceptualisation of motivation. The L2MSS was a new motivational framework which marked a significant change in the understanding of motivation in future years, and therefore opening up the L2 motivation research agenda. Furthermore, the L2MSS synthesised previous research in L2 motivation and reformed it by adding some aspects of the self-research in language learner psychology and including a wider range of methodological, theoretical, and practical interests (Ryan, 2019). Within this framework of the L2MSS, future selves have been found to be central in L2 motivation research over the last decade.

The L2MSS is composed of three main components: (i) the Ideal L2 Self, representing "a desirable yet possible self-image of the learner as a future L2 user" (Ryan, 2019, p. 416), that is, the attributes that the L2 learner would ideally like to possess, including aspirations, wishes, or hopes -for instance, if the person the learner would like to become speaks an L2, the Ideal L2 Self motivates the learner to learn that particular L2 since he/she would like to reduce that perceived discrepancies between the ideal and his/her perceived current selves (Dörnyei et al., 2006, as cited in Ortega, 2009); (ii) the Ought-to L2 Self, which refers to the attributes the learner believes he/she ought to possess in order to meet not only the expectations of others, but also the obligations to others (Ryan, 2019), thus avoiding possible negative outcomes; and (iii) the L2 Learning Experience, which is "an ongoing internal narrative formed through an interaction between interpretations of past successes and failures as a language learner [i.e., experience] together with assessments of a range of immediate situational factors [i.e., the immediate learning environment]" (Ryan, 2019, pp. 416-417). In line with this, Manchón and Roca de Larios (2007) stated that more recently, the orientation of L2 motivation studies is cognitive and, consequently, it is firmly rooted in psychology. Furthermore, another important characteristic of this new paradigm is that it focuses on L2 learning in formal contexts, in contrast to Gardner and Lambert's (1972) research conducted in natural contexts. From this perspective, (i) motivation has been considered as a dynamic process with the possibility of evolution over time; (ii) the attempt to develop a motivational model that reflects motivation in a classroom context; and, finally, (iii) the relationship between motivation and the components of learning, especially self-regulation.

II.7. INDIVIDUAL DIFFERENCES IN SLA AND TASK COMPLEXITY

Our own empirical study looked into the effects of IDs in writing as potentially modulated by task complexity (TC). In order to frame our study in the relevant research, in what follows we first provide an account of TC studies in SLA. Then we focus on cognitive and affective/motivational IDs in the context of L2 task-based complexity research.

II.7.1. Task Complexity

Task-based language learning and teaching (hereafter TBLT) approach has received much attention from some researchers in the field of L2 acquisition (SLA) as well as practitioners (Long, 2014; Long & Crookes, 1993; Van den Branden et al., 2009). In the mid-1980s, researchers resorted to tasks as tools used for SLA research and since then, there has been interest in tasks as potential building blocks of L2 instruction (Richards & Rodgers, 2014). The strategies and cognitive processes used by L2 learners have been a focus of research for many researchers in the field of L2 acquisition. In this regard, a psycholinguistic perspective has been taken by TBLT-oriented investigation, and seen from this perspective, tasks are pedagogic tools to "predispose, even induce learners to engage in certain types of language use and mental processing that are beneficial for acquisition" (Ellis, 2000, as cited in Vasylets et al., 2017, p. 2).

TBLT researchers agree that TC is a complex and multidimensional construct (Robinson, 2007b; Sasayama, 2016; Skehan, 1998, 2014; Vasylets et al., 2017) that interacts with task design, mode and material, as well as cognitions (i.e., learner cognition) and IDs (Révész, 2011; Robinson, 2011) (as cited in Awwad & Tavakoli, 2022). Over the past decades, the construct of TC has received much research investigation in TBLT, and TC has been found to be central to research in both TBLT and SLA as "it is assumed to affect L2 processing, production and acquisition" (Awwad & Tavakoli, 2022, p. 2). In this regard, there has been a growing interest in conceptualising, defining and investigating the construct of cognitive TC (e.g., Awwad et al., 2017; Tavakoli & Foster, 2008; Cho, 2018; Declerck & Kormos, 2012; Robinson, 2007b; Sasayama, 2016). In his Cognition Hypothesis, Robinson

(2001, p. 29) defines TC as “the result of the attentional, memory, reasoning and other information processing demands imposed by the structure of the task on the language learner” and, more recently, Sasayama (2016) defined TC as “the cognitive load of a second language (L2) communication [or performance] task” (p. 231). In this regard, as argued by Liu and Li (2012, as cited in Awwad & Tavakoli, 2022), when defining TC in general terms, TBLT researchers make reference to three task qualities, which are the following: (a) task structure, (b) resource requirements of the task, and (c) the interaction between the task and learner-internal variables. Nevertheless, many TBLT researchers have opted to investigate TC within theoretical frameworks proposed by two influential cognitive-interactionist TC models, i.e., the Limited Attentional Capacity Model (Skehan, 1998, 2014) and the Cognition Hypothesis (Robinson, 2001, 2011).

Theoretical and methodological questions have arisen about whether TC facilitates SLA and L2 production, and the way in which this construct interacts with attention allocation, noticing, and automaticity, as psycholinguistic processes (Awwad & Tavakoli, 2022). In this regard, the substantial research interest in TC has been inspired by these mentioned questions. Moreover, from a pedagogic angle, the interest in investigating TC “is rooted in the need for developing an index of complexity to be used in task design and task sequencing in language teaching, syllabus design and assessment” (Malicka, 2014; Robinson, 2015, as cited in Awwad & Tavakoli, 2022, p. 2). Nonetheless, as noted in Awwad and Tavakoli (2022), Jackson and Suethanapornkul (2013) mentioned two limitations to research in TBLT. One limitation lies in the fact that there is a scarcity of empirical studies on TC, as well as on diverse task-related variables, including reasoning demands and the inconsistency in the operationalisation of such variables (Awwad & Tavakoli, 2022). Furthermore, as cited in Awwad and Tavakoli (2022), another limitation is that the relationship between TC and learner-internal variables (such as language proficiency and individual learner differences) has been to a certain extent neglected in TBLT research and, as a result, this above-mentioned relationship is under-researched in TBLT. However, it should be noted that examining this relationship (thus considering the effects of learner-related variables and the possible interaction between them on task performance) is believed to contribute to the development of a more comprehensive understanding of how TC may mediate both L2 production and SLA (Awwad & Tavakoli, 2022). In this sense, some research on TC (e.g., Gilabert & Muñoz, 2010; Kormos & Trebits, 2011) has recently been conducted and it has shown that, for instance, "the impact of learner-internal variables, e. g. language proficiency (LP) and working memory (WM), on task performance is weak relative to the effects of TC" (as cited in Awwad & Tavakoli, 2022, p. 2).

II.7.2. Individual Differences and Task Complexity: Theoretical Perspectives and Research Findings

Task-based language learning and teaching (TBLT) research has investigated the influence of individual differences (IDs) on L2 learning and task performance. The theoretical foundations of the role of IDs in performing tasks were anticipated by Robinson (2001, 2011) in his Cognition Hypothesis. The central construct of this hypothesis is TC, which Robinson (2011) defines as "attentional, memory, reasoning and other information processing demands imposed by the structure of the task on the language learner" (p. 29). One of the most relevant principles of the Cognition Hypothesis is that "individual differences in affective and cognitive abilities... [will be factors that] will increasingly differentiate learning and performance as tasks increase in complexity...So there should be less variation between learners in performing simple tasks than there is when performing more complex versions" (Robinson, 2011, p. 19). In other words, as stated by Awwad and Tavakoli (2022), in the Cognition Hypothesis (Robinson, 2011), the human brain has access to multiple resources, and thus, increasing the cognitive complexity of the task (leading to a higher cognitive demand on the part of learners) promotes access to many resources and L2 learners produce more complex and accurate language to convey such demands. Moreover, the Cognition Hypothesis predicts that the pressure that results from this higher cognitive demand will create opportunities for learning and L2 acquisition (Awwad & Tavakoli, 2022). In this model, TC is further broken down into resource-dispersing and resource-directing factors, which can be intentionally manipulated in order to achieve the predetermined effects on L2 performance and L2 development.

On the contrary, Skehan's Limited Attentional Capacity model (1998, 2014) envisages that the higher cognitive demand limits opportunities for L2 development and acquisition (Awwad & Tavakoli, 2022). This model hypothesises that "a higher cognitive demand requires greater attentional resources, thus forcing learners to prioritise their allocation of attention" (Skehan, 1998, 2014, as cited in Awwad & Tavakoli, 2022, p. 3). In this regard, Skehan's (1998, 2014) Limited Attentional Capacity hypothesis is based on the premise that learners have limited attentional capacity, and due to this limited nature of learners' processing capacity and taking as a basis the limitations in the cognitive resources available to language users, Skehan stated that the different dimensions of L2 performance (i.e., complexity, accuracy and fluency) compete for resources and this is why L2 learners prioritise allocating attention to particular goals in detriment of others depending on the task (Skehan, 2015). More precisely, it was theorised that this competition between performance dimensions gave priority to meaning over form and to fluency over accuracy and complexity in demanding tasks, being complexity and accuracy in competition for attention (Skehan, 2009, 2014, as cited in Vasylets et al., 2017).

CHAPTER III. INDIVIDUAL DIFFERENCES AND L2 WRITING

The current chapter provides an account of research on the role of cognitive and affective/motivational individual differences (IDs) in the modality of writing. It is comprised of two sections. The first section focuses on the cognitive IDs (language aptitude and working memory) considered in the study of this doctoral dissertation, and it is divided into two parts. Part 1 is devoted to language aptitude, and Part 2 is devoted to working memory. Theoretical paradigms and previous research on these cognitive IDs and writing will be addressed in both parts. Also, the moderating effects of proficiency and task complexity on cognitive IDs and writing will be addressed.

The second section of this chapter focuses on the affective and motivational IDs (writing anxiety, self-efficacy and motivation) targeted in our study. Theoretical paradigms and previous research on these affective/motivational IDs and writing will be addressed. This section will also address the moderating effects of proficiency and task complexity on such affective and motivational IDs and writing.

Prior to that, we provide an introduction to the rationale and significance of the role of IDs in L2 writing.

III.1. INDIVIDUAL DIFFERENCES IN L2 WRITING: INTRODUCTION

The general aim of the study in this doctoral dissertation is to add to the gradually expanding body of scholarly research on the role of IDs in L2 writing by shedding further light on (i) to what extent cognitive (language aptitude and working memory) and affective/motivational (writing anxiety, self-efficacy and motivation) IDs affect L2 written performance, that is, how these mentioned ID variables are implicated in written language use; and (ii) whether or not learner's L2 proficiency level and task complexity moderate any potential ID effects.

As mentioned in the previous chapter, individual differences (IDs) and their effects on second language (L2) acquisition has been and still is a featured research area in SLA studies, with extensive empirical research being conducted on the role of IDs in the pace of learning as well as in the ultimate attainment of language competence. This SLA research has showed that IDs can influence the rate of L2 acquisition and overall outcomes, this being in line with Dörnyei's (2005) claim that IDs are the most consistent predictors of L2 achievement).

Nevertheless, although IDs play an important role in L2 learning and have been recognised as the most consistent predictors of L2 learning success, SLA-oriented L2 writing research has underscored the important role that cognitive and affective/motivational IDs may play in L2 writing -especially from the perspective of the connection between writing and language learning (Manchón, 2011, 2020, 2023; Manchón & Vasylets, 2019)-, and IDs have not been sufficiently investigated in this domain, although the situation has recently changed (as reviewed in Ahmadian & Vasylets, 2022; Manchón & Sanz, 2023a; Papi, 2022; Papi et al., 2022).

As stated by Kormos (2012), the lack of attention to IDs in SLA-oriented L2 writing research is surprising as writing is a complex and time-consuming activity that requires not only the skillful coordination of various cognitive and linguistic processes and resources (Hayes, 1996; Kellogg, 1996) but also concentration and determination. Also, this state of affairs is surprising given the influence of ID factors on the performance of writing tasks, and given the importance of writing tasks in L2 development (Manchón & Vasylets, 2019). Nevertheless, cognitive and affective/motivational IDs have been found to play a role in every stage of the L2 writing process (see Kellogg's [1996] cognitive model, consisting of the following processes: formulation [planning and translation], execution and monitoring) and in how L2 learners exploit the potential of writing in order to acquire the L2 (Manchón, 2023; Manchón & Williams, 2016; Williams, 2012), as well as have an effect on the quality of the final written product (Kormos, 2012). Thus, in L2 writing research Kellogg's (1996) cognitive model is fundamental to consider the way in which cognitive and affective/motivational IDs influence composition writing processes.

Additionally, as mentioned above, the role of cognitive and affective/motivational ID factors has also been explored in relation to L2 learning through writing: writing is thought to help L2 learners to notice and internalise new knowledge of the L2, provides output opportunities and, as a result, promotes automatisation, knowledge consolidation and hypothesis testing (Manchón, 2023; Manchón & Williams, 2016; Williams, 2012). As stated by Dörnyei (2005), L2 learners differ in these various SLA processes based on their cognitive and affective/motivational ID factors. In addition, and in line with Dörnyei's (2005) statement, IDs have been found to exert an influence on the variability in L2 writing, as L2 learners differ in their cognitive abilities and they are expected to execute and orchestrate the cognitive and linguistic processes with varying degrees of efficiency (Kormos, 2012). In this respect, Manchón and Roca de Larios' (2011) account of the mental model of the L2 writer is another way of explaining the potential benefits of writing for L2 learning, as well as the important role cognitive, affective and motivational IDs play in goal-setting (i.e., L2 learners' goal-setting behaviour with regard to the writing task at hand as well as the different aspects of the writing task L2 learners attend to), determining the depth of problem-solving behaviour L2 learners engage in and the amount of attention paid to the process of L2 writing and the feedback L2 learners receive (as cited in Kormos, 2012).

Writing is not only one of the most challenging skills that individuals can learn throughout their lifespan, but it is also a time-consuming activity which requires determination and concentration (Kormos, 2012), as well as motivation and self-regulation. Moreover, the route and pace of becoming proficient in the writing skill varies from one individual to another. In other words, due to the complexity and time-consuming activity of writing, the development of the writing skill proceeds at a varied pace and is itself characterised by a high variability in ultimate attainment. In line with this, Bereiter and Scardamalia (1987) stated that even in the first language (L1), the acquisition of writing skills develops at a varied pace and exhibits a wide range of inter- and intra-individual variations. The acquisition of L2 writing, however, can be even more constrained as it involves some additional challenges such as gaps in L2 knowledge or lack of automatisation of L2 spelling rules (Weigle, 2005). During the writing process, IDs may become involved at any time and have an effect on the quality of L2 writing (Chae, 2013). For instance, Chae (2013) pointed out that a learner with a higher level of self-efficacy (confidence), motivation (pleasure) and skills to use writing strategies in L2 writing is more likely to produce a better essay. Moreover, L2 learners' IDs, both cognitive and affective/motivational, are significant factors that have also been found to exert an influence on the variability in L2 writing, as these are inherent personal characteristics that L2 learners bring to the L2 writing tasks under performance (Kormos, 2012; see also Ahmadian & Vasylets, 2022; Papi, 2022; Papi et al., 2022).

For instance, in the past decade, there have been advances in research findings in relation to the role of cognitive individual differences such as LA and WM in both L2 writing processes and performance. Recent empirical evidence (Ahmadian & Vasylets, 2022; Serafini & Sanz, 2016; Vasylets & Marín, 2021) has shown that WM and LA are two fundamental cognitive variables which contribute positively to L2 writing, mediating the potential language learning gains that may derive from engaging in writing tasks (as well as from processing the feedback provided to L2 learners). L2 learners' cognitive IDs are significant factors that have been found to exert an influence on the variability in L2 writing, as these are inherent personal characteristics that L2 learners bring to the L2 writing tasks under performance (Kormos, 2012; Papi et al., 2022). Nevertheless, as will be explained later in this chapter, the nature of the research findings obtained is mixed and diverse, thus not providing a fully nuanced understanding of the relationship between cognitive resources and L2 writing. In line with this, the role of cognitive IDs (i.e., WM and LA) in L2 writing (including the diversity of empirical results obtained from this area of research) may depend on different learner internal and external factors (both of them being fundamental in writing activity) which can moderate this main relationship, such as the level of L2 proficiency, the task under performance, the performance dimension that is analysed (Robinson, 2013; Williams, 2015), the linguistic feature/area, age, or the writing medium of performance (i.e., pen-and-paper versus computer-based writing).

Moreover, it must be noted that although a growing body of empirical research (e.g., Bergsleithner, 2010; Kormos & Trebits, 2012; Michel et al., 2019; Yang et al., 2019; Yi & Ni, 2015; Zabihi, 2018; Zalbidea, 2017) has investigated the mediation of learner-related variables (including grammatical sensitivity, inductive language learning capacity, motivation, or strategic behaviour) on the characteristics of L2 writing, most studies have investigated specific IDs rather than combinations of IDs (for instance, the prevalent focus on just the component of language analytic ability, e.g., Benson & DeKeyser, 2019; Stefanou & Révész, 2015). Therefore, our study adds to previous empirical work on cognitive and affective/motivational IDs and writing given (i) the consideration of all components of aptitude (i.e., vocabulary learning, recognition of patterns in oral language, sound-symbol correspondence, grammatical inference) in contrast to the prevalent focus on just the component of language analytic ability, e.g. Benson & DeKeyser, 2019; Stefanou & Révész, 2015; and (ii) the attempt to combine in one and the same study an inquiry into the potential interactions of learner-related variables (LA, WM, writing anxiety, writing motivation, writing self-efficacy, L2 proficiency) and task-related variables (TC) that have hitherto been addressed separately.

Importantly, it has been since Kormos's (2012) call to make the study of IDs more central in L2 writing research intended to establish SLA-L2 writing interfaces that theory and empirical work on the way in which learning through writing and feedback processing may be mediated by learner IDs has gradually expanded (Manchón & Sanz, 2023b). In fact, the momentum gained so far on the study of IDs and writing has been attested by the inclusion of comprehensive syntheses on IDs and writing in two SLA handbooks published recently: Manchón and Polio's (2022) *Routledge Handbook of Second Language Acquisition and Writing* (e.g., Ahmadian & Vasylets, 2022, for the role of cognitive IDs in writing performance and written corrective feedback processing and use), and Papi and Li's (2022) *Routledge Handbook of Second Language Acquisition and Individual Differences* (e.g., Papi et al., 2022, for IDs in L2 writing).

As the necessary background for our own study, in what follows we first provide an account of the research on cognitive and affective IDs (LA, WM, writing anxiety, writing self-efficacy and writing motivation) in L2 writing. Also, the moderating effects of proficiency and TC on cognitive, affective, and motivational IDs and writing will be addressed in the following sections.

III.2. COGNITIVE INDIVIDUAL DIFFERENCES. LANGUAGE APTITUDE AND L2 WRITING

III.2.1. Language Aptitude and L2 Writing: Overview

Language aptitude (LA) is recognised as one of the central cognitive abilities in language learning in general (Curcic et al., 2019; Dabrowska, 2019; DeKeyser, 2013; Doughty, 2019; Granena, 2013a; Granena & Yilmaz, 2019a; Skehan, 1991; Wen et al., 2017, 2019) that refers to those characteristics of an individual which are associated with pace of progress in learning a language (Carroll, 1981), and this cognitive construct is also believed to be able to influence L2 writing quality (Kormos & Trebits, 2012; Vasylets et al., 2022; Yang et al., 2019), therefore being also recognised as one of the fundamental cognitive abilities in L2 writing, in particular (Ahmadian & Vasylets, 2022; Granena, 2023; Kormos, 2012, 2023; Li, 2023b; Olive, 2022; Papi et al., 2022; Serafini & Sanz, 2016; Vasylets & Marín, 2021). However, although LA has been extensively researched in L2 oral research (e.g., Bowles et al., 2016; Granena, 2019; Saito et al., 2019), L2 writing is a domain of language use that has until recently received little attention both in LA theory and in empirical research (Kormos, 2012). In spite of its empirically-proven relevance in SLA, and despite the theoretical framework which clearly identifies the role of LA on L2 writing, there are very few empirical studies which have investigated this issue (Kormos, 2012), and to date only a few L2 writing studies have focused on LA and L2 writing products (e.g., Kormos & Trebits, 2012; Mujtaba et al., 2021; Vasylets et al., 2022; Yang et al., 2019). As regards L2 writing processes and development, the role of LA has been explored in this area (see contributions by Granena, 2023 and Li, 2023b, in Manchón & Sanz, 2023a), this being grounded in Carroll's (1981) traditional argument suggesting that LA plays a fundamental role in the early stages of the learning process, and that LA is particularly relevant in formal contexts through classroom instruction, in which most learning is intentional and conscious (as cited in Kormos, 2023). Nevertheless, no role of LA has been found in L1 writing models.

In line with Carroll's (1981) classical framework of LA and the componential nature of LA, Kormos (2012) made her own hypotheses about the specific effects that the different components of LA may have on L2 writing. Therefore, phonetic coding ability (which consists in the ability to learn sound-symbol associations) is predicted to contribute to more accurate spelling; higher levels of deductive learning ability (which refers to the ability to induce language rules from input) as well as grammatical sensitivity (which refers to the ability to identify grammatical functions of words) can benefit linguistic encoding; rote learning ability (which consists in the ability to learn sound-meaning associations) is expected to benefit the lexical complexity of L2 writing; therefore, those learners with a high level of rote learning ability, who can potentially have a richer vocabulary, could be expected to produce more lexically complex written texts. Finally, good deductive learning skills are expected to help learners to exploit the language-learning potential of L2 writing to a higher degree (Manchón, 2011, 2020; Manchón & Vasylets, 2019). Moreover, regarding how and whether each of the aptitude constructs in Skehan's (2016) Macro-SLA aptitude model relate to the basic L2 writing processes (Flower & Hayes, 1981), WM and attentional control mechanisms are clearly associated with all writing processes (i.e., planning, translation, programming, execution, reading, and editing). The LA component of memory retrieval was found to play a fundamental role in all writing processes, except for programming. Moreover, language analytic ability and phonetic coding ability were found to play an important role in translation (converting non-linguistic thoughts into actual sentences), reading, and editing processes (Kormos, 2012). Finally, chunking was found to support the writing processes of planning and translation.

The majority of previous short, experimental classroom-based or longer-term studies have centred on the relationship between different components of LA and the linguistic quality of individual L2 writing tasks. Although findings from these previous empirical studies posit a certain role for LA in L2 writing in the sense that, overall, there is an indication of some positive links between LA and L2 writing performance, they are scarce and far from being conclusive. Therefore, the available data are too scarce to make firm conclusions, but certain patterns concerning the effects of LA in the L2 writing domain can already be traced. Overall, the available findings point out that there is an indication of a positive link between

LA and L2 writing performance, and there is also evidence that other factors (e.g., TC) may mediate this relationship. Yet, in his recent review of LA, Li (2019) concludes that the "predictive research shows that overall aptitude is a strong predictor of learning success, but it seems less predictive of L2 writing and vocabulary learning" (p. 93). This claim needs further empirical validation given that L2 writing aptitude research is limited (Kormos & Trebits, 2012; Mujtaba et al., 2021; Vasylets et al., 2022; Yang et al., 2019) as compared to the research on aptitude effects on feedback processing and use (Benson & DeKeyser, 2019; Ishikawa, 2019; Ishikawa & Révész, 2023; Ishikawa & Suzuki, 2023; Sheen, 2007; Shintani & Ellis, 2015; Stefanou & Révész, 2015; Yamashita, 2022; see also Granena, 2023, and Kormos, 2023). Nevertheless, in research on LA and WCF, the picture is even unclear. For instance, as Papi et al. (2022) noted, Stefanou and Révész (2015) found that higher grammatical sensitivity was an advantage in using English articles from direct WCF. Benson and DeKeyser (2019) revealed that higher aptitude positively contributed to the effectiveness of direct WCF on the learning of English verbal tenses, but not to metalinguistic WCF. Moreover, Sheen (2007) found that learners with high language analytic ability benefited more from both direct correction and direct metalinguistic correction. Also, Shintani and Ellis (2015) found that learners with higher abilities benefited more from both direct and metalinguistic WCF.

As regards previous empirical research on LA and L2 writing performance, Kormos and Sáfár (2008) demonstrated certain facilitative effects of LA on L2 writing, as they found a strong link between the component of the LA test that measures metalinguistic awareness and teacher ratings of L2 writing tasks. In a more recent study, Yang et al. (2019) explored how LA (assessed by LLAMA tests; Meara, 2005) and productive and receptive vocabulary size may affect L2 writing performance. In this study, 59 Chinese university learners of EFL (age: 20-23 [average age: 22], and an average English learning experience of 10 years) performed a picture description narrative task, that is, a narrative writing story according to a sequenced set of pictures in the L2. L2 written performance was assessed by means of an automated scoring system (http://www.pigai.org) which assigns a holistic score on the basis of the evaluation of five dimensions (i.e., the dimensions of content, organisation, sentence structure, vocabulary choice and coherence).

Yang et al. (2019) established two main research questions, which were as follows: (i) are LA and its subcomponents, vocabulary size (receptive and productive) and L2 writing performance, significantly correlated? and (ii) to what extent are LA and its subcomponents and vocabulary size predictive of L2 writing performance? Yang et al. (2019) predicted that LA and vocabulary size would be correlated with and predictive of L2 writing performance. Generally, they found that L2 written performance correlated positively with LLAMA E and LLAMA F, but no correlation was found with LLAMA B and LLAMA D. More specifically, they found that LA (LLAMA E score), especially associative learning and analytical learning ability, may contribute to the linguistic encoding and monitoring process of L2 writing; that is, results showed that L2 writing quality was predicted by vocabulary learning and grammar inferencing abilities, which are believed to tap into aptitude for explicit language learning, that is, into associative learning and analytical learning ability (Granena, 2013b). Thus, L2 writing score (i.e., holistic L2 writing quality) was moderately correlated with LLAMA E (which measures sound-symbol correspondence), writing score (r) = .34, with a medium effect size ($r^2 = .11$); that is, there was moderate (positive) correlation between LLAMA E and holistic L2 writing quality. In the same vein, considering the fact that L2 learners with stronger ability in learning associations between sound and orthographic signs are better able to allocate their attention to their L2 writing performance, especially to the measures of accuracy and/or clausal complexity (Yang et al., 2019), Kormos and Trebits (2012) found an association between LLAMA E and metalinguistic awareness, which monitors writing output in order to avoid grammatical or spelling errors, thus resulting in better quality of L2 learners' writing performance.

Furthermore, the study by Yang et al. (2019) found that LLAMA F, which measures grammatical inferencing ability (i.e., inductive learning ability/language analytic ability), was slightly correlated with participants' overall L2 writing performance as well, but the correlation was not as strong as LLAMA E (Yang et al., 2019). Nonetheless, LLAMA B, which measures rote memory (i.e., vocabulary learning), and LLAMA D, which measures phonetic recognition (i.e., sound recognition) were not correlated with L2 writing performance. Granena's (2013b) findings also reported that LLAMA D was not significantly correlated with L2 writing. In the study by Yang et al. (2019), the regression analysis showed that L2 writing was significantly predicted by LLAMA E score (β = .08, p = .015), which taps into associative learning and analytical learning ability. This result is in line with Granena's (2013b) findings which revealed that LLAMA E (and LLAMA F) are significantly correlated with L2 learning that measures the use of analytical, metalinguistic knowledge in explicit instructional contexts, whereas LLAMA D, which measures sound recognition, tapped into implicit knowledge or automated use and was not correlated with L2 writing performance. Granena (2013b) found that LA is associated with grammar learning ability, but not with syntactic complexity in L2 writing. Moreover, in addition to LLAMA E, the regression analysis also showed that L2 writing was significantly predicted by receptive vocabulary size (β = .001, p = .045). Yang et al. (2019) reported that receptive vocabulary size, writing score (r) = .29, is another important predictor of L2 writing quality, with a medium effect size (r^2 = .08). Receptive vocabulary size was shown to be moderately correlated with L2 writing quality. Moreover, the findings in Yang et al.'s (2019) study are consistent with those obtained in Mujtaba et al.'s (2021) study (with a total of 50 EFL graduate-level learners), in which LA and its subcomponents LLAMA B, LLAMA E and LLAMA F were also significantly correlated with L2 writing performance. As in Yang et al. (2019), LLAMA D was not correlated with L2 writing performance. The regression analysis in Mujtaba et al.'s (2021) study revealed that LLAMA B and LLAMA E emerged as strong predictors of learners' L2 writing performance. In this study, the LLAMA tests (Meara, 2005) were employed to measure LA, and participants were also asked to complete two picture description writing tasks as a measure of L2 writing performance. Learners' writings were rated based on the measures of grammar, content, organization, spelling, and vocabulary.

Also, the findings in Yang et al. (2019) resonate with the results of Vasylets et al.'s (2022) study (with a total of 42 Spanish EFL undergraduate learners), which also showed that LLAMA F was significantly and positively correlated with L2 writing performance (in the pen-and-paper writing modality). However, the contribution of LLAMA B and LLAMA D to the quality of L2 writing production was almost negligible; LLAMA E was positively correlated with L2 writing performance (small and moderate correlations), but the correlation was not significant. In this study, LA was measured via the LLAMA tests (Meara, 2005), and L2 writing performance was assessed by an argumentative reasoning writing task (the "Fire-

Chief' task, Gilabert, 2007). CAF measures were employed to assess learners' L2 written production. These findings for LLLAMA F and L2 writing performance also resonate with the results of the study by Kormos and Trebits (2012), which will be described in section III.2.3. above.

In sum, the existing research insights do point to a positive effect of LA on the quality of L2 texts, especially regarding the aptitude component of language analytic ability. Given the limited research on LA and writing as compared to the research on LA effects on feedback processing and use, the second aim of our study was to investigate potential LA effects on the CAF indices of L2 written production. We also aimed to investigate the potential mediation of task-related factors (task complexity) and language-related factors (L2 proficiency) on any observed LA effects, on account of the limited research on the interaction between LA effects and task complexity (e.g., Kormos & Trebits, 2012) and on the L2 proficiency-dependency of LA effects in the writing domain. This research provides the motivation for the second aim of our study.

III.2.2. Language Aptitude and L2 Writing: Moderating Effects of Proficiency

Li's (2016) meta-analysis on the correlation between aptitude and writing performance found that L2 writing was not significantly correlated with LA (i.e., the results for L2 writing were not statistically significant) except for the two subcomponents of LA related to number learning and spelling clues (r = .42 for both) (as cited in Yang et al., 2019), which are two subtests of the MLAT. Number learning showed a higher correlation with L2 writing than with other outcomes variables (i.e., grammar learning and vocabulary learning, for L2 knowledge; and listening comprehension, speaking and reading comprehension, for L2 skills), and spelling clues was strongly correlated with reading comprehension and writing. Thus, it is observed that LA had low predictive validity for vocabulary learning and L2 writing, and different aptitude components demonstrated differential predictive validity for different aspects of learning. In terms of overall proficiency, rote memory was found to be the least predictive among the three aptitude components (phonetic coding, analytic ability, and rote memory) (Li, 2016). In terms of specific aspects of learning, phonetic coding was the strongest predictor for vocabulary learning, analytic ability was the strongest predictor for grammar learning, and rote memory was the weakest predictor for all aspects of L2 learning, including vocabulary learning.

The reason why L2 writing was not found to correlate with LA remains to be explored since most studies in Li's (2016) meta-analysis did not state how L2 writing was evaluated (as cited in Yang et al., 2019). Nevertheless, the explanation given for these unexpected results by Li (2016) is that the set of skills required by writing might be different from the set of skills which are measured in traditional aptitude tests. In line with this, the findings in Li's (2015) meta-analysis revealed that "language aptitude [LA] as measured via traditional aptitude tests is a set of cognitive abilities that were more implicated in initial stages of L2 development and conscious learning conditions" (Li, 2015, p. 385). In fact, Li (2015, 2016) reported that a strong correlation was found between overall aptitude and high school FL learners' L2 achievement, as compared to the lower correlation between general aptitude and university learners' L2 achievement. The explanation for this might be that language aptitude is more relevant for initial stages of learning than for later stages, as mentioned above. This is in line with Carroll (1981), who argued that traditional aptitude is an initial state of readiness for language learning from scratch. In relation to the influence of L2 proficiency on the associations between aptitude and L2 acquisition, Hummel (2009) found that overall aptitude significantly predicted general L2 proficiency. Nevertheless, when learners were divided into high and low L2 proficiency based on their median scores obtained, aptitude was not a significant predictor for any L2 proficiency level.

Given the lack of empirical work on L2 proficiency-dependency of LA effects in the writing domain, our study attempted to provide new empirical evidence on the potential interaction between LA and proficiency effects on L2 written production. Therefore, to advance in this direction, the second aim of our study was also to investigate whether any observed LA effects on CAF measures of L2 written production were moderated by L2 proficiency.

III.2.3. Language Aptitude and L2 Writing: Moderating Effects of Task Complexity

In his Cognition Hypothesis, Robinson (2001) defines task complexity as "the result of the attentional, memory, reasoning, and other information processing demands imposed by the structure of the task on the language learner" (p. 29, as cited in Liu & Li, 2012, p. 555). In Chapter IV we will present a detailed analysis of relevant research findings in TC and L2 writing. As will be discussed, the findings of research on TC and L2 writing do not offer clear support for the Cognition Hypothesis (Robinson, 2001, 2011), with inconclusive and sometimes contradictory findings being reported in the literature, as evidenced in Johnson's (2017, 2022) meta-analyses of TBLT-informed L2 writing studies.

The rationale for a predicted interaction of LA and TC in writing lies in the consideration of the cognitively-demanding nature of the act of composing, characterised by its higher cognitive demands and increased problem-solving nature. Kormos and Trebits (2012) investigated the relationship between the components of LA (assessed by the L1 version of the MLAT, i.e., HUNLAT [Hungarian Modern Language Aptitude Test, Ottó, 2002]) and the CAF (lexical and syntactic complexity, accuracy, and fluency) measures of L2 oral and written performance in two different types of writing tasks (given storyline vs. designing own plot), which differed in their level of cognitive complexity. The results showed that LA components were differently related to the CAF measures of oral performance as compared to L2 writing performance of 44 upper-intermediate secondary school learners in Hungary (L2: English; age: 15-18).

Using a correlational design, in the written mode, Kormos and Trebits (2012) found that learners with high grammatical sensitivity produced longer clauses in the task with high demands in the linguistic encoding (simple task; given storyline), but no relationship between quality of written production and LA (grammatical sensitivity) was found in the task which posed high demands on content conceptualisation (complex task; designing own plot). LA components had a moderately strong correlation with measures of performance (Kormos & Trebits, 2012). In other words, learners with higher grammatical sensitivity produced longer clauses, but only in the task which was demanding (i.e., which posed high demands) in the linguistic encoding phase, that is, in the task which was considered simple (the task with the pre-defined plot), suggesting that LA may play different roles in influencing performance depending on the complexity of the task or the mode in which the task is performed. Therefore, when learners had to write a narrative according to a given storyline, a significant positive correlation was found between grammatical sensitivity and L2 writing performance (Kormos & Trebits, 2012), a finding which resonates with the results of other studies (i.e., Vasylets et al., 2022; Yang et al., 2019) which also found a positive link between grammatical inferencing ability and L2 writing performance. Nevertheless, Kormos and Trebits (2012) showed that when participants were required to design their own story plot, no relationship was found between LA (i.e., grammatical sensitivity) and L2 writing. That is, no relationship was found between LA and L2 writing in the complex task, that is, in the task which was demanding in content conceptualisation.

In sum, motivated by the limited research on the interaction between LA effects and task complexity in the writing domain, our second aim was also to investigate the relationship between potential LA effects on the CAF measures of L2 written texts produced by L2 writers of higher and lower proficiency levels and the complexity of the task to be completed. The second aim of our study was also motivated by the consideration of previous SLA research on the interaction between TC and proficiency in L2 writing (e.g., Ishikawa, 2007; Kuiken et al., 2005; Kuiken & Vedder, 2008).

III.2.4. Language Aptitude and L2 Writing: Summary

On the basis of the empirical findings reported, the available results point to the positive relationship between LA and L2 writing performance. Significantly, there is also evidence that other factors (e.g., task complexity and L2 proficiency) may mediate this link between LA and L2 writing. However, the lack of studies (i) makes it difficult to generalise the research findings obtained, and (ii) allows us to make only hypothetical assumptions (and not a fine-grained understanding of the effects of LA in L2 writing) about the role of LA in L2 writing production, although there seems to be an indication that LA may play a mediating role in L2 writing and that learners with higher levels of LA may produce L2 written products of higher quality.

III.3. COGNITIVE INDIVIDUAL DIFFERENCES. WORKING MEMORY AND L2 WRITING

III.3.1. Working Memory and L2 Writing: Writing as a Complex Task

As already mentioned in the previous section, WM refers to a limited-capacity cognitive system involved in the temporary manipulation and maintenance in active attention of the task-relevant information and the inhibition of task-irrelevant information (Baddeley, 2003). Manchón et al. (2023) emphasised the relevance of WM and its interaction with other variables, including L2 proficiency and task complexity, since composition writing is a cognitively demanding activity which entails the allocation and orchestration of learners' attentional resources and skills during text production.

Firstly, Manchón et al. (2023) stated that "the availability of and (ideally automatic) access to required L2 knowledge, knowledge of genre conventions and rhetorical requirements (Schoonen et al., 2011), and domain knowledge relevant to the task at hand" (p. 738) are necessary requirements for performing writing individually and collaboratively, as well as in time-constrained and time-expanded conditions. Secondly, Manchón et al. (2023) continued to acknowledge that "in order to successfully orchestrate (and switch between) the higher-order processes" (p. 738) which are required for writing (basically the writing processes of planning, linguistic encoding, revision, and monitoring), writing also requires a variety of cognitive abilities (Olive, 2011, 2022, as cited in Manchón et al., 2023). Manchón et al. (2023) emphasised that this includes "decision-making on the part of the writer as to the allocation of attentional resources throughout the entire process of composing" (p. 738). Hence, the importance of WM in L2 writing.

In this respect, Kormos (2012) made a compelling case for the importance of working memory capacity (WMC) at all phases of composition writing in her ground-breaking work on IDs and L2 writing. As noted in Manchón et al. (2023), Kormos (2012) stated that (i) writing is generally known to be cognitively demanding in nature, and (ii) writing in an L2 may place additional demands on cognitive resources because the learner lacks automatic access to the necessary L2 knowledge in order to effectively convey his/her intended meaning. Thus, as posited in Kormos (2012), it can be hypothesised that the cognitive demands on (low-proficiency) L2 writers would develop as a result of “their likely more limited and less sophisticated lexicon, less efficient lexical access, and less automatic processes involved in syntactic packaging for translation of thoughts and ideas into sentences” (Kormos, 2012, as cited in Ahmadian & Vasylets, 2022, p. 141). In fact, Manchón et al. (2023) noted that there is evidence of empirical research on L2 writing processes accounting for “the more labour intensive nature of linguistic encoding in L2 writing” as contrasted to writing in one's native language (p. 739). For instance, as acknowledged in Manchón et al. (2023), Manchón et al. (2009) provided a synthesis of empirical studies on L2 writing processes on account of learners’ problem-solving behaviour when performing a writing task in their first and second language. Manchón et al. (2023) noted that this synthesis corroborated that there exist differences in how L1 and L2 writing processing take place, and these differences might be explained by the fact that learners’ automatic access to L1 and L2 knowledge needed to convey his/her meaning differs in their L1 and L2. In addition, as cited in Manchón et al. (2023), the synthesis by Manchón et al. (2009) also provided evidence that both L1 and L2 writers devote most of their writing time to transforming ideas into language (that is, to the linguistic encoding phase of the writing process). Nevertheless, Manchón et al. (2009, as cited in Manchón et al., 2023) stated that L1 writers are more fluent when involved in the process of linguistic encoding than L2 writers, thus providing evidence of the cognitively demanding nature of L2 composition writing.

Moreover, Manchón et al. (2023) also stated that since WM is "the place where writing processes are activated and coordinated and where the writer's representation of the text is constructed" (Olive, 2011, as cited in Manchón et al., 2023, p. 738), its importance in managing the cognitively demanding and problem-solving nature of composition writing cannot be overstated. According to Olive (2011), "[it is] the cognitive space where operations of the writing process take place” (as cited in Manchón et al., 2023, p. 738). Furthermore, Manchón et al. (2023) continued to acknowledge the important role played by WM functions in writing. The justification for such importance of WM functions in composing is that writing requires the use of WM functions because, on the one hand, the storage function of

WM enables "temporary stores for transient information created during composing" (Olive, 2022, as cited in Manchón, 2023, p. 738) and, on the other, the processing function of WM facilitates the "coordination and switching among the writing processes, construction of the different representations necessary to create written discourse, and particularly construction of the writer's multidimensional representation of the text" (Olive, 2022, as cited in Manchón, 2023, p. 738). All this serves as an explanation for the essential role that WM plays in the different theoretical models of writing that have been proposed over the years (e.g., Berninger & Winn, 2006; Flower & Hayes, 1981; Hayes, 1996, 2012; Kellogg, 1996, 2001; Kim & Schatschneider, 2017; McCutchen, 1996, 2000, 2011). These theoretical models of writing will be addressed in further detail below.

III.3.2. Working Memory and L2 Writing: Theoretical Perspectives. Models

Prominent theorists of L1 writing (e.g., Hayes, 1996, 2012; Kellogg, 1996, 2001; McCutchen, 1996) have assigned an important role to WM in L1 written production, and in their theoretical models of L1 writing (e.g., Hayes, 2012; Kellogg, 1996, 2001) the WM construct has always been considered as one of the central cognitive resources underpinning writing performance. In this respect, the implication of WM components is based on two premises: first, that writing requires the different WM functions of storing and processing components, and second, that composition writing is cognitively taxing. Importantly, as stated by Manchón and Sanz (2023b) in their own introduction to their volume on WM and writing, the existing body of empirical studies conducted on WM effects on L2 writing has relied not only on the extensive empirical work on WM in the L1 writing domain, but also on theoretical paradigms and models. Accordingly, Manchón and Sanz (2023b) stated that “the most influential models of L1 writing […] have emphasised WM as an explanation for differential success in L1 writing” (p. 605), but Manchón and Sanz (2023b) continued to state that the role attributed to WM subcomponents (i.e., verbal WM, phonological short-term memory, visual-spatial WM, and the three executive functions of inhibition, shifting, and updating) in the writing processes differs in these theoretical models of L1 writing. When explaining variability in success at L2 writing, we are mindful that the situation changes, as L2 learners differ in their vocabulary range, and their grammar, for instance (Manchón &

Sanz, 2023b). Therefore, as noted in Manchón and Sanz (2023b), scholars decide to adapt existing L1 writing models to explain L2 writing, as well as to consider language-related (language proficiency) and task-related considerations.

In what follows we present a detailed description of theoretical models of WM and writing that have been developed over the years.

In her contribution to Manchón and Sanz's (2023a) recent volume on WM and L2 writing, Kormos (2023) provided a detailed explanation of early and more recent L1 writing models that attributed a role to WM. As noted in Kormos (2023), Flower and Hayes's (1981) L1 writing model constitutes one of the early L1 writing models on WM and writing processes, being later revised by Hayes (1996, 2012). Kormos (2023) continued to acknowledge that in Flower and Hayes's (1981) L1 writing model, the writing process is cyclical and recursive, and it consists of the phases of planning, translating and reviewing. Additionally, as Kormos (2023) noted, these three phases of the writing processes originally proposed by Flower and Hayes (1981) were further reconceptualised in Hayes's (1996) revised model, in which the writing process was comprised of the phases of reflection, production and text interpretation. As cited in Manchón and Sanz (2023b), in Hayes's (1996) WM model of L1 writing, phonological memory, visuospatial memory, and semantic memory are fully involved in all writing processes. Moreover, as Kormos (2023) noted, Hayes's (1996) L1 writing model is comprised of two components, including the task environment (the social and the physical environments) and the individual. Importantly, Kormos (2023) also stated that this WM model of L1 writing emphasises the relevance of cognitive resources in WM, motivation, and affective ID variables when implementing writing processes. Some time later, Hayes's (2012) model revised the model proposed by Chenoweth and Hayes (2001), and in this model writing is viewed as being comprised of the levels of control, resource and process (Kormos, 2023). Importantly, as Kormos (2023) noted, in Hayes's (2012) model the resource level includes WM, long-term memory (LTM), the process of reading, and attention. The process level includes task environment (comprised of collaborators and critics, transcribing technology, task materials and written plans, and the text written so far) and writing processes (including the evaluator, the proposer, the translator and the transcriber). Finally, the process level includes motivation, the writing schema, the current plan, and goal setting for planning, composing and revising.

Kellogg’s (1996) L1 writing WM model, based on Baddeley's (1986) multicomponent model of WM and integrating Flower and Hayes’s (1981) cognitive process model of writing, has influenced the majority of studies on WM in L2 writing, being taken as the theoretical basis for empirical studies exploring the role of WM in L2 writing. Kellogg’s (1996) L1 writing WM model draws links between WM components and writing processes, as will be explained below.

In Kellogg’s model of writing processes (1996) (see Figure 3 for Ellis & Yuan’s (2004) adaptation of Kellogg’s model of writing processes, 1996; Source: Wu & Erlam, 2016), accepted in both L1 and L2 writing, each stage of L2 writing (formulation [involving planning -i.e., goal setting- and translation/linguistic encoding of ideas into actual words and sentences], execution [entailing programming the output of translation, and executing -i.e., typing or handwriting-], and monitoring [involving reading/revision and editing]) is influenced by the individual writer’s WMC, with the three WM components (i.e., central executive, visual-spatial sketchpad and phonological loop) being linked with each of these writing processes. As Kormos (2023) noted, each WM component is differently engaged by the interactive and recursive writing processes. Thus, in Kellogg’s (1996) L1 writing model, the central executive is the WM component that is purported to be linked to all higher-level writing processes, which in Kellogg’s (1996) L1 writing model are formulation (including planning and linguistic encoding), execution, and monitoring (including revision and editing), as mentioned just above. In other words, previous research in L1 writing has proven that WM (the central executive, in the first place) is implicated in higher-order writing processes (Kellogg et al., 2013), except for motor execution. In contrast, the visual-spatial sketchpad is related to just planning, whereas the phonological loop is purported to be implicated only in the writing processes of translation and reading processes/revision. Theoretical predictions regarding the role of WM on L1 writing have been confirmed empirically (Olive, 2011, 2022, for reviews) due to the fact that WM has been demonstrated to play a crucial role in both older and younger writers' L1 writing performance or ability (Olive, 2011, 2022, for reviews. See also Kormos, 2023 and Li, 2023b).

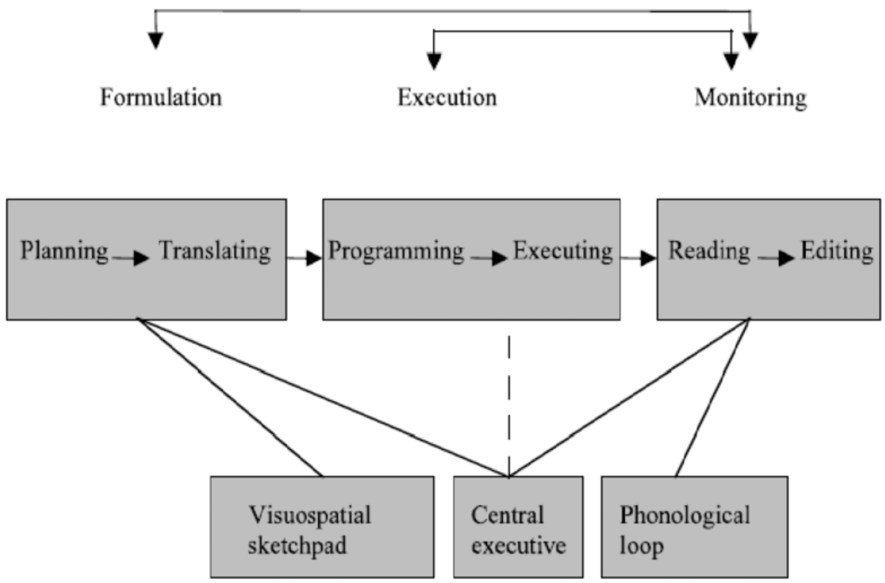

Figure 3. Ellis and Yuan's (2004) adaptation of Kellogg's model of writing processes (1996). Source: Wu and Erlam (2016).

As seen in Figure 3. Kellogg's model of writing processes (1996) focused on "how the phonological loop and the visual-spatial sketchpad (the code-specific components of WM) are engaged by the writing processes" (Bergsleithner, 2010, p. 5), and in this model, Kellogg (1996) also considered the limited capacity of WM for the cognitive resources (demanding in nature) that the writing processes required from the central executive (i.e., the control mechanism) (as cited in Bergsleithner, 2010). In line with this, more recently, Kellogg (2001, 2006) suggested that the development of writing expertise may be constrained by WMC, and also suggested that writing as a complex skill involves multiple processes (as cited in Bergsleithner, 2010). To sum up, as a complex process, writing involves the interaction between cognitive (e.g., high-level thinking or planning processes) and linguistic processes, thus placing high demands on the limited capacity of WM (Galbraith, 2009) due to the fact that this complex set of processes involved in writing has to be executed in a limited capacity WM.

Kormos (2023) also noted that another theoretical model of WM and writing was McCutchen's (1996, 2000, 2011) capacity theory of writing, which builds on the capacity theory of WM proposed by Daneman and Carpenter (1980). This theoretical model of WM was also described in detail by Olive (2022), who also acknowledged the role attributed to WM in the implementation of writing processes and outcomes in the theoretical model of writing proposed by McCutchen (1996, 2000, 2011). In this respect, McCutchen's (1996, 2000, 2011) capacity theory of writing considers WM as a single pool of general resources employed for the temporary and simultaneous storage and processing of information, while the limited WM capacity constrains the development of writing processes.

As also noted in Kormos (2023), McCutchen (1996, 2000, 2011) proposed this WM model based on research suggesting that more skilled L1 writers (i.e., those with higher WM span) produced more fluent sentence-generation processes than less skilled L1 writers, with this higher fluency releasing WM for storing items (McCutchen, 1994, 1996, as cited in Olive, 2022), as well as on research conducted by Bourdin and Fayol (1994), who showed that unskilled transcription required WM resources to the detriment of more central processes involved in recall. This shows how WM capacity contributes to individual and developmental differences in the writing skill. Accordingly, as noted in Kormos (2023), in McCutchen's (1996, 2000, 2011) model, WM is responsible for the efficient interaction of writing processes, which happens when such writing processes are efficient enough so as to be implemented in WM capacity. In fact, due to the limited capacity of WM, writing processes compete for WM resources. As noted in Kormos (2023), this WM model proposed by McCutchen (1996, 2000, 2011) considers that automatisation of lower-level writing skills (e.g., handwriting) is necessary to occur so as to free up WM resources and allocate them to higher-level writing processes (e.g., planning, translating, and revising). Kormos (2023) stated that this way, once lower-level writing skills become more efficient, higher-level writing processes can emerge. Consequently, efficient interactions among writing processes occur in WM, and writers are better able to face the competing demands of the writing processes as well as consider the constraints exerted by the limited WM capacity on the developing writing processes (Olive, 2022). Accordingly, McCutchen (2011) emphasised the importance of writers' developing "efficient linguistic encoding and transcription processes, as well as rich linguistic and genre-based knowledge" (e.g., domain-specific knowledge) in order to be able to easily access knowledge in long-term (LT)-WM (as cited in Kormos, 2023, p. 630).

Additionally, Kormos (2023) also acknowledged the relevance of Berninger and Swanson's (1994) model. In this respect, Berninger and Swanson (1994) also contributed to the model proposed by McCutchen (1996, 2000, 2011) and, considering the relationship between text composition and its demands placed on WM, they showed that beginner L1 writers' WM constraints resulted not only from "lack of automaticity in handwriting, but also from effortful spelling" (as cited in Kormos, 2023, p. 628). Kormos (2023) stated that this work by Berninger and Swanson (1994) and the theoretical framework of the Simple View of Writing (Berninger et al., 2002) led to the development of the Not-so-Simple View of Writing (Berninger & Winn, 2006) theoretical model, which includes the central executive (CE) that "is responsible for attention regulation", and also predicts a role for the extended construct of CE functions including attention, goal setting, planning, revising, self-monitoring and regulation, and cognitive flexibility (Berninger & Winn, 2006, as cited in Kormos, 2023, p. 629; see also Cartwright, 2015; Graham & Harris, 2000; Meltzer, 2010). Accordingly, Kormos (2023) also noted that in this WM model, the extended construct of CE functions directly influences low-level writing/transcription skills such as handwriting and spelling, as well as higher-level writing processes including planning, editing and revision during text generation (including the main goals in writing, word, sentence, and text levels).

Nevertheless, as Kormos (2023) noted, in a study recently conducted by Ahmed at al. (2022) on the role of CE functions in transcription skills with struggling L1 readers and writers (*n* =402; in grades 3-5), the results of this study showed that CE was directly related to the transcription skill of spelling and indirectly to writing. That is, there was an indirect effect of CE on the higher-level writing processes of editing and revision, as mediated by spelling skills (Kormos, 2023). Importantly, in line with Berninger and Winn's (2006) WM model, Olive (2022) stated that concurrent coordination of low- and high-level writing processes "requires executive control for monitoring not only process switching, but also information flow and related processing and short-term storage demands" (p. 514). In terms of executive functions, Olive (2022) also emphasised the relevance of WM (updating) for "storing and processing the retrieved semantic and declarative knowledge before it is written" (p. 515). As regards the field of L2 writing, as cited in Kormos (2023), "the role of CE functions has […] been recently […] [explored in WM L2 writing research] (e.g., Mavrou, 2020; Michel et al., 2019; Peng et al., 2022; Révész et al., 2023)" (p. 629), with few studies considering the three different CE functions of inhibition, updating and attention shifting (Miyake et al., 2000, as cited in Kormos, 2023).

Kormos (2023) also described more recent WM theoretical models of L1 writing, such as the Direct and Indirect Effects Model of Writing, proposed by Kim and Schatschneider (2017). As Kormos (2023) explains, this theoretical model considered that foundational language skills (such as vocabulary and grammatical knowledge) and cognitive skills (including WM and attention control) had not only a direct influence, but also an indirect effect on text production. Higher-order cognitive skills, such as inference, theory of mind, comprehension monitoring, and perspective taking mediated such relationship. In addition, Kormos (2023) also noted that this WM model emphasised the relevance of the role of WM in discourse-level comprehension and production that asked younger writers to produce writing fluently and accurately, and it also emphasised the relevance of discourse-level oral language in children's developing writing skills. As noted in Kormos (2023), the model was empirically validated with young L1 writers. Kormos (2023) continued to acknowledge that the results found that WM was directly associated with children's foundational language skills of vocabulary and grammar knowledge. Furthermore, a strong association was found between WM and children's higher-order cognitive skills of inference and perspective taking, as well as with their transcription skills of spelling and handwriting fluency on writing task performance. Nonetheless, as noted in Kormos (2023), WM was not found to have any direct effect on writing performance, but it made an indirect contribution to writing, with discourse-oral level language and the transcription skills of spelling and handwriting fluency playing a mediating role.

Finally, another influential model is Kormos's (2023) own recently proposed *Task-Mediated Cognitive Model of L2 Writing and Writing to Learn* (see Figure 4. Task-Mediated Cognitive Model of L2 Writing and Writing to Learn. Source: Kormos, 2023). In their own introduction to their volume on WM and L2 writing, Manchón and Sanz (2023b) noted that Kormos's (2023) theoretical model contributes to strengthening synergies between SLA and L2 writing research. Furthermore, Kormos's (2023) theoretical model constitutes the most recent and comprehensive theoretical proposal of how IDs may mediate writing processes and products as well as L2 learning through writing. As Manchón and Sanz (2023b) noted, Kormos's (2023) model considered the role of cognitive ID factors (working memory and aptitude) in L2 writing processes, products, and the potential language development during L2 writing (i.e., writing to learn) with and without access to feedback, and the interaction between learner-related (such as L2 proficiency and L1 skills) and task-related (such as task type and task administration conditions) variables. More specifically, as Kormos (2023) noted in her contribution to Manchón and Sanz (2023a), her theoretical model indicated how the role of cognitive IDs (WM and LA) in L2 writing processes and outcomes might differ as a function of L2 proficiency, potential L1 literacy skills (including vocabulary size, morphological awareness, and reading and writing skills), and task-related factors such as time allocation for writing, the complexity of the task instructions, planning time, linguistic, cognitive and genre-based task demands, and transcription technology (handwritten versus typed). In this respect, Kormos (2023) acknowledged the relevance of investigating the independent and interactive effects of cognitive ID factors such as WM and LA on writing processes and products in conjunction with task demands and the existing knowledge of L2 learners. As a recent initiative in L2 writing research agendas, for instance, Manchón et al. (2023) contributed to Manchón and Sanz's (2023) volume with a study that explored the role of WM in writing performance in conjunction with L2 proficiency and TC.

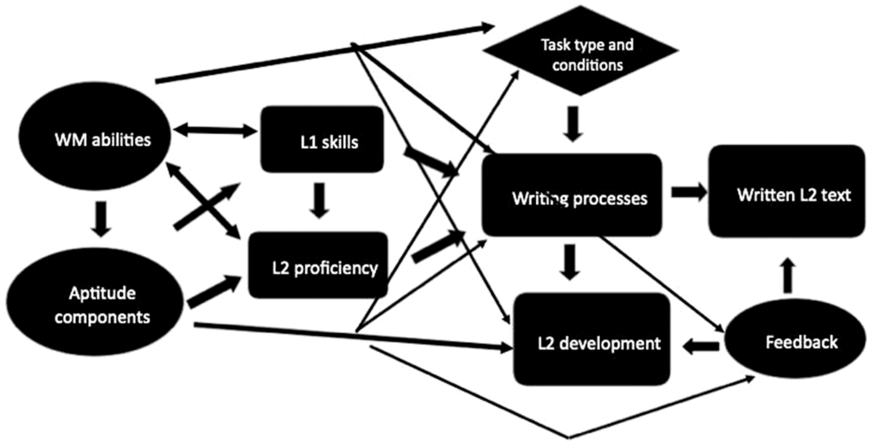

Figure 4. Task-Mediated Cognitive Model of L2 Writing and Writing to Learn. Source: Kormos (2023).

III.3.3. Working Memory and L1 Writing

As discussed above, various theoretical models of writing have attributed a role to the construct of WM (Berninger & Winn, 2006; Flower & Hayes, 1981; Hayes, 1996, 2012; Kellogg, 1996, 2001; Kellogg et al., 2013; Kim & Schatschneider, 2017; McCutchen, 1996, 2000, 2011). Furthermore, as Vasylets and Marín (2021) noted, the role of WM has also been justified empirically in the field of L1 writing (e.g., Vanderberg & Swanson, 2007). Accordingly, previous research in L1 writing has shown that WM (the central executive, in the first place) is implicated in higher order writing processes (Kellogg, 2013, as cited in Ahmadian & Vasylets, 2022). Thus, the importance of devoting this section of the doctoral dissertation to discuss the role of WM and L1 writing. There have been previous empirical studies exploring the role of WM in L1 writing performance (e.g., Bourke & Adams, 2003; Hoskyn & Swanson, 2003; Lehto, 1996; McCutchen et al., 1994; Swanson & Berninger 1996; Vanderberg & Swanson, 2007) (see Table 4. Previous studies investigating the relationship between working memory and L1 written performance), and the findings of these mentioned empirical studies indicated that correlations between WM and L1 written performance were positive.

Table 4. Previous studies investigating the relationship between working memory and L1 written performance.

Empirical study	**Number of participants, L1 and age**	**Tests**	**Writing task**	**Measures of written performance**	**Relationship between WM and L1 written performance**
Bourke & Adams (2003)	*n* =60 L1: English age: 6.1	Complex WM, visuospatial memory, and STM	Picture description task	Holistic rating, diversity of vocabulary, sentence length, text coherence	Positive link between central executive and all measures, except with sentence length
Hoskyn & Swanson (2003)	*n* =75 L1: English age: 42.8	Four WM subtests (picture sequence, mapping and directions, phrase sequence, and story retelling; Swanson, 1995), digit and sentence span tasks Reading comprehension, word knowledge, and handwriting tests	Narrative writing task, 15 min.	Spelling, organisation and cohesion; propositional, structural and syntactic complexity	Positive link with structural complexity (events)

Lehto (1996)	*n* =60 L1: Finnish age: 15.9	Sentence-word and operation-word span tasks (Turner & Engle, 1989)	Summarising (summary of an expository passage)	Low-level and high-level information	Positive link between WM and low-level information/macropropositions (details and subheadings) in writing
McCutchen et al. (1994)	*n* =210 L1: English age: 8-13	Reading and speaking span tasks (Daneman & Green, 1986)	Two essays	Holistic rating, length of sentences, range of ideas, mechanics	Positive link between WM and L1 writing quality (sentence generation)
Swanson & Berninger (1996)	*n* =300 L1: English age: 10-12	Verbal WM tests (sentence spans, rhyming, semantic categorisation, semantic association, phrase sequence, story recall; Swanson, 1992), visuospatial WM tests (visual matrix, mapping and directions; Swanson, 1992), and phonological STM tests (phonetic memory, written	Narrative task, expository task, spelling test, vocabulary test, text copying, and reading tests	Rating of content quality, and number of words and clauses	Positive link between the central executive component of WM and higher-order writing skills

		recall of nonwords, and written recall of letters in nonwords, and written recall of letter clusters in nonwords)			
Vanderberg & Swanson (2007)	*n* =160 L1: English age: 15.2	Four STM measures (written recall of nonwords, written recall of letter clusters in nonwords, written recall of digit span, and auditory test of word span; Swanson & Berninger, 1996), six WM tasks (rhyming words, sentence span, visual matrix, mapping and directions, semantic association, and emantic categorisation; Swanson, 1995; Daneman & Carpenter, 1980), a vocabulary subtest, and a spelling subtest	Picture description task	Capitalisation, vocabulary and spelling, structural complexity, and ratings of structural quality	Positive link between the central executive component of WM and higher-order writing skills (structure, vocabulary, grammar)

Accordingly, learners with more efficient WM resources at their disposal when composing their written texts showed higher quality of L1 writing performance (Hoskyn & Swanson, 2003; Vanderberg & Swanson, 2007). These findings resonate with the hypothesis that learners with longer verbal WM spans write more accurate and complex sentences as compared to those learners with shorter WM spans (Flower & Hayes, 1994; McCutchen, 1996; Swanson & Berninger, 1996; Swanson & Siegel, 2001, as cited in Yi & Ni, 2015), and, as will be reviewed later in this chapter, findings of research on WM and L2 writing (e.g., Bergsleithner, 2010; Baoshu & Luo, 2012) are also consistent with this hypothesis. For instance, Bergsleithner (2010) carried out an investigation on working memory capacity (WMC) and L2 writing performance, and his findings revealed that "learners with higher spans could process more accurate and complex grammatical and lexical cognitive processing during language performance" (as cited in Yi & Ni, 2015, p. 45). Furthermore, as noted in Yi and Ni (2015), the study conducted by Baoshu and Luo (2012) also found that WM had a significant effect on the accuracy of Chinese EFL learners' descriptive writings. In contrast to these aforementioned findings, empirical research conducted by Bridges (2011), Juffs (2004, 2005) and Li (2003) reported that WM had no correlation with L2 writing performance. In this regard, we can hypothesise that WM could play a more important role for L2 writers due to the fact that, in contrast to L1, L2 writing is a complex process that results in additional difficulties, "which can stem from the gaps in L2 knowledge and/or from insufficiently automatized access to L2 linguistic representations" (Weigle, 2005, as cited in Vasylets & Marín, 2021, p. 3). Nevertheless, this assumption is not well supported by the available research as this research has obtained mixed and inconclusive findings. The empirical evidence from these WM-L2 writing studies will be synthesised later in this chapter.

It should be mentioned that in these previous empirical studies on WM and L1 writing performance (i.e., Bourke & Adams, 2003; Hoskyn & Swanson, 2003; Lehto, 1996; McCutchen et al., 1994; Swanson & Berninger 1996; Vanderberg & Swanson, 2007), English was the first language (L1) of participants, except in the study carried out by Lehto (1996) in which Finnish was the participants' L1. For instance, Hoskyn and Swanson (2003) found a positive relationship with structural complexity with respect to the linkage among events in a story. Moreover, Vanderberg and Swanson (2007) indicated a positive relationship between the central executive component of WM and higher-order writing skills (structure, vocabulary and grammar), and these findings were in line with Swanson and Berninger's (1996) study, which also found a positive relationship between the central executive component of WM and higher-order writing skills. Considering these two mentioned studies (i.e., Hoskyn & Swanson, 2003; Vanderberg & Swanson, 2007), in L1 writing, it should be noted that there is a higher role for WM for adults (Hoskyn & Swanson, 2003; Vanderberg & Swanson, 2007). Furthermore, Bourke and Adams (2003) found a positive relationship between central executive and all measures, except with the length of sentences. Finally, Lehto (1996) indicated a positive relationship between WM and low-level ideas (including details and subheadings) in writing, but not with higher-level ideas, such as the number of topics, subtopics and conclusions; and McCutchen et al. (1994) indicated a positive relationship between learners' WM and L1 writing quality. This research has been carried out to investigate the role of WM functions for L1 writing both in adults (e.g., Hoskyn & Swanson, 2003; Olive et al., 2008) and in children and adolescents (for a review, see McCutchen, 2011). Importantly, it is interesting to observe that these findings from L1 writing are consistent with the results reported in Linck et al.'s (2014) meta-analysis which showed a robust, positive correlation between WM and L2 outcomes -moderate effects of WM in L2 writing-, with the estimated population effect size (*p*) of .255.

In sum, findings on WM studies in the field of L1 writing research normally reported a positive link between WM and written performance. However, as will be mentioned in the following section, the effects of WM in L2 writing are less clear (e.g., Ahmadian & Vasylets, 2022; Kormos & Sáfár, 2008; Lu, 2015) and although the extant empirical WM-L2 writing research has provided initial support for the view that WM is related to L2 writing, the results are conflicting and difficult to be interpreted.

III.3.4. Working Memory and L2 Writing: Empirical Research

On the one hand, divergent findings have been obtained on the links between different WM functions and writing processes (especially regarding pausing behaviour; Kim et al., 2021; Michel et al., 2019; Révész et al., 2017, 2023; Torres, 2023). On the other hand, to date, only a few studies have explored WM effects in L2 writing products (e.g., Adams & Guillot, 2008; Baoshu & Luo, 2012; Bergsleithner, 2010; Cho, 2018; Kormos & Sáfár, 2008; Lu, 2015; Manchón et al., 2023; Mavrou, 2020; Michel et al., 2019; Mujtaba et al., 2021; Peng et al., 2022; Vasylets & Marín 2021; Vasylets et al., 2022; Yi & Ni, 2015; Zabihi, 2018). See Table 5 for a synthesis of previous empirical studies exploring the role of WM in L2 written performance. As regards WM and WCF, more research is required, as to our knowledge, only Li and Roshan (2019) has investigated this issue (as cited in Papi et al., 2022). As noted in Papi et al. (2022), Li and Roshan (2019) found that complex WM positively predicted the effects of WCF with metalinguistic explanation and direct WCF plus revision. Phonological short-term memory negatively predicted the effects of direct WCF plus revision.

Table 5. Previous studies exploring the role of working memory in L2 written performance.

Study	Number of participants, L1, L2 and age	Tests	Writing task	Measures of written performance	Relation between WM and L2 written performance
Adams & Guillot (2008)	*n* =22 L1: French L2: English age: 12-15	Listening, spatial, digit span	Picture prompt, 8 min.	Holistic score	Partially positive (link between PSTM and L2 writing, in the area of spelling)
Bergsleithner (2010)	*n* =32 L1: Brazilian L2: English age: 20-40	OSPAN (L1)	Picture description, 7 min.	CAF indices: Accuracy, syntactic complexity	Moderate correlation (mixed)
Cho (2018)	*n* =39 L1: Korean L2: English age: 20	L2 Rspan and Ospan tests (verbal WM)	Argumentative writing: Four writing tasks of varying levels of complexity	CAF indices	Null (no verbal WM effects on any CAF measures of L2 writing)
Kim et al. (2021)	*n* =100 L1: Spanish, Oromo, Hindi, Arabic, Mexican, Urdu,	Background survey, Stroop test (inhibition), written letter running span task (verbal WM), western-based general	Essay (SAT-based prompts; argumentative writing)	Words per minute (fluency), text length, and text	Null (no correlation between verbal WM and writing fluency)

	Vietnamese and Shona L2: English age: 20.53	knowledge test, vocabulary knowledge test, reading comprehension skills test		quality (holistic rating)	
Kormos & Sáfár (2008)	*n* =121 L1: Hungarian L2: English age: 15-16	Non-word repetition (PSTM), backward digit span (verbal WM)	Composition task from Cambridge 1st Certificate Exam	Overall performance (holistic score)	Partially positive: No significant verbal WM effects on L2 writing for lower, beginner learners; unclear whether verbal WM predicts L2 writing for learners with a higher level of proficiency Positive, moderate PSTM effects on L2 writing, only for pre-intermediate learners; negative and nonsignificant PSTM effects on L2 writing for beginner learners

Lu (2015)	*n* =104 L1: Chinese L2: English age: 16-30	OSPAN (L1, L2)	Argumentative essay, 30 min.	Overall writing performance (holistic score)	Null (no correlation)
Manchón et al. (2023)	*n* =76 L1: Spanish L2: English age: 17-25	N-back WM test (Kane et al., 2007)	Problem-solving, picture-based "Fire-Chief" writing task (Gilabert, 2007), 50 min.	CAF indices	Null (no correlation)
Mavrou (2020)	*n* =59 L1: English, Chinese, Korean, German, Italian, Dutch, and Polish L2: Spanish age: 20	OSPAN and running memory span task (WM: updating), number letter task (shifting), emotional Stroop task (inhibition), backward Corsi block-tapping (visuospatial WM), and trait emotional intelligence questionnaire	Video narrative: Writing task based on an animated short film. Participants describe the plot of the film and express how they felt about it	CAF indices	Partially positive: The updating function of verbal WM influenced the accuracy and syntactic complexity (subordination) of the L2 written video-retelling texts; no other measures of WM influenced any CAF measures

Mavrou (2020)	*n* =59 L1: English, Chinese, Korean, German, Italian, Dutch, and Polish L2: Spanish age: 20	OSPAN and running memory span task (WM: updating), number letter task (shifting), emotional Stroop task (inhibition), backward Corsi block-tapping (visuospatial WM), and trait emotional intelligence questionnaire	Video narrative: Writing task based on an animated short film. Participants describe the plot of the film and express how they felt about it	CAF indices	Partially positive: The updating function of verbal WM influenced the accuracy and syntactic complexity (subordination) of the L2 written video-retelling texts; no other measures of WM influenced any CAF measures
Michel et al. (2019)	*n* =94 L1: Hungarian L2: English age: 11-13	Backward digit (executive WM), symmetry task (spatial WM), and forward digit (phonological STM)	Four writing tasks from the Writing section of the TOEFL Junior test (editing task, email task, opinion task, and listen-write task), and a background questionnaire	Overall writing ability, editing	Null (no correlation); WM effects only on editing

Peng et al. (2022)	*n* =374 L1: Spanish L2: English age: 8-11	Listening sentence span and updating (verbal WM), and visual matrix, mapping and directions tasks (visual WM), L1 and L2 conceptual span, and rhyming	Narrative writing/three subtests	Overall writing ability using a latent factor	Partially positive: Positive verbal WM effects on writing in English (L2) and Spanish (L1)
Vasylets & Marín (2021)	*n* =59 L1: Spanish/Catalan L2: English age: 19	Background questionnaire, Oxford Quick Placement Test (UCLES, 2001), reading span task (verbal WM)	Narrative video-retelling task	Overall writing and CAF indices (propositional complexity, lexical complexity, syntactic complexity, accuracy, and fluency	Partially positive: Positive relation between verbal WM and lexical sophistication at higher levels of proficiency Positive relationship between verbal WM and accuracy at lower proficiency levels
Yi & Ni (2015)	*n* =31 L1: Chinese L2: English	OSPAN	Argumentative essay, 1 hour)	CAF indices	Partially positive (link between WM and

	age: 19-21				syntactic complexity and accuracy)
Zabihi (2018)	*n* =232 L1: Persian L2: English age: 21	OSPAN (verbal WM)	Picture description, 11 min.	CAF indices	Mixed (positive correlation between verbal WM and syntactic complexity and fluency; negative with accuracy)
Zalbidea (2017)	*n* =32 L1: English L2: Spanish age: 19.6	OSPAN (verbal WM)	Argumentative writing task, 10 min.	CAF indices: Accuracy, lexical, and syntactic complexity	Partially positive: Positive correlation between verbal WM and accuracy of L2 writing performance in the complex writing task No correlations between verbal WM and lexical and syntactic complexity

Table 5 summarises empirical research on WM and L2 writing. As seen in the table, empirical research has aimed at investigating the effects of WM on L2 writing performance, at times adding moderating variables such as proficiency and TC. As observed, and as also noted in Li (2023b), these studies have been conducted with EFL learners and relied on different writing genres (mostly argumentative writing and narrative tasks), different WM tests (mostly operation and digit span tests), and different measures of writing performance (holistic and CAF measures). The findings of previous studies on WM and L2 writing performance are unclear and at times contradictory, as recently reviewed in Kormos (2023) and Li (2023b). Globally, as observed in Table 5, although some previous studies have shown that there is a positive relationship between WM and L2 writing performance (Adams & Guillot, 2008; Kormos & Sáfár, 2008; Mavrou, 2020; Mujtaba et al., 2021; Peng et al., 2022; Vasylets & Marín, 2021; Yi & Ni, 2015; Zalbidea, 2017), others have found mixed results (Bergsleithner, 2010; Vasylets et al., 2022; Zabihi, 2018) or practically null WM effects (Cho, 2018; Lu, 2015; Manchón et al., 2023; Michel et al., 2019). We provide below a detailed description of these empirical studies.

WM-L2 writing empirical research has been recently reviewed in the literature (e.g., Ahmadian & Vasylets, 2022; Kormos, 2023; Li, 2023b; Papi et al., 2022), and all of these contributions provide evidence of the mixed and contradictory nature of available empirical findings on WM and L2 writing. Also, as Manchón et al. (2023) noted in their background to the literature in their contribution to Manchón and Sanz's (2023a) volume, these previous studies exploring WM effects on L2 written production have been conducted with adolescent and young adults of diverse L1 backgrounds who are learning an L2 (being either English or Spanish). For instance, Adams and Guillot (2008) conducted an early study on WM effects on writing with a total of 22 French/English bilingual students aged between 12 and 15 years. This study explored the effects of the WM components of verbal working memory (VWM), visuo-spatial working memory (VSWM) and phonological short-term memory (PSTM) on the bilingual students' spelling and writing in both English and French. The results of this study showed that the only significant finding was a moderate correlation between PSTM and L2 writing performance in English (particularly in the area of spelling) ($r = .48$, $p \leq 0.05$). No significant links between verbal or visual WM and writing performance were shown neither in English nor in French. In this study, as Ahmadian and Vasylets (2022) noted, the digit recall test was used to measure participants' PSTM, a visuo-spatial span was employed to measure their VSWM, and a listening recall test was employed to gauge their VWM. The picture description writing task was assessed by means of holistic scores on a 0-10 scale.

In addition, as Ahmadian and Vasylets (2022) stated in their contribution to Manchón and Polio's (2022) *handbook on SLA and writing*, the results obtained in Adams and Guillot's (2008) study are consistent with the findings obtained in Kormos and Sáfár‘s (2008) study, which also showed links with PSTM (i.e., links between spelling performance among bilingual writers and PSTM capacity), but not with complex WM (i.e., no significant relationship between text composition and verbal WM capacity). The findings of this study will be reported in the following section. However, findings in Peng et al.'s (2022) study are at odds with Adams and Guillot's (2008) and Kormos and Sáfár's (2008) studies. Peng et al. (2022) found a link between verbal WM and L2 spelling in L2 narrative writing performance. In this study, verbal WM was measured by listening sentence span and updating tasks, and writing performance was operationalised in terms of overall composition scores in their narrative writings.

Added to this, as Ahmadian and Vasylets (2022) noted in their review of previous WM-L2 writing research, they acknowledged that a number of previous empirical studies (e.g., Bergsleithner, 2010; Zabihi, 2018; Zalbidea, 2017) showed significant links between complex WM and L2 written performance. Higher quality was found to be displayed in written productions of writers with more efficient WM resources as compared to writers with less WMC (Bergsleithner, 2010; Zalbidea, 2017). Therefore, in the study by Bergsleithner (2010) a total of 32 adult learners of English (age: 20-40; L1: Brazilian) participated in this study. As Ahmadian and Vasylets (2022) noted, complex WM (as measured by an operation-word span test [OSpan] in L1) positively correlated with the measures of accuracy and subordination of the English L2 written texts composed by the participants; in this case, an L2 picture description writing task. In other words, and as mentioned above when referring to the usual hypothesis that learners with longer verbal spans write more accurate and complex sentences as compared to those learners with shorter spans (Flower & Hayes, 1994;

McCutchen, 1996; Swanson & Berninger, 1996; Swanson & Siegel, 2001), Bergsleithner's (2010) findings showed that "learners with higher spans could process more accurate and complex grammatical and lexical cognitive processing during language performance" (as cited in Yi & Ni, 2015, p. 45). Furthermore, another study that explored WM effects on L2 writing was the one conducted by Mavrou (2020), which found that the updating function of WM influenced the accuracy and subordination of the L2 written video-retelling texts produced by the L2 learners. In this study, the participants were Spanish L2 learners and they completed five tasks in order to measure their WM. These WM tasks included a backward Corsi block-tapping task, an operation span task, a running memory span task, a number letter task, and an emotional Stroop task.

Furthermore, the empirical studies conducted by Baoshu and Luo (2012), Zalbidea (2017), and Mujtaba et al. (2021) also reported WM effects on accuracy. In these three studies, WM was measured by an operation span task. As compared to the study by Bergsleithner (2010), Ahmadian and Vasylets (2022) noted that the findings in Zalbidea's (2017) study (which examined the written argumentative performance of L2 Spanish learners) partially proved the positive relationship between complex WM and accuracy in writing, but not with complexity. In this study, 32 intermediate learners of L2 Spanish with a mean age of 19.6 years performed an OSpan test to measure their WM, and then they were asked to complete an argumentative task (both the simple and complex versions) orally and in writing. The results showed that there was a positive correlation between complex WM and accuracy in the complex written task, but no correlations were found between WM and complexity. Zalbidea (2017) stated that "more efficient WM functioning allows learners – even during complex tasks – to devote their limited attention to accuracy" (Zalbidea, 2017, as cited in Michel et al., 2019, p. 33). Zalbidea's (2017) study highlights the importance of considering the fact that the effects of WM on performance might depend on task-related factors, such as the complexity of the task learners perform.

In contrast to the findings obtained in the studies by Bergsleithner (2010), Baoshu and Luo (2012), Mavrou (2020), Mujtaba et al. (2021) and Zalbidea (2017), in Zabihi's (2018) study WM effects were reported on fluency (measured by the number of words per T-unit) and subordination, but not in accuracy. In this study by Zabihi (2018) with a total of 232 Persian upper-intermediate EFL learners whose age ranged from 18 to 40, the participants also performed an OSpan test to measure their WM and a timed narrative writing task which involved students writing a story based on a sequence of pictures. These L2 written texts were measured in terms of CAF measures. More specifically, resonating with Bergsleithner's (2010) findings, Zabihi's study (2018) reported a positive relationship between WMC and syntactic complexity (subordination) and fluency (number of words per T-unit), but not with accuracy as measured by the ratio of error-free T-units (as cited in Ahmadian & Vasylets, 2022). With respect to the dimension of lexical complexity, the empirical study by Vasylets and Marín (2021) found positive effects between WM and lexical sophistication, but not with lexical diversity (in this case, as also found in Mavrou, 2020).

Furthermore, Yi and Ni's (2015) study, with a total of 31 Chinese EFL learners, found that WM had a significant effect on the syntactic complexity (operationalised as the number of words per sentences) and fluency (measured by words per minute) of Chinese EFL learners' argumentative written compositions, but no impact was found on lexical complexity (measured in terms of word standardised type/token ratio) and accuracy (operationalised as the number of errors per 100 words). That is, those learners with higher WM outperformed those learners with lower WM in the dimensions of fluency and syntactic complexity (Yi & Ni, 2015). However, these findings in Yi and Ni's (2015) study were not consistent with those results found in other empirical studies carried out in the domain of L2 speech performance (e.g., Fortkamp, 1999; Guara-Tavares, 2009) and in studies on WM and L2 writing (e.g., Bergsleithner, 2010; Baoshu & Luo, 2012). For instance, as Yi and Ni (2015) noted, Fortkamp (1999) found that WM had a significant effect on fluency, accuracy and complexity. Moreover, as also noted in Yi and Ni (2015), Guara-Tavares (2009) found that WM only correlated with fluency.

In the L2 writing domain, empirical findings of Bergsleithner's (2010) study, which were mentioned above, revealed the effect of WM on accuracy and complexity, that is, a significant correlation between the OSpan test and L2 writing performance. Also, Baoshu and Luo's (2012) study found a significant effect of WM only on the accuracy of Chinese EFL learners' written texts. In this regard, there are several reasons in order to explain the inconsistency in the findings of these studies. First, one of the reasons that accounts for this variation of the results relates to Skehan's (1998) trade-off effect in the sense that CAF measures compete for limited cognitive resources, and one of the CAF measures may gain to the detriment of the others (as cited in Yi & Ni, 2015). Second, another reason that contributes to the differences in the findings refers to the tasks employed in writing performance. Features related to the task such as "task complexity, task difficulty and task condition may account for the variation in accuracy, fluency and complexity of language performance" (Foster & Skehan, 1996; Kuiken & Vedder, 2007, as cited in Yi & Ni, 2015, p. 50). Yi and Ni (2015) based their study on argumentative writing tasks; Baoshu and Luo (2012) and Bergsleithner (2010) used narrative tasks and descriptive tasks, whereas Fortkamp's (1999) empirical investigation was based on L2 speech performance. In this respect, those features which characterise argumentative writing tasks may contribute to higher syntactic complexity and fluency (Yi & Ni, 2015). Moreover, according to Kellogg's (1996) model of WM in writing, more mental imagery is implied when performing a descriptive task than when composing an argumentative task (as cited in Yi & Ni, 2015). Therefore, based on this assumption, it could be hypothesised that "overloading the visuo-spatial sketchpad should have more impact on descriptive tasks than on argumentative tasks" (Yi & Ni, 2015), and, as a result, fluency may slow down when writers perform descriptive tasks.

Some recent studies (e.g., Cho, 2018; Kim et al., 2021; Lu, 2015; Manchón et al., 2023; Michel et al., 2019) found absence of relationship between WM and L2 writing performance. For instance, Cho (2018) conducted a study with a total of 39 Korean upper-intermediate university EFL learners, and findings in this study reported that there was no significant relationship between complex WM and any of the measures of L2 writing performance. In this study, WM was gauged by RSpan and OSpan tests, and L2 writing performance was operationalised in terms of CAF measures. Participants in Cho's (2018) study were invited to perform four writing tasks of varying levels of complexity. The findings in Cho's (2018) study resonate with the findings obtained in Kim et al.'s (2021) study, which found absence of verbal WM (as measured by a running span task) effects on writing fluency, as measured by length of P-bursts.

The findings in the study by Lu (2015) will be explained in the following section on WM, L2 writing, and the moderating effects of L2 proficiency; and the findings in the study by Manchón et al. (2023) and Michel et al. (2019) will be addressed in the section on WM, L2 writing, and the moderating effects of TC (also considering L2 proficiency in Manchón et al.'s [2023] study).

Overall, the existing empirical research does indicate that WM plays a role in explaining the linguistic characteristics of L2 written texts, albeit there are mixed results on the particular L2 written performance dimensions that are found to be WM-affected. Thus, although the overall findings on the effects of WM on L2 writing are mixed, a considerable amount of investigations have provided support to a positive effect of WM on L2 writing, providing support to the "more is better" hypothesis (Miyake & Friedman, 1998). On the one hand, it is relevant to mention that the "more is better" hypothesis assumes that higher WMC may confer advantage in (i) noticing and learning from oral feedback (Mackey et al., 2002; Mackey & Sachs, 2012); (ii) ability to learn from recasts (Goo, 2012); (iii) ability to produce modified output following corrective feedback (Mackey et al., 2010); and (iv) vocabulary and grammar learning (Martin & Ellis, 2012; Serafini & Sanz, 2016). On the other hand, the "more is better" hypothesis assumes that there is a positive (but moderate) relation between WMC and L2 outcomes (Linck et al., 2014; meta-analysis, n =79 studies, n =3707 participants). In a nutshell, in terms of our knowledge of the role of WM and language aptitude (LA) in L2 writing (for meta-analytical studies see Grundy & Timmer, 2017; Li, 2016; Linck et al., 2014; Shin, 2020), previous empirical research has shown that there is a positive, but moderate link between WM (Linck et al., 2014), LA (Li, 2016) and L2 writing performance.

In sum, the available research insights point to a role for WM in explaining the characteristics of L2 written texts. WM effects have been observed in the case of writing processes, although the effects on writing products are less clear or consistent, with mixed findings on the specific CAF dimensions found to be affected by WM. Thus, given these mixed empirical findings on the role of WM on written output, the inconclusive nature of previous research, and the suggested relevance of expanding the range of CAF dimensions to be investigated so as to gain a more nuanced understanding of WM effects on writing production, our first aim was to investigate potential WM effects on a range of CAF measures of L2 written production.

Additionally, open questions exist as to whether WM effects are independent of proficiency or task-related variables. Some empirical studies have examined WM effects as a function of either learner-related (basically, proficiency) or task-related factors (focusing primarily on TC) in order to shed more light on the intricate relationship between WM and writing and also due to the potential moderating role of additional variables on WM effects on written output. This research is reviewed in the following two sections, and it also provides the motivation for the first aim of our study.

III.3.5. Working Memory and L2 Writing: Moderating Effects of Proficiency

Manchón et al. (2023) acknowledge the relevance of examining the moderating effects of proficiency on the relationship between WM and L2 writing. Weigle (2005, as cited in Manchón et al., 2023) stated the following:

> As language is heavily involved in the unavoidable writing process of formulation - or linguistic encoding- in the case of L2 writing, the greater availability of/more automatic access to required L2 knowledge the writer has, the more attentional resources and processing capacity s/he will have to devote to processes other than linguistic encoding. (p. 738)

Importantly, empirical research (Serafini & Sanz, 2016) that has investigated the relationship between WM, proficiency and L2 performance, as well as recent theoretical thinking (Baddeley, 2015) have suggested that the relationship between this cognitive trait (WM) and L2 performance may depend on several factors, such as the level of L2 proficiency, thus hypothesising that the role of WM in L2 writing may also be moderated by L2 proficiency. With respect to the moderating effects of L2 proficiency on the links between WM and L2 outcomes, as cited in Manchón et al. (2023), Serafini and Sanz (2016) found that WM facilitated morphosyntactic development only for learners at a low proficiency level, and it should be noted that the positive correlation between WM and L2 performance was found to be restricted only to learners at a high proficiency level in L2 oral production (Gilabert & Muñoz, 2010) or reading comprehension (Joh & Plakans, 2017).

Accordingly, similar to general SLA findings, there are L2 writing studies that have found that WM is moderated by L2 proficiency, with contradictory findings being obtained (see Table 6 for a synthesis of previous studies exploring the role of working memory, proficiency and L2 written performance).

Table 6. Previous studies exploring the role of working memory, proficiency and L2 written performance.

Study	Number of participants, L2 and age	Tests	Writing task	Measures of written performance	Relation between WM and L2 written performance
Kormos & Sáfár (2008)	*n* =121 L1: Hungarian L2: English age: 15-16	Non-word repetition, backward digit span	Composition task from Cambridge 1st Certificate	Holistic score	Partially positive: No significant verbal WM effects on L2 writing for lower, beginner learners; unclear whether verbal WM predicts L2 writing for learners with a higher level of proficiency Positive, moderate PSTM effects on L2 writing, only for pre-intermediate learners; negative and nonsignificant PSTM effects on L2 writing for beginner learners

Lu (2015)	*n* =104 L1: Chinese L2: English age: 16-30	OSPAN (L1, L2)	Argumentative essay, 30 min.	Holistic score	Null (no correlation)
Vasylets & Marín (2021)	*n* =56 L1: Spanish/Catalan L2: English, age: 19	Background questionnaire, Oxford Quick Placement Test (UCLES, 2001), reading span task (verbal WM)	Video-retelling task	CAF indices (propositional complexity, lexical complexity, syntactic complexity, accuracy, and fluency	Partially positive: Positive relation between verbal WM and lexical sophistication at higher levels of proficiency Positive relationship between verbal WM and accuracy at lower proficiency levels

Therefore, in terms of WM effects as a function of proficiency, contrasting findings were reported in the empirical studies conducted on the effects of WM on L2 writing as mediated by proficiency. These findings are consistent with those obtained in the SLA literature, which also reported mixed (albeit positive) findings. Thus, as mentioned at the beginning of this section, there are some empirical studies (e.g., Kormos & Sáfár, 2008; Lu, 2015; Vasylets & Marín, 2021) that have taken into account the level of L2 proficiency as a moderating factor when investigating WM effects in L2 writing performance. Importantly, as reviewed in Ahmadian and Vasylets (2022), Kormos and Sáfár (2008) studied 121 Hungarian (of beginner and pre-intermediate L2 proficiency levels) secondary school EFL learners whose age ranged from 15 to 16 and who completed tasks measuring phonological short-term memory (PSTM) and the simultaneous storage and processing function of WM. More specifically, as Ahmadian and Vasylets (2022) noted, learners took a PSTM test (i.e., a non-word span test), a complex WM test (a backward digit span test; taken only by the beginning learners [*n* =50]), and three writing tasks of different genres, evaluated for content and accuracy. The scores that learners obtained in the Cambridge First Certificate Exam were employed in order to measure their L2 proficiency level. Kormos and Sáfár (2008) reported that PSTM (phonological short-term memory; phonological loop) showed a negative, non-significant correlation with beginning ESL learners' writing performance, but a positive, moderate correlation was found between PSTM and L2 writing (operationalised as a holistic rating measure) with pre-intermediate (a higher level) learners' written performance, thus indicating that PSTM may play a different role in the case of beginning and pre-intermediate learners.

Furthermore, in Kormos & Sáfár's (2008) study, no significant effects of WM on L2 writing were reported for the lower, beginner learners. In this sense, for those pre-intermediate learners of EFL, a positive and moderate correlation was found between PSTM scores (i.e., performance on a non-word repetition test) and their writing scores. In contrast, no significant correlation was found between the storage and processing function of WM (measured by a backward digit span task) and L2 learners' writing scores. Nevertheless, complex WM (processing + storage) was not correlated with the beginners' written performance (pre-intermediate learners did not take this memory test). In other words, a moderate correlation was found between the scores awarded in the writing component of a proficiency test and the PSTM span, but no correlation was shown with a backward digit span test used to measure complex WM capacity.

Different findings were obtained in the study carried out by Lu (2015) which (in the same way as Kormos and Sáfár [2008]) also took into account the level of L2 proficiency when examining WM effects in L2 writing. Importantly, Lu (2015) conducted a study with a total of 136 EFL university students (L1: Chinese), with a mean age of 20 years, who performed a complex WM test (i.e., an operation span task) in both Chinese and English. Furthermore, they performed an argumentative writing task which was assessed by means of an analytic rubric (on a scale ranging from 0 to 15); accuracy and language were the dimensions that were analysed in this study. As noted by Ahmadian and Vasylets (2022), the participants were divided into low and high proficiency groups taking into account the score that they obtained in their L2 vocabulary tests measuring productive and receptive L2 vocabulary knowledge. The findings in Lu's (2015) study showed that there was no link between WM and L2 writing for either low or high proficiency groups (as cited in Ahmadian & Vasylets, 2022).

As seen in Table 6, and as Manchón et al. (2023) also noted in their contribution to Manchón and Sanz's (2023) volume, these two empirical studies (Kormos & Sáfár, 2008; Lu, 2015) differ in terms of the methodology employed in these studies. Firstly, differences were observed in terms of how these studies assessed L2 proficiency and WM, as cited in Manchón et al. (2023). Manchón et al. (2023) noted that in the study by Kormos and Sáfár (2008), proficiency was assessed using a standardised test (the Cambridge First Certificate Exam), whereas Lu (2015) employed receptive and productive L2 vocabulary tests and participants were divided into a high or low proficiency group depending on the scores they obtained in such vocabulary tests. Furthermore, Manchón et al. (2023) continued to note that as regards the WM instrument employed, Kormos and Sáfár (2008) employed a non-word span test to gauge PSTM and a backward digit span test to gauge WM capacity. The digit span test was only administered to the beginning learners. However, Lu's (2015) study assessed WM using an operation span task. Secondly, these empirical studies differed in terms of the number and type of text they had to perform. Participants in Kormos and Sáfár (2008) performed three writing tasks that differed in terms of genre, whereas participants in Lu (2015) had to complete only an argumentative task. Finally, Manchón et al. (2023) referred to another methodological consideration in these two empirical studies; that is, how the outcome variable was operationalised. An analytical rubric was employed in Lu (2015), whereas holistic scores were employed in Kormos and Sáfár (2008).

On the other hand, the recent study carried out by Vasylets and Marín (2021) obtained different results, showing how L2 proficiency differed in term of the level of proficiency. As Ahmadian and Vasylets (2022) noted, 56 native Spanish/Catalan EFL learners with a mean age of 19 years participated in this study. WM capacity was assessed by means of a complex verbal span task (i.e., an RSpan test in the participants' L1), and L2 proficiency was assessed by means of the pen-and-paper version of the standardised Oxford Quick Placement Test (QPT) (UCLES, 2001). In addition, participants completed a video-retelling narrative writing task assessed in terms of holistic scores and in terms of CAF measures. According to the Common European Framework of Reference for Languages (CEFR) (Council of Europe, Council for Cultural Cooperation, Education Committee, & Modern Languages Division, 2001), participants' level of L2 proficiency ranged from B1 to C2. Vasylets and Marín's (2021) study clearly demonstrated differential WM effects found on diverse dimensions of L2 written production across proficiency levels. Therefore, a positive correlation was found between higher WM capacity and the measure of accuracy, only for low proficiency writers; and WM correlated positively with lexical sophistication only for the higher L2 proficiency participants. Thus, as observed in Vasylets and Marín's (2021) study, WM contributed positively only to the selected dimensions (i.e., accuracy and lexical sophistication) of L2 writing performance, and L2 proficiency mediated such relationship. Thus, interaction effect between WM and L2 proficiency was significant for lexical complexity (i.e., lexical sophistication [Advanced Guiraud]) for highly proficient L2 writers, and accuracy [errors/100 words]) for low proficient L2 writers. With respect to the interpretation of the finding that higher WM capacity was positively related to accuracy, but only for low proficiency writers, results in Vasylets and Marín's (2021) study may be explained by the fact that higher WMC may confer an advantage in accuracy for low proficient L2 writers, and because higher WMC writers might be better equipped to self-monitor, edit or search for linguistic alternatives, which enhances accuracy. Vasylets and Marín's (2021, as cited in Manchón et al., 2023) justified this finding by stating that "writers with higher WMC [working memory capacity] would find themselves better equipped to compensate for gaps in L2 proficiency, successfully resolving various linguistic challenges related to the ability to communicate without errors" (p. 742). It should be noted here that the effect of WMC on performance becomes less prominent as the knowledge increases, as supported by the theory of the compensatory scenario (Ackerman, 1988; Salthouse, 1995).

Secondly, with respect to the interpretation of the finding that WM correlated positively with lexical sophistication only for the higher L2 proficiency participants in the study, higher WMC may confer an advantage in lexical sophistication for highly proficient L2 writers, and higher WM capacity writers may be able to better exploit the depth of their vocabulary knowledge by strategically directing their cognitive resources to lexical search and/or monitoring. Vasylets and Marín's (2021) suggested interpretation of this finding is that WM plays a fundamental role in the association between lexical complexity and higher-order writing processes, specially in the processes of formulation (linguistic encoding) and monitoring. Vasylets and Marín (2021) explained this interpretation in the sense that the implication of WM is crucial for the production of sophisticated language, and it is when learners have reached a high level of L2 proficiency and have the necessary lexical resources to draw on that they can make use of strategies. Vasylets and Marín (2021, as cited in Manchón et al., 2023) came to the conclusion that WM had no impact on lexical sophistication in the case of L2 writers with a low level of proficiency because "their vocabulary was not sophisticated enough for WM to make a meaningful impact" (p. 742). It should be noted here that a high level of WM capacity enhances the facilitative effects of proficiency on performance ("rich-get-richer" hypothesis; Hambrick & Engle, 2002). As evidenced by the "rich-get-richer" hypothesis (Hambrick & Engle, 2002), a high level of WM capacity enhances the facilitative effect of domain knowledge on cognitive performance. Therefore, if WM reflects a cognitive resource that can be used to activate needed information that is stored in long-term memory and to maintain this activation during task performance (Cantor & Engle, 1993; Just & Carpenter, 1992), then higher WMC learners may be able to draw upon more preexisting domain knowledge during cognitive task performance than lower WMC learners. That is, those learners with high WM capacity are prone to benefit more from the preexisting knowledge in a given domain than learners with low WM capacity. In line with this, more recently, the study by Leeser (2007) reported that the effect for domain knowledge was greater for learners with high WM. Finally, it should be mentioned that WM capacity might not be a crucial determining factor of quality of L2 written performance, but it does constitute a source of variance in L2 writing.

Furthermore, as has been clearly evidenced, the relationship between WM and L2 writing performance is intricate and depends on the level of L2 proficiency and linguistic area (Wen et al., 2015; Williams, 2015). Nevertheless, in the domain of L2 writing, empirical research has also examined how WM interacts with factors other than L2 proficiency. In this respect, justification for this is based on previous research that has explored task-related factors and writer-related factors (independently or in conjunction) in both L2 writing processes (in terms of the orchestration and implementation) and products (in terms of the characteristics of the texts (as posited by Kormos, 2012). For instance, Manchón et al. (2023) noted that there is ample empirical evidence showing that task characteristics (Barkaoui, 2016; Michel et al., 2019, 2020; van Weijen, 2009), proficiency (Barkaoui, 2019; Gánem-Gutiérrez & Gilmore, 2018; Manchón & Roca de Larios, 2007; Roca de Larios et al., 2008; Tillema, 2012), or WM capacity (Michel et al., 2019; Révész et al., 2017) influence writing processes.

In sum, given the open questions that exist as to whether WM effects are independent of proficiency, and given the diverse and at times contradictory findings on L2 proficiency-dependency of WM effects (Kormos & Sáfár, 2008; Lu, 2015; Vasylets & Marín, 2021) in the writing domain, further research is needed in order to shed light on the attested intricate and complex interaction between the effects of WM and L2 proficiency on L2 written performance. For instance, in future research agendas it would be interesting to explore the differential implication of WM subcomponents on the development of more or less linguistic constructions at different proficiency levels, as in the study conducted by Serafini and Sanz (2016). Additionally, future research should also consider the attested effects of WM and L2 proficiency in learning and task performance across modalities (Manchón & Vasylets, 2019; Vasylets & Gilabert, 2022; Zalbidea, 2021; Zalbidea & Sanz, 2020; for a review, see also Johnson, 2022). Finally, future work could also examine the role of WM and its components in L2 writing from a process-oriented perspective, across different stages of writing and using such methodology as stimulated recall, keystroke logging, and eye-tracking in combination, as in Révész et al. (2017, 2023).

Therefore, to advance in this direction, our first aim was also to investigate whether proficiency mediated any potential WM effects on CAF measures. A further motivation for this research aim derives from the consideration of Vasylets and Marín's (2021) evidence of the differential involvement of WM on diverse CAF dimensions across proficiency levels.

III.3.6. Working Memory and L2 Writing: Moderating Effects of Task Complexity

Working memory (WM) is assumed to interact not only with L2 development and performance in general (Gilabert & Muñoz, 2010; Mitchell et al., 2015), but also with TC in particular (Awwad & Tavakoli, 2022; Cho, 2018; Kormos & Trebits, 2011, as cited in Awwad & Tavakoli, 2022). "The tendency to incorporate WM in TC studies stems from the notion that WM is at stake in the performance of L2 complex tasks […] for its potential influence on regulating L2 learners' linguistic repertoire and attentional resources during language performance" (Wen et al., 2015, as cited in Awwad & Tavakoli, 2022, p. 9). Sasayama (2016) referred to task complexity (TC) as the cognitive load of task performance. In his Cognition Hypothesis, Robinson (2001) defined TC as "attentional, memory, reasoning, and other information processing demands imposed by the structure of the task on the language learner" (p. 29).

In addition to the moderating effects of L2 proficiency, other empirical studies have shown that the effects of WM on L2 writing can depend on the level of TC (e.g., Awwad & Tavakoli, 2022; Kormos & Trebits, 2011; Manchón et al., 2023; Michel et al., 2019; Zalbidea, 2017). See Table 7 for a synthesis of studies on WM, TC and oral and written performance. McCormick and Sanz (2022, as cited in Manchón et al., 2023) claimed that the role of WM is “contingent on task characteristics that challenge learners’ storage and processing capacities” (p. 453), which are two crucial functions of WM capacity. In this respect, in more complex tasks (which require a more cognitive load), WM is more heavily involved in writing processes as well as in products (Kormos, 2012).

Table 7. Studies on working memory, task complexity and oral and written performance.

Study	Number of participants, L1, L2 and mean age	Modality	Measures of WM and oral or written performance	Relation WM, TC and oral or written performance
Awwad & Tavakoli (2022)	*n* =48 L1: Arabic L2: English age: 16	Oral	Backward-digit span task, and two video-based narrative tasks; Syntactic and lexical complexity, accuracy, and fluency	WM predicted accuracy in more and less complex tasks WM predicted lexical complexity in the more complex task
Kormos & Trebits (2011)	*n* =44 L1: Hungarian L2: English age: 17-18	Oral	Backward digit span task, and two narrative tasks - cartoon description task (simple) and picture narration task (complex); Fluency, lexical complexity, accuracy, and grammatical complexity	WM effects only on one of the tasks, which consisted in narrating a picture story (simple cartoon-narration task)
Manchón et al. (2023)	*n* =76 L1: Spanish L2: English age: 19.8	Writing (Paper)	*N*-back WM test (Kane et al., 2007), and "Fire-Chief" writing task (Gilabert, 2005); CAF indices	No significant effects of WM on L2 writing performance; no interactions between WM and task complexity
Michel et al. (2019)	*n* =94 L1: Hungarian L2: English	Writing (Computer)	Backward digit (executive WM), symmetry task (spatial WM), and forward digit (phonological STM);	Lack of WM effects on L2 writing, except for the academic version of the editing task and the integrated

	age: 11-13		Four writing tasks from the Writing section of the TOEFL Junior test (editing task, email task, opinion task, and listen-write task), and a background questionnaire; overall writing ability, editing	task (in this case only for one proficiency level)
Zalbidea (2017)	*n* =32 L1: English L2: Spanish age: 19.6	Writing (Paper)	OSPAN (verbal WM) Argumentative task, 10 min.; CAF indices (accuracy, lexical and syntactic complexity)	Verbal WM effects on the accuracy of L2 writing performance in complex tasks No correlations between verbal WM and lexical and syntactic complexity

Table 7 summarises empirical research (e.g., Awwad & Tavakoli, 2022; Kormos & Trebits, 2011; Manchón et al., 2023; Michel et al., 2019; Zalbidea, 2017) on the interaction between WM and TC in L2 oral and written performance, with mixed findings being reported in these studies. However, on the basis of both the Cognition Hypothesis (Robinson, 2001, 2011) and previous empirical findings, it can be hypothesised that WM would play a more significant role in complex tasks due to their higher cognitive demands and increased problem-solving nature. As also noted by Manchón et al. (2023), in the oral domain, TC effects on performance have been found to be stronger than those of L2 proficiency level or WM (e.g., Awwad & Tavakoli, 2022; Kormos & Trebits, 2011), although it is relevant to mention that in these mentioned empirical studies, interactions between TC and WM were also reported. For example, in Awwad and Tavakoli's (2022) recent empirical study with 48 EFL learners (age: 16), WM was found to be a predictor of the linguistic dimension of accuracy in more and less complex tasks and of the linguistic dimension of lexical complexity in the more cognitive task. No WM effects were found on fluency. Awwad and Tavakoli (2022) used a backward-digit span task to assess WM capacity, and participants in this study completed two video-based narrative tasks in L2 English. L2 oral production was operationalised in terms of syntactic and lexical complexity, accuracy, and fluency (CAF) indices; TC was operationalised in terms of varying degrees of intentional reasoning. Also, participants also took the Oxford Placement Test (OPT) as a measure of L2 proficiency, and elicited imitation tasks. In the study conducted by Kormos and Trebits (2011) with 44 EFL learners (age: 17-18), WM effects were found only on one of the tasks, which consisted in narrating a picture story (the complex task); high WM correlated only with syntactic complexity (subordination ratio and clause length) in the simple task. A backward digit span task was employed to assess WM capacity, and participants completed two narrative tasks differing in terms of the cognitive demands that were required in order to complete the task - a cartoon description task (simple), and a picture narration task (complex). L2 oral production was operationalised in terms of lexical and grammatical complexity, accuracy, and fluency (CAF) indices.

Kormos and Trebits (2011) found that high WM correlated with syntactic complexity only in the simplex spoken narrative task in terms of length of clause and ratio of subordination. This study also found that more accuracy and less lexical complexity were obtained in the complex task than in the simple task, but there were no effects for the measures of grammatical complexity or fluency (as cited in Awwad & Tavakoli, 2022). Moreover, Niwa's (2000) study investigated the effects of WM and of the complexity of a monologic narrative task along +/- reasoning demands (i.e., a resource-directing task aspect of TC; simple vs. complex reasoning demands) on oral language production. The results in this study found that learners with higher WM produced more accurate and more syntactically complex spoken narrative tasks. However, higher WM learners showed less fluency in the cognitively more complex tasks during spoken performance.

As observed in Table 7, some research has been conducted on WM, TC and L2 writing (e.g., Michel et al., 2019; Zalbidea, 2017), whose findings revealed that TC (albeit the facts were small at times) moderated WM effects on written performance. For instance, in the study conducted by Zalbidea (2017) with a total of thirty-two intermediate L2 learners of Spanish (mean age: 19.6), WM effects on the accuracy of L2 writing were found in argumentative complex tasks, a finding which is in line with Michel et al.'s (2019) study. Nevertheless, the findings in Zalbidea (2017) reported no correlations between WM and lexical and syntactic complexity. WM capacity was assessed by an operation span test (OSpan), and an argumentative task (10 min.) was composed by the participants. Accuracy, lexical and syntactic complexity were the measures employed in order to measure L2 written argumentative performance.

More recently, the study by Michel et al. (2019) with 94 young EFL learners (Grades 6 and 7) in Hungary (age: 11-14) revealed no WM effects on L2 written performance; only WM effects were found for the academic version of the editing task and the integrated Listen-Write task (complex task) that participants were invited to complete. In the case of the integrated Listen-Write task, the WM effect was only found for one proficiency level (i.e., for Grade 7). The four writing task types were part of the computer-based TOEFL Junior Comprehensive test battery, thus including an editing task (consists in correcting four errors in a paragraph of a non-academic and an academic text, respectively), an email task (consists in replying to an email), an opinion task (consists in expressing learners' opinion on a topic in a paragraph of 100-150 words), and an integrated Listen-Write task (consists in listening to a teacher talking for about 90 seconds about an academic topic with the help of visual input, followed by the writing of a summary paragraph, with the task instructions and the illustration remaining visible while typing the paragraph using the computer keyboard). WM capacity was assessed by a range of cognitive tests, including visual forward and backward digit span tasks to measure the storage and processing functions of WM, the Symmetry Span task (SymSpan; Kane et al., 2004) to assess the task-switching function of WM, and a Stop-Signal task (Logan, 1994) was employed to measure participants' inhibitory control WM component.

Nonetheless, the findings in Manchón et al.'s (2023) study were not consistent with the findings reported by Michel et al. (2019) and Zalbidea (2017). Manchón et al. (2023) showed lack of significant WM effects on L2 writing performance, and no significant interaction was found between WM and TC. In this study, OPT (proficiency) appeared as the sole significant predictor of L2 writing performance at both levels of TC, given that L2 proficiency was the variable most connected to various dimensions of the text produced. Nevertheless, there was an indication that the role of proficiency in L2 writing might vary depending on TC (for example, proficiency explained 21% of variance in accuracy in the simple task, but 41% of variance in the complex task). Also, L2 proficiency played a different role for some measures of complexity (e.g., lexical density, nominal complexity) and the total number of words in L2 writing depending on the level of TC Finally, no significant interaction between WM and proficiency was reported in this study.

In sum, given the open questions that exist as to whether WM effects are independent of task complexity, and given the limited research on the topic and the mixed empirical findings on the interaction between WM effects and TC (e.g., Michel et al., 2019; Zalbidea, 2017) in the writing domain, our first aim was also to investigate the relationship between potential WM effects on the CAF measures of L2 written texts produced by L2 writers of higher and lower proficiency levels and the complexity of the task to be completed.

Furthermore, the first aim of our study was also motivated by the consideration of previous SLA research on the interaction between task complexity and proficiency in L2 writing (e.g., Ishikawa, 2007; Kuiken et al., 2005; Kuiken & Vedder, 2008).

III.3.7. Working Memory and L2 Writing: Summary

As Ahmadian and Vasylets (2022) and Papi et al. (2022) concluded, the findings on WM and L2 writing are mixed and limited research has been done so far on this topic. Nevertheless, they also continued to acknowledge that a considerable amount of research has provided support to a positive effect of WM on L2 writing, thus supporting the “more is better” hypothesis (Miyake & Friedman, 1998), as clearly evidenced in the above synthesis of empirical findings in this chapter. However, despite the fact that a considerable amount of investigations have provided support to a positive link of WM capacity with overall L2 writing quality (e.g., Adams & Guillot, 2008; Baoshu & Luo, 2012; Kormos & Sáfár, 2008; Mavrou, 2020; Mujtaba et al., 2021; Peng et al., 2022; Vasylets & Marín, 2021; Yi & Ni, 2015; Zalbidea, 2017), and specific measures of writing performance, such as syntactic complexity and accuracy in complex versions of L2 writing tasks (e.g., Zalbidea, 2017), the overall findings on the effects of WM on L2 writing are mixed (Bergsleithner, 2010; Zabihi, 2018) or practically null (Cho, 2018; Kim et al., 2021; Lu, 2015; Manchón et al., 2023; Michel et al., 2019). These mixed findings make it challenging to reach any firm conclusion regarding the role of WM in L2 writing.

Moreover, as observed previously, and as reviewed by Papi et al. (2022) in their contribution to Li et al. (2022a), it has been indicated that other factors, such as the L2 proficiency level (Kormos & Sáfár, 2008; Lu, 2015), TC or L2 written performance dimension (Michel, et al., 2019), may moderate the potential effects of WM in L2 writing. However, it is not clear whether proficiency moderates the links between WM and L2 writing performance, as the research that has been conducted on this topic is very scarce and has certain methodological limitations. For instance, in the study carried out by Kormos and Sáfár (2008), the more advanced learners performed only the phonological short-term memory (PSTM) test, which limits the study’s conclusions regarding the role of complex WM in L2 writing. On the other hand, Lu (2015) divided the participants into high and low proficiency groups on the basis of their vocabulary scores, which might be questionable (as cited in Vasylets & Marín, 2021). More studies on the effects of WMC on L2 writing are required to ascertain the moderating role of the level of proficiency, that is, if and how students' proficiency level may have an impact on the involvement of WM in L2 writing. Finally, concerning the way in which the quality of L2 writing was assessed, some studies (e.g., Kormos & Sáfár, 2008) have employed holistic ratings in order to measure overall writing quality, and other studies have employed quantitative CAF measures which tap into the discrete areas of L2 performance (e.g., Zabihi, 2018). In this regard, in line with Vasylets and Marín (2021), it has been observed that there are limitations in the assessment of the linguistic dimension of L2 complexity in the sense that, for instance, concerning syntactic complexity, the available empirical studies have focused almost exclusively on subordination, leaving out coordination or nominal complexity. Concerning lexical complexity, only the study carried out by Zalbidea (2017) looked into lexical diversity, while the role of WM in lexical sophistication of L2 writing has not been yet explored. Finally, none of the previously mentioned studies assessed propositional complexity.

III.4. AFFECTIVE AND MOTIVATIONAL INDIVIDUAL DIFFERENCES IN L1 AND L2 WRITING RESEARCH

III.4.1. Affective and Motivational Individual Differences in L1 Writing

III.4.1.1. Affective and motivational individual differences in L1 writing models

Affective and motivational IDs have also been considered in L1 writing models. For instance, as Kormos (2023) noted, Hayes's (1996) model of L1 writing emphasises the relevance of cognitive resources in WM, motivation, and affective factors in the implementation of writing processes. Also, cognitive models of writing (e.g., Flower & Hayes, 1981; Hayes, 2012) postulate that "the development of ideas during writing depends on the extent to which the retrieval of content is strategically controlled to satisfy rhetorical goals" (as cited in Teng & Wang, 2022, p. 5). Accordingly, Boscolo and Hidi (2007, as cited in Teng & Wang, 2022) stated that writing is a process which is both cognitive and emotional (as also stated by Kormos, 2012, 2023), and they emphasised that it is through this process that affective factors (for instance, self-efficacy) can predict writing performance (as cited in Teng & Wang, 2022). Additionally, as Teng and Wang (2022) noted, writers with a higher level of self-efficacy, for instance, have more capacity for reflective thought during composition writing, and they may be more capable of using self-regulated strategies when writing (with empirical studies being conducted on this topic, e.g., Teng, 2019; Teng & Huang, 2019; Teng et al., 2022) and showing more perseverance skills during writing (Woodrow, 2011, as cited in Teng & Wang, 2022). Hence, more efficacious writers are more capable of adapting to the demands of writing, set ambitious goals, maintain their effort, and have better writing performance (Teng et al., 2018, as cited in Teng & Wang, 2022). Thus, they may show much more evidence of greater involvement in every stage of the writing process.

III.4.1.2. Affective and motivational individual differences in L1 writing: Empirical research

Affective and motivational individual differences (IDs) have been explored in many studies in the field of L1 writing research (as reviewed by Pajares, 2003), with these studies demonstrating that affective and motivational IDs play a role in the quality of L1 writing.

As regards writing anxiety, MacIntyre and Wang (2022) noted in their contribution to Li et al.'s (2022a) *handbook on IDs and SLA* that much of the research in L2 writing anxiety is grounded in L1 writing apprehension studies (e.g., King & Smith, 2017; Pae, 2013), and they stated that the Daly-Miller writing apprehension test (Daly & Miller, 1975) has been widely employed to measure writing anxiety in L1 and L2 contexts (Cheng et al., 1999; Pae, 2013, as cited in MacIntyre & Wang, 2022). Abundant research has been conducted on L1 writing anxiety (e.g., Daly & Miler, 1975; Daly & Shamo, 1976; Daly & Wilson, 1983, as cited in Cheng, 2002), being prompted by the work of Daly and his colleagues and their interest in the role of anxiety in writing processes (Cheng, 2002). The empirical findings in these studies reported a negative relationship between this affective trait and L1 writing performance.

As regards writing self-efficacy, Bruning et al. (2013) reviewed previous research on writing self-efficacy, and their synthesis provided evidence of the positive link between self-efficacy and L1 writing performance (e.g., Klassen, 2002; Pajares, 2003; Pajares & Johnson, 1994; Pajares et al., 1999; Pajares & Valiante, 1999, 2006; Prat-Sala & Redford, 2012; Schunk, 2003; Shell et al., 1995). Accordingly, this prior research has acknowledged the prominent role play by self-efficacy in L1 writing, as noted by Rahimi and Zhang (2019). In this respect, these empirical studies have shown that those learners with a high level of writing self-efficacy are prone to write better and have lower writing anxiety as compared to learners with low writing self-efficacy (McCarthy et al., 1985; Pajares & Valiante, 2006, as cited in Bruning et al., 2013). The term of writing self-efficacy was first coined by Pajares (2003) and since then this ID construct has been investigated in the past two decades (Bruning et al., 2013). Some empirical research (Bruning & Horn, 2000; Karaglani, 2003; Pajares & Johnson, 1996; Pajares & Valiante, 1999; Zimmerman & Bandura, 1994, as cited in Bruning et al., 2013) has been conducted on writing self-efficacy and writing, with the results revealing that learners' writing self-efficacy beliefs acted as a powerful predictor of writing outcomes. For instance, as noted in Bruning et al. (2013), the studies by Karaglani (2003) and Pajares and Johnson (1996) found that third and ninth graders' self-efficacy beliefs regarding their L1 writing ability significantly contributed to the quality of their writing, that is, to the quality of holistic stories (in the case of the third graders) and holistic essays (in the case of ninth graders).

Furthermore, Bruning et al.'s (2013) review of the literature on writing self-efficacy indicated that there is a relationship between self-efficacy beliefs and writing performance, writing anxiety and depth of processing, as shown in the findings reported in studies such as the ones conducted by McCarthy et al. (1985) and Shell et al. (1989). In this respect, similar results have been found in most of the early studies conducted on writing self-efficacy and writing performance (e.g., McCarthy et al., 1985; Pajares & Johnson, 1996; Pajares & Valiante, 1997, 1999, 2001; Schunk & Schwarts, 1993; Shell et al., 1989, 1995; Zimmerman & Bandura, 1994, as cited in Bruning et al., 2013), which will be addressed below.

In their synthesis of previous work on self-efficacy and writing, Bruning et al. (2013) reviewed the early work on writing self-efficacy conducted by McCarthy and her associates (1985), Shell and her associates (1989), and Pajares and his associates (beginning in the 1990s). Thus, as Bruning et al. (2013) noted, writing self-efficacy research extends back into the mid-1980s with the work conducted by McCarthy and her associates (1985), who investigated the relationship between the writing self-efficacy of college students and writing performance. Following McCarthy et al.'s (1985) research, Shell et al.'s (1989) work also investigated the relationships among writing self-efficacy, outcome expectancy beliefs and writing achievement. The results found that writing skills self-efficacy predicted writing performance (as cited in Bruning et al., 2013). As also noted in Bruning et al. (2013), in line with Shell et al.'s (1989) finding, a later study also conducted by Shell at al. (1995) found that writing skills self-efficacy predicted writing performance at all grade levels (fourth, seventh, and tenth), but no significant increases were observed with grade level (contrary to what was found with writing task self-efficacy). In this respect, Shell et al. (1995) suggested that "writing self-efficacy gains are more related to students' abilities to successfully perform various writing tasks than to changes in specific writing skills" (as cited in Bruning et al., 2013, p. 26).

Then, Pajares and his associates's work starting at the beginning in the 1990s (e.g., Pajares, 2003, 2007; Pajares et al., 1999, 2000; Pajares & Johnson, 1994; Pajares & Valiante, 1997, 1999, 2001, 2006, as cited in Bruning et al., 2013) is of relevance in the area of writing self-efficacy research, as their influential work provides the most comprehensive program to date of research on writing self-efficacy. In this respect, some research has investigated the relationship between learners' writing self-efficacy and other affective factors related to the writing domain and writing performance. For instance, as Bruning et al. (2013) noted, the study by Pajares and Johnson (1994) examined the predictability of writing self-efficacy (writing skills self-efficacy and writing tasks self-efficacy) on undergraduate learners' L2 writing performance, and it was found that writing skills self-efficacy emerged as a predictor of learners' skills in writing essays. Furthermore, as Bruning et al. (2013) also noted, the study by Pajares and Valiante (1997) investigated the effects of writing self-efficacy on elementary students' writing, and it was found that students' writing self-efficacy predicted their writing performance and had an influence on students' writing apprehension, utility of writing and essay writing. Therefore, when an L2 learner has a higher level of self-efficacy (confidence) as well as motivation (pleasure) for instance, in L2 writing, the more likely it is that the learner will produce a better essay.

Bruning et al. (2013) also acknowledged that in line with these findings reported by Pajares and Johnson (1994) and Pajares and Valiante (1997), the study conducted by Pajares and Johnson (1996) on ninth graders' writing self-efficacy also showed that self-efficacy perception strongly predicted their writing performance. Moreover, Zimmerman and colleagues' work on self-efficacy for writing self-regulation (e.g., Zimmerman & Bandura, 1994; Zimmerman & Kitsantas, 2007) has also been very influential in writing self-efficacy research, as it has contributed to the identification of multiple tasks linked to self-regulatory competence in the writing domain (as cited in Bruning et al., 2013).

Finally, extensive research on motivation (and its constructs, e.g., task value) and L1 writing has found positive and facilitative links between this ID variable and L1 writing performance and development (e.g., Albin et al., 1996; Hayes, 2012; Pintrich & Schunk, 2002, as cited in Rahimi & Zhang, 2019). In the field of L1 writing, it has also been suggested that motivation should be a multidimensional construct consisting of goal orientations, success attributions, self-efficacy beliefs, attitudes, and perceived task value and interest (Rahimi & Zhang, 2019). Also, theories of motivation (e.g., expectancy-value theory) have been explored in relation to L1 writing in the field of educational psychology (Rahimi & Zhang, 2019). The expectancy value theory, as well as other motivation theories such as self-determination theory, attribution theory, social cognitive theory, Dweck's mindsets and unified theory, interest theory and achievement goal theory have been grounded in social cognitive approaches (Wigfield et al., 2021). The expectancy-value theory reflects the interaction between learners' expectancy for success in a task (i.e., learners' confidence in their ability to success in a given task) and the task value (i.e., learners' perceptions of a task) to predict learners' achievement. Importantly, extensive research has been conducted on the expectancy-value theory of motivation (above all, in relation to task value and interest) and L1 writing performance, with facilitative effects being observed in this relationship (e.g., Albin et al., 1996).

III.4.2. Affective and Motivational Individual Differences in L2 Writing: Writing Anxiety

This section provides an overview and empirical research on the effects of affective/motivational IDs (writing anxiety, writing self-efficacy and writing motivation) on L2 writing. Thus, we first focus on writing anxiety and L2 writing, followed by writing self-efficacy and L2 writing. Finally, we address the role of writing motivation and L2 writing. Also, the moderating effects of L2 proficiency and task complexity on the role of such affective and motivational IDs on L2 writing will be addressed in this section of the doctoral dissertation.

The quality of L2 writing performance has been shown to be contingent on such traits as writing anxiety (Woodrow, 2011), self-efficacy (Pajares, 2003) or motivation (Yu et al., 2019). Regarding these affective and motivational factors, as noted in several seminal publications on IDs and writing (for comprehensive syntheses of the available affective/motivational ID research see, for instance, contribution by Papi, 2022, in Manchón & Polio, 2022; and contribution by Papi et al., 2022, in Li et al., 2022a), the body of empirical work in L2 writing is limited (but see, for instance, Jang & Lee, 2019; Rahimi & Zhang, 2019; Tahmouresi & Papi, 2021; Zabihi, 2018; for a review of research on IDs and L2 writing performance, see also Manchón & Sanz, 2023b). Even less research has been conducted on affective/motivational IDs and engagement with and use of feedback (but see Han & Hyland, 2015; Waller & Papi, 2017).

In relation to this insufficient research on affective and motivational IDs in L2 writing, Papi et al. (2022) stated that "there have rarely been any motivational or affective interventions designed and implemented to enhance the processes and outcomes of L2 writing" (p. 383). According to Papi et al. (2020), this gap might be due to "lack of attention to the agentic role of learners and ignoring the qualitative differences in the affective, motivational, and behavioral patterns that learners display throughout the process of L2 writing and its development" (as cited in Papi et al., 2022, p. 383).

III.4.2.1. Writing anxiety and L2 writing: Empirical research

Papi (2022) has recently provided a comprehensive synthesis of previous affective and motivational ID research on L2 writing in his contribution to Manchón and Polio's (2022) *handbook on SLA and writing*. As Papi (2022) noted, emotions have been explored in the SLA field (e.g., Teimouri, 2017). However, Papi (2022) acknowledged that in the field of L2 writing, the construct of L2 writing anxiety has been the only emotion receiving attention in this field, with "other emotions [such as enjoyment and self-confidence] [being] examined only as secondary to L2 writing anxiety […] or [being] completely ignored (e.g., pride, shame, guilt, enthusiasm)" (p. 154). L2 learning anxiety has been researched for decades, and there is general agreement that less L2 English anxiety is attributed to students with higher performance, whereas lower performing students show more L2 English anxiety (Bailey et al., 2017). In this regard, as also noted by Bailey et al. (2017), a bulk of studies have investigated speaking anxiety (e.g., Aida, 1994; Horwitz, 2012; Kim, 2009), listening anxiety (e.g., Kim, 2002; Sin, 2004) and other empirical studies have examined the relationship between the four skill-based L2 anxieties (e.g., Pae, 2012). However, L2 writing anxiety has received less attention, as compared to the other linguistic skills (but see Cheng et al., 1999; Leki, 1999; Pae, 2013). These existing research findings indicated the detrimental influence of anxiety on foreign language (FL) learning.

Existing empirical research has reported a negative/debilitating connection between anxiety and L2 written performance (e.g., Atay & Kurt, 2006; Cheng, 2002, 2004; Cheng et al., 1999; Daly, 1978; Fitrinada et al., 2018; Hassan, 2001; Rahimi & Zhang, 2019; Rezaei et al., 2014; Rodríguez-Sabiote et al., 2017; Soleimani et al., 2020; Tahmouresi & Papi, 2021; Trebits, 2016; Xiao & Wong, 2014; Zabihi, 2018; for meta-analyses see Botes et al., 2020; Teimouri et al., 2019; Zhang, 2019). Accordingly, it should be noted that although there is abundant research on writing anxiety and L2 writing, as compared to other affective and motivational IDs, this issue has been relatively underestimated.

In the past four or five decades, several studies have been conducted on L2 writing anxiety in order to investigate the relationship between this affective ID variable and L2 writing performance (being this research carried out mainly with native English speakers) and also with the aim of giving consideration to the complexities of the construct of writing anxiety in different L2 learners. In this respect, as noted in Papi (2022), the Daly and Miller's (1975) Writing Apprehension Test (WAT), developed to examine anxiety in L1 writing, was employed to conduct early studies on L2 writing anxiety. From a theoretical perspective, writing anxiety is regarded as a hindering factor on L2 writing performance, with lower writing anxiety learners performing better on writing (Soleimani et al., 2020). As noted in Papi (2022), existing empirical research (e.g., Rahimi & Zhang, 2019; Soleimani et al., 2020; Tahmouresi & Papi, 2021; Zabihi, 2018) has shown that L2 writing anxiety is negatively correlated with L2 writing performance and different aspects of the L2 writing process, thus negatively affecting the quality of learners' cognitive and behavioural engagement in the L2 writing process (for meta-analyses see Botes et al., 2020; Teimouri et al., 2019; Zhang, 2019; for literature reviews see Horwitz, 2001; MacIntyre, 2017; MacIntyre & Gardner, 1991), and it has been seen as a predictor variable of learners' competence in the writing skill.

The study conducted by Zabihi (2018) with a total of 232 Persian upper-intermediate EFL learners found that writing anxiety was significantly negatively correlated to the CAF indices of learners' L2 writings. Daly's (1978) study was conducted in order to test the prediction that low apprehensive students should perform better on standardised writing tests than highly apprehensive students. With a total of 3602 undergraduate students, the findings of this study revealed that those students with high anxiety about writing did differently than those students with low anxiety about writing on standardised writing tests. High anxious students produced lower quality compositions than their low anxious counterparts as they employed shorter and simpler structures (Daly, 1978). In line with the findings from Daly's (1978) study, Hassan's (2001) study revealed that the written compositions performed by high anxious learners are of worse quality than those compositions performed by low anxious learners. Moreover, high anxious learners write less (in terms of quantity) than their low anxious counterparts. For high anxious learners, composing under time pressure has also been found to be a factor associated with the detrimental effect of writing anxiety (Cheng, 2002). In Hassan's (2001) study it was also found that EFL learners' writing anxiety increases when their writing tasks are evaluated by their teachers (fear of negative evaluation) and, as a result, they undertake various ways in order to avoid writing. Moreover, Cheng's (2002) study showed that those learners with a high level of writing anxiety (i.e., more anxious writers) are more inclined to avoid taking writing classes, and instead they prefer to pursue careers or majors whose focus is not on writing.

Kim (2006) also conducted a study on the relationship between writing anxiety and writing achievement among 136 EFL Korean college students. The correlational analysis revealed that higher writing anxiety was attributed to students who had obtained lower final grades. Writing anxiety factors such as negative perceptions about writing, avoidance behaviour reflected in writing and fear of evaluation were identified in this study. These findings were consistent with those of Cheng's (2004) study conducted with a total of 421

Taiwanese EFL learners. As Papi (2022) noted, the results in Cheng (2004) showed a significant negative correlation between L2 writing anxiety and L2 writing performance, L2 writing self-efficacy, motivation, and willingness to take L2 writing courses. In order to measure L2 writing anxiety, and "in response to the needs of the field of L2 writing and the limitations of [Daly and Miller's (1975) Writing Apprehension Test] WAT" (Papi, 2022, p. 159), Cheng (2004) developed a self-report measure of L2 writing anxiety entitled Second Language Writing Anxiety Inventory (SLWAI). As Papi (2022) noted, this questionnaire represents a three-dimensional conceptualisation of anxiety which included three different types of anxiety, that is, somatic anxiety, cognitive anxiety and avoidance behaviour. Cognitive anxiety refers to the mental aspect of anxiety, representing the thoughts and worries characteristic of the feeling of anxiety (as reflected in negative expectations, preoccupation with performance, and concern about others' perceptions and evaluations); somatic anxiety refers to autonomic responses (i.e., nervousness and tension), reflecting the physiological symptoms of feeling anxious; and behavioural anxiety concerns the behavioural consequences of anxiety, and refers to procrastination, withdrawal, and overall avoidance behaviour in writing (Papi, 2022). The SLWAI was evaluated on a total of 65 Taiwanese EFL learners in order to determine the validity and reliability of Cheng's (2004) proposed writing anxiety measure. The main reason for including different types of anxiety is because anxiety, being one of the most hindering factors affecting the development of the writing ability, intellectually affects various aspects of human behaviour and performance.

In the same vein, and in line with the fact that writing anxiety is a negative factor in L2 writing, the study conducted by Cheng et al. (1999) with a total of 433 Taiwanese EFL university students also found a negative impact of L2 classroom anxiety and L2 writing anxiety on students' speaking and writing performance, respectively. Findings from Cheng et al.'s (1999) study also showed that L2 classroom anxiety is a general type of anxiety, whereas L2 writing anxiety is a language-specific type of anxiety. Finally, as Papi (2022) noted, in other empirical studies the construct of L2 writing anxiety has been found to be "negatively associated with learners' L2 writing self-efficacy (Kirmizi & Kirmizi, 2015), use of self-regulatory control strategies in L2 writing (Tsao et al., 2017), perceived value of WCF

(Tsao et al., 2017), and writing achievement (McCarthy et al., 1985; Tahmouresi & Papi, 2021)" (p. 159).

Furthermore, the results of Soleimani et al. (2020) showed that a negative (albeit significant) correlation was found between L2 writing anxiety and global L2 writing performance (r (127) = -.514 representing a large effect size, p = .000). Moreover, the regression analysis showed that writing anxiety was not found to be a significant predictor of global L2 writing performance (B = -.008, Beta = -.017, t = -.213, p = .832). These findings are in line with those reported in the study conducted by Fitrinada et al. (2018), as mentioned above, which also found a fair negative significant correlation (r = -.545, p = .000) between students' writing anxiety and their L2 writing performance.

Fitrinada et al. (2018) also explored the correlations between each aspect of writing anxiety (i.e., somatic anxiety, cognitive anxiety, and avoidance behaviour) and writing performance. In this regard, fair negative significant correlations were found between each writing anxiety's aspect and writing achievement (r = -.481, p = .000 for somatic anxiety; r = -.430, p = .000 for avoidance behaviour; r = -.540, p = .000 for cognitive anxiety). In terms of the contribution of writing anxiety on students' writing performance, writing anxiety explained 29.7 % of the variance in learners' writing achievement. In line with this, Cheng (2004) claimed that the cognitive components (of test anxiety) are more important than the physiological components or avoidance behavior in explaining the negative association between test anxiety and L2 writing performance.

As Papi (2022) noted, it has been the negative influence of L2 writing anxiety in writing performance that has led researchers to identify the sources of L2 writing anxiety among anxious writers. In this respect, several early and more recent empirical studies have been conducted on the sources of L2 anxiety in writing performance (e.g., Abdel Latif, 2015; Bloom, 1981; Cheng, 2002; Genc & Yayli, 2019; Hassan, 2001; Heaton & Pray, 1982; Hyland, 2003; Rezaei et al., 2014; Tahmouresi & Papi, 2021; Zhang, 2011). For example, Rezaei et al. (2014) conducted a study on the levels, types and causes of writing anxiety among 120 Iranian EFL students. It was found that there is a high level of L2 writing anxiety

(M = 88.96 ($\geq$ 65), Min = 61, Max = 98) among 298 Iranian EFL major students. The mean total score for writing anxiety was 67.21($\geq$ 65); M = 63.91 $\leq$ 65, for a moderate level of L2 writing anxiety; and M = 48.77 $\leq$ 65, for a low level of L2 writing anxiety. Therefore, the results revealed that the Iranian EFL learners experience a level of anxiety when they are engaged in writing tasks. Moreover, the findings showed that somatic anxiety (41.2 %) is the most common type of anxiety among EFL students, followed by cognitive anxiety (36.5 %) and avoidance behaviour (23.3 %). This finding is consistent with that of Zhang's (2011) study and also with that of Genc and Yayli's (2019) recent study. A total of 257 Turkish EFL learners participated in Genc and Yayli's (2019) study, which aimed to examine the levels and sources of writing anxiety and whose findings also revealed that somatic anxiety was the most common type of anxiety experienced by EFL learners, followed by avoidance behaviour and finally, by cognitive anxiety. Nevertheless, the results of the study revealed that after the Turkish EFL learners took writing modules, the distribution of the three types of L2 writing anxiety changed, with avoidance behaviour being the type of anxiety most experienced by the EFL learners, followed by the somatic and the cognitive types of anxiety. In this study, the majority of EFL learners pointed out the negative effects of anxiety on their L2 writing performance.

The finding in Hassan's (2001) study that EFL learners' writing anxiety increases when their writing tasks are evaluated by their teachers (fear of negative evaluation) is consistent with that of Rezaei et al. (2014), which showed that fear of teacher's negative comments (83%) is the major cause of writing anxiety. This finding is also consistent with that obtained by Heaton and Pray (1982) and Hyland (2003), who also found teachers' negative comments as one of the causes of writing anxiety. Hyland (2003) also considered lack of ability to express ideas in English appropriately as a source of anxiety. In Rezaei et al.'s (2014) study, low self-confidence in L2 writing (80%) (see also Cheng, 2002) and linguistics difficulties (78%) were the following sources of writing anxiety. These two sources of anxiety are related to each other, as having poor linguistic knowledge (with the absence of good writing skills and the difficult nature of the writing task itself; see also Heaton & Pray, 1982, for absence of good writing skills, such as those related to brainstorming and organisation of ideas, mechanics of writing, and writing instruction and practice) results in low self-confidence and discourages students to engage in writing, i.e., students refrain from writing as they lack their motivation to write (Rezaei et al., 2014). This finding is in line with that of Zhang's (2011) study, which revealed that linguistic difficulty was the primary source of anxiety among Chinese EFL students (83%).

Furthermore, in Rezaei et al.'s (2014) study, fear of writing tests was another source of writing anxiety highly ranked by the students (76%). Even those students with a good command of writing skill often experience some degree of anxiety when taking a writing test. In this respect, the findings in Rezaei et al.'s (2014) study demonstrate that some degree of anxiety is necessary (as well as beneficial) to perform a task, but a high degree of anxiety acts as an inhibitory or debilitating factor, in the sense that it inhibits students to achieve their desired outcome. Self-imposed pressure for perfect work and insufficient writing practice (65%) were other causes of anxiety reported by the students (see also Bloom, 1981, for self-imposed pressure for perfect work as a cause of writing anxiety). In this sense, as pointed out by Rezaei et al. (2014), if students do not have sufficient writing practice, they cannot perform good quality writings. And obligating them to perform good quality writings can result in anxiety. Moreover, 61% of students mentioned time pressure (see also Heaton & Pray, 1982, who identified having a limited time to plan, write and revise as a source of writing anxiety), 52% of students had problems with topic choice (see also Bloom, 1981), and 47% of students reported to have insufficient writing techniques (which made them feel anxious and unable to engage in writing), with all of these being sources of writing anxiety experienced by the Iranian EFL learners in Rezaei et al.'s (2014) study. The least chosen source of writing anxiety was high frequency of writing assignments (35%).

These sources of anxiety reported in Rezaei et al.'s (2014) study and in the empirical studies mentioned above in relation to the sources of anxiety are in line with those reported in Genc and Yayli's (2019) and Abdel Latif's (2015) studies. Level of linguistic knowledge, perceived language competence, level of writing performance, perceived writing competence, instructional practices, and fear of criticism are the sources of writing anxiety mentioned by the students in Abdel Latif's (2015) study. In Genc and Yayli's (2019) study, the sources behind students' English writing anxiety include topic selection, finding supporting ideas, time limitation, lack of effective feedback, and specific steps during the writing process (e.g., the use of adequate grammar in writing, brainstorming and organisation of ideas). Importantly, more recently, Tahmouresi and Papi's (2021) study, with 85 Iranian university-level EFL learners, investigated how anxiety, enjoyment and learners' L2 writing future selves (i.e., ideal L2 writing self and ought L2 writing self) influenced L2 writing achievement. As Papi (2022) noted, findings in Tahmouresi and Papi's (2021) study showed that L2 writing anxiety (but not L2 writing enjoyment) negatively predicted L2 writing achievement and motivation. Furthermore, the study showed a negative correlation between the ideal L2 writing self (reflecting those L2 writing skills an individual would like to possess) and L2 writing anxiety (but the ideal L2 writing self positively predicted L2 writing enjoyment, motivation, and achievement), whereas a positive correlation was found between the ought-to L2 writing self (reflecting the L2 writing attributes an individual needs to have in order to avoid negative consequences) and L2 writing anxiety and motivation.

In sum, the existing empirical research does report a negative connection between anxiety and written performance (Cheng, 2004; Fitrinada et al., 2018; Rahimi & Zhang, 2019; Soleimani et al., 2020; Tahmouresi & Papi, 2021; Trebits, 2016; Xiao & Wong, 2014; Zabihi, 2018). Given the limited body of empirical work on affective and motivational IDs in L2 writing in general (but see, for instance, Jang & Lee, 2019; Rahimi & Zhang, 2019; Tahmouresi & Papi, 2021; Zabihi, 2018), and given the existing research on writing anxiety on L2 writing, the third aim of our study was to investigate potential writing anxiety effects on CAF measures of L2 written production.

Also, to shed further light on the relationship between writing anxiety and writing, some existing empirical studies have explored the effects of writing anxiety as a function of either proficiency or task complexity. This research is reviewed in the two sections that follow, and it also provides the motivation for the third aim of our study.

III.4.2.2. Writing anxiety and L2 writing: Moderating effects of proficiency

Previous empirical research on L2 writing anxiety has shown a negative relationship between L2 proficiency, L2 writing anxiety and L2 writing (e.g., Cheng, 2002, 2004; Kim, 2006; Kurt & Atay, 2007; Lee & Krashen, 2002; Pae, 2007). In this respect, as noted in Zhang's (2019) meta-analysis, this statistically significant negative relationship between L2 English proficiency and general L2 English anxiety is found not only in L2 writing anxiety, but also in general foreign language anxiety (e.g., Aida, 1994; Horwitz, 2012; Hurd & Zia, 2010; Kim, 2009; Kim, 2002; Liu & Ni, 2015; Pae, 2007, 2012; Sin, 2004), which is an expected finding as learners with a lower level of L2 proficiency are inclined to have higher L2 anxiety than their higher performing counterparts. Pae's (2007) study, with a total of 15 intermediate university-level Korean EFL learners performing four online wiki-based writing assignments, investigated how the level of L2 writing anxiety varies depending on learners' L2 English proficiency level. The findings in this study showed a negative relationship between L2 proficiency and L2 writing anxiety.

Limited previous empirical research has been carried out on the mediation of proficiency in writing anxiety effects in the writing domain (e.g., Rodríguez-Sabiote et al., 2017; for a meta-analysis see Zhang, 2019), with this research pointing to an absence of interactive effects between L2 proficiency and writing anxiety in relation to L2 writing quality. The meta-analysis by Zhang (2019) reported that the negative correlation of anxiety with L2 performance remained stable across groups with different proficiency levels. Rodríguez-Sabiote et al. (2017) investigated whether anxiety and English proficiency level affect writing performance in L2 learning. In this study, with a total of 71 native Spanish high school EFL learners (proficiency level: lower intermediate, average 24.79 -B1 or B2-), it was found that L2 English proficiency level (and not writing anxiety) was the predictor variable that was more closely correlated with students' L2 writing performance, with the results indicating a positive and statistically significant correlation (r = 0.654; p <.01). Nevertheless, a statistically significant negative correlation was found between writing anxiety and students' L2 writing performance (r = -0.319; p <.01), but this correlation is not strong enough in order to establish a predictive model. The Foreign Language Classroom

Anxiety Scale (FLCAS; Horwitz et al., 1986) was used to measure writing anxiety, and the Quick Placement Test (QPT; Part 1: questions 1-40) was administered to the participants in this study in order to measure their L2 English proficiency level. To measure English writing performance, learners were invited to complete a composition, assessed in terms of CAF indices.

Given this absence of interaction between proficiency and writing anxiety in relation to L2 writing, and motivated by the limited research on affective IDs in L2 writing in general and the existing research on writing anxiety on L2 writing, the third aim of our study also investigated whether any writing anxiety effects on CAF measures of L2 written production were moderated by proficiency.

III.4.2.3. Writing anxiety and L2 writing: Moderating effects of task complexity

This subsection is devoted to the writing anxiety effects on L2 writing and the mediating role of task complexity (TC).

As mentioned in earlier section and as will be discussed in Chapter IV, prior research has examined the effects of increasing task complexity on L2 writing production. However, to date, the role of affective/motivational IDs (namely writing motivation and anxiety) has not been examined in these investigations. In fact, previous research (e.g., Ellis & Yuan, 2004; Kormos, 2011) has called for the inclusion of IDs in future research. Robinson (2011) predicted that the role of affective factors, which are an essential part of learner IDs, will be more clearly evident in learners' cognitively complex L2 writing task performance. Importantly, anxiety effects on L2 writing performance and achievement seem to vary depending on task complexity. Few empirical studies on writing anxiety (Rahimi & Zhang, 2019; Zabihi et al., 2018; see also Révész, 2011; Robinson, 2007b; Trebits, 2016, for oral modality) exist that investigate how writing anxiety relates to L2 production on tasks which differ in their cognitive complexity, thus showing that the L2 writing anxiety effects on L2 writing achievement and performance are not fixed, but seem to vary depending on the cognitive complexity of the task, as also stated by Papi (2022).

For instance, the study by Zabihi et al. (2018) found that somatic anxiety and cognitive anxiety negatively correlated with accuracy in the simpler narrative task, whereas cognitive anxiety negatively correlated with one measure of accuracy and all fluency measures in the more complex argumentative writing task (as cited in Papi, 2022). Rahimi and Zhang's (2019) study, with a total of 60 upper-intermediate EFL learners (L2: English), investigated the relationship between individual learner factors (i.e., writing motivation and anxiety) and L2 writing in simple versus complex tasks (i.e., in two writing tasks with varying degrees of complexity), as well as the effects of increasing the degree of reasoning demands and the number of elements on learners' L2 writing syntactic complexity and accuracy. In this study, writing anxiety was measured by a writing anxiety questionnaire adapted from Cheng (2004), and L2 written performance was operationalised in terms of accuracy and syntactic complexity. In Rahimi and Zhang's (2019) study, it was found that (i) the role of affective/motivational factors (i.e., writing motivation and writing anxiety) was more clearly manifest in complex L2 writing task performance; (ii) increasing the level of reasoning led to an increase in the cognitive complexity of the task; and (ii) increasing the cognitive complexity of a task increased the number of subordinate clauses per clause (i.e., syntactic complexity) in complex L2 writing task performance, but it led to decreases in learners' L2 writing accuracy, thus supporting the Trade-Off Hypothesis (Skehan, 1998) that increasing the difficulty of the task leads to a trade-off between the CAF indices of L2 written production.

More specifically, Rahimi and Zhang (2019) found that the behavioural avoidance subcomponent of L2 writing anxiety (avoidance behaviour) negatively correlated with writing complexity, that is, with the mean length of t-units (MLT) [which is a general measure of syntactic complexity] only in complex L2 writing task performance (i.e., in the complex task). This suggests that the role of L2 writing anxiety is more clearly evident in complex tasks (i.e., writing anxiety can play a role in task performance especially when the task at hand has a high level of cognitive complexity), thus confirming Robinson's (Cognition Hypothesis; 2001, 2011) prediction that the role of affective/motivational individual differences related to the learner will be more apparent in learners' performance of cognitively complex tasks (as cited in Rahimi & Zhang, 2019).

Furthermore, these findings support those of previous studies (e.g., Atay & Kurt, 2006; Cheng et al., 1999) and also confirm that it is necessary to employ "multidimensional measures of affective factors […] on learners' performance" (Cheng, 2004, as cited in Rahimi & Zhang, 2019, p. 14). In terms of accuracy, in Rahimi and Zhang's (2019) study, no significant level was reached by any of the three components of writing anxiety (i.e., somatic anxiety, cognitive anxiety and avoidance behaviour) and measures of L2 writing accuracy (i.e., the number of errors per t-unit, and the ratio of error-free t-units to the total number of t-units). In the same way, the dimensions of writing motivation did not associate significantly with measures of accuracy (i.e., error-free t-units per t-unit) (Rahimi & Zhang, 2019). However, a significant, moderate positive correlation was established between self-efficacy and task value with the measure of the number of errors per t-unit in the complex task (Rahimi & Zhang, 2019). This final finding contradicts previous results on studies that have investigated the relationship between affective/motivational factors and writing performance (e.g., Atay & Kurt, 2006; Cheng et al., 1999). We can relate this surprising and unexpected finding to the moderate positive relationship that was found between the dimensions of writing motivation (i.e., mastery goal, avoidance goal, performance goal, self-efficacy, task value, attribution internal, and attribution external) and L2 writing syntactic complexity in complex L2 writing task performance. Therefore, this moderate positive association indicates that learners with high self-efficacy and task value employed more complex syntactic structures, which resulted in a decline in their accuracy as a function of increases in syntactic complexity (Rahimi & Zhang, 2019). This result does not lend support to one aspect of Robinson's (2001, 2011) Cognition Hypothesis (which predicts a more prominent role of affective factors in the more complex tasks) and supports Skehan's (1998, 2009) Trade-Off Hypothesis (as cited in Rahimi & Zhang, 2019).

III.4.2.4. Writing anxiety and L2 writing: Summary

To sum up, previous empirical studies have reported a negative connection between anxiety and written performance (Cheng, 2004; Fitrinada et al., 2018; Rahimi & Zhang, 2019; Soleimani et al., 2020; Tahmouresi & Papi, 2021; Trebits, 2016; Xiao & Wong, 2014; Zabihi, 2018). Furthermore, negative relationship between anxiety and L2 proficiency was reported in numerous previous studies, and the nature of the effects of anxiety and task complexity is limited, and firmed conclusions cannot be made; more research is needed.

Given the limited nature of anxiety effects, L2 writing performance and task complexity (Rahimi & Zhang, 2019), and motivated by the limited research on affective IDs in L2 writing in general and the existing research on writing anxiety on L2 writing, the third aim of our study also investigated whether any writing anxiety effects on CAF measures of L2 written production were moderated by task complexity.

III.4.3. Affective and Motivational Individual Differences in L2 Writing: Writing Self-Efficacy

This section reviews the empirical studies conducted on the effects of L2 writing self-efficacy on L2 writing performance.

III.4.3.1. Writing self-efficacy and L2 writing: Empirical research

In relation to the writing domain, self-efficacy is regarded as a determinant of "whether L2 learners engage in writing at all and, when given the choice, what kind of writing tasks they decide to perform" (Kormos, 2012, p. 399). In addition, self-efficacy also affects the processes involved in L2 writing (Kormos, 2012).

Writing self-efficacy has an influence on students' academic writing performance, as students' self-efficacy beliefs and perceptions influence the choices they make, their efforts and their determination in the process of writing (Bandura, 1986; Social Cognitive Theory). Learners' affective processes influence their L2 writing performance, and this is why people usually try some tasks they think they can succeed and do not try those tasks they think they will not accomplish. Nevertheless, to date, there have been few studies investigating whether there is a relationship between writing self-efficacy and L2 writing performance and whether students' overall writing self-efficacy is a predictor of their overall L2 writing performance. Some recent empirical studies (e.g., Kong & Teng, 2020; Sun & Wang, 2020; Teng et al., 2018; Woottipong, 2020) found that English writing self-efficacy exerts a positive and significant influence on L2 writing performance. In fact, most previous research has reported a significant positive connection between writing self-efficacy and L2 written performance, thus being in line with the tenets of the Social Cognitive Theory (Bandura, 1986) and aligning with empirical studies which found a positive association between writing self-efficacy and L1 writing performance (e.g., Klassen, 2002; Pajares, 2003; Pajares & Johnson, 1994, 1996; Pajares & Valiante, 2006; Prat-Sala & Redford, 2012; Schunk, 2003).

Previous research has shown that writing self-efficacy could enhance writing performance, while writing anxiety may hinder writing achievement (for instance, Sanders-Reio et al., 2014; Woodrow, 2011). In this respect, as cited in Papi et al. (2022), positive L2 writing self-efficacy beliefs "have been found to enhance L2 writers' self-regulatory control (Csizér & Tankó, 2015)" (p. 386), contribute to higher levels of L2 writing quality (McCarthy et al., 1985, as cited in Papi et al., 2022), as well as decrease learners' writing anxiety (Kirmizi & Kirmizi, 2015, as cited in Papi, 2022) and improve their engagement with written corrective feedback (Ferris et al., 2013, as cited in Papi, 2022). In L2 writing research, factors such as learners' enactive mastery experiences, vicarious experiences, verbal persuasion, and learners' physiological states as regards learners' chances of success or failure in the pursuit were found to have a significant effect on the enhancement of learners' L2 writing self-efficacy (Manchón, 2009; Sasaki et al., 2018, as cited in Papi, 2022). In this respect, when performing a new task, a certain sense of confidence in one's abilities in order to complete the task is needed in order to motivate the learner to do so, and as stated by Papi (2022), L2 writing is such a long-term process of trial and error that something more than self-efficacy is necessary for the learner in order to start this process of writing. For instance, findings in Ferris et al.'s (2013) study revealed that one of the participants had low levels of L2 writing self-efficacy but she had "a teachable attitude," (as cited in Papi, 2022, pp. 155-156) a mindset which not only helped her believe she can learn her ability to write in the L2, but also helped her grow her L2 writing ability.

Importantly, in addition to self-efficacy, Papi (2022) noted that mindsets have also been examined in L2 writing, with the findings in the study by Waller and Papi (2017) with a total of 142 US-based ESL learners revealing that learners with “a growth L2 writing mindset […] showed a preference for receiving WCF and high levels of L2 writing motivation whereas those who endorsed a fixed mindset [and believed] their natural talent for L2 writing was [not malleable -but] fixed reported a feedback-avoiding orientation and low motivation” (p. 156).

Some empirical studies have shown that learners with high writing self-efficacy are highly motivated (Zhang & Guo, 2012) and less anxious (Pajares et al., 2000), are prone to study harder and are more intrinsically motivated (Woodrow, 2011). Furthermore, recently, writing self-efficacy has been found to be a more significant predictor of learners’ writing performance than writing anxiety (Sander-Reio et al., 2014; Woodrow, 2011). In Woodrow’s (2011) study, with a total of 738 Chinese EFL learners, it was found that writing self-efficacy mediated the relationship between writing anxiety and writing performance, thus supporting Bandura’s (1986) Social Cognitive Theory of learning in the sense that perceptions of affect can have an influence on self-efficacy beliefs. Those learners with high writing self-efficacy had a better performance in their English written texts and put in more effort.

Traditionally, writing self-efficacy (as well as writing motivation) is a facilitative and contributing factor for L2 writing performance. In many studies conducted in ESL/EFL contexts, students’ self-efficacy beliefs have been found to positively and significantly correlate with writing performance (Chen & Lin, 2009; Woodrow 2011). Therefore, it can be assumed that writing self-efficacy also plays an essential role in learners’ writing performance. In terms of our knowledge of the role of writing self-efficacy in L2 writing, we know from previous research that in the field of L2 writing, normally there is a positive link between writing self-efficacy and L2 written performance (e.g., Bruning et al., 2013; Chae, 2011, 2013; Chea & Shumow, 2015; Chen & Lin, 2009; Hetthong & Teo, 2013; Karaglani, 2003; Oh et al., 2015; Sanders-Reio et al., 2014; Shah et al., 2011; Soleimani et al., 2020; Woodrow, 2011; Yilmaz, 2010; Zabihi, 2018), but it is important to highlight that there are some studies in which no relationship has been found, i.e., there is absence of correlations (Hashemnejad et al., 2014).

In this respect, the study conducted by Zabihi (2018) with a total of 232 Persian upper-intermediate EFL learners found that writing self-efficacy was positively correlated to the CAF indices of L2 learners' narrative writings. Chea and Shumow's (2015) study looked at the relationships among writing self-efficacy, writing goal orientation and writing achievement (with a total of 244 Cambodian EFL university students), and it found that (i) writing self-efficacy had a positive and significant correlation with writing achievement, $r(242) = .15$, $p < .05$, as was writing mastery goal orientation, $r(242) = .11$, $p < .05$, but the two writing performance goal orientations, i.e., writing performance-approach goal orientation and writing performance-avoidance goal orientation, did not have a significant relationship with writing achievement, and (ii) writing self-efficacy was significantly and positively associated with writing mastery goal orientation, $r(242) = .40$, $p < .001$, and with writing performance-avoidance goal orientation, $r(242) = .17$, $p < .01$, but it did not have a significant correlation with writing performance-approach goal orientation, $r(242) = .04$, $p > .05$. In this study, writing achievement was measured by students' paragraph scores obtained on their final writing exam (writing achievement operationalised as paragraph-writing achievement); the inter-rater reliability that was calculated to ensure the reliability of the scores obtained in order to gauge students' writing achievement was found to be .71. Students' paragraph-writing self-efficacy was measured by a writing self-efficacy scale specifically assessing students' confidence in their skill to write English paragraphs and consisting of seven items based on Prat-Sala and Redford (2010). The internal reliability of the writing self-efficacy scale was high, as the Cronbach's α value was .92; and the items from the scale yielded one component with eigenvalue of 4.7, thus accounting for a variance in the items of 66.8%. Therefore, taken together, the results of (i) the principal-component factor analysis suggested unidimensionality of the self-efficacy construct through different measurement items, thus accounting for the validity of the scores from the self-efficacy measure, and (ii) the Cronbach's α value (.92) explained the high internal reliability of the writing self-efficacy scale. The finding reported in this study concerning the positive relationship between writing self-efficacy and writing achievement supports Bandura's

(1977) self-efficacy theory and is consistent with those findings from a number of other previous empirical studies on the relationship between writing self-efficacy and achievement in general academic subjects as well as in writing as a specific subject area, including Pajares and Johnson (1996) and Pajares and Valiante (1997, 1999).

Moreover, results from Chea and Shumow's (2015) study are in line with those obtained in Hetthong and Teo's (2013) study, whose findings revealed that (i) writing self-efficacy was significantly and positively correlated with writing performance both at the paragraph and sub-skill levels, and (ii) the students' overall writing self-efficacy significantly and strongly predicted their overall writing performance ($R = .712$, $F = 50.509$, $df = 50$, $p < 0.001$). More specifically, in Hetthong and Teo's (2013) study, when examining the correlation at the level of paragraph writing, a high positive association/relationship between the students' overall writing self-efficacy and their overall writing performance ($r = 0.71$) was found. As regards the correlations between writing self-efficacy and writing performance at the sub-skill level, that is, between the students' judgement about their corresponding ability in seven different sub-skills, it was found that there were variations in the sub-skill correlations, which ranged from 0.36 to 0.61: cohesion ($r = 0.36$), vocabulary ($r = 0.52$), punctuation ($r = 0.55$), spelling ($r = 0.56$), content ($r = 0.57$), grammar ($r = 0.60$), and organisation ($r = 0.61$). In this regard, organisation was the aspect which students judged themselves about their ability most accurately; by contrast, cohesion was the aspect that students judged themselves about their ability least accurately.

The findings in Hetthong and Teo's (2013) study are in line with those of Shah et al.'s (2011) study which explored the association between general self-efficacy, writing self-efficacy and writing performance (with a total of 120 Malaysian Form-3 and Form-5 students). Students' essay writing tests were measured by holistic scores, and a moderate positive correlation ($r = 0.563$) was found between writing performance (as measured by the students' holistically scored essays) and general self-efficacy, and a high positive correlation ($r = 0.641$) was found between writing performance and writing self-efficacy. Moreover, in Shah et al.'s (2011) study, a moderate correlation was found between students' writing ability/performance in the areas of mechanics (e.g., punctuation and spelling) and organisation (at the sub-skill level) and writing self-efficacy. However, there is a controversial result. In contrast to Shah et al.'s (2011) study in which cohesion was the aspect found to yield a moderate positive correlation, in Hetthong and Teo's (2013) study the cohesion aspect was found to produce a low positive correlation.

The findings in Chae's (2013) study, which investigated the effects of L2 writing self-efficacy and interest on 212 Korean college students' L2 writing strategy use and L2 writing performance, revealed a statistically significant positive relationship between writing self-efficacy and L2 writing performance. That is, those students who had high writing self-efficacy had better scores on the L2 writing performance task than those students with a low level of writing self-efficacy. Students reported a medium self-efficacy level (M = 54.69, $S.E.$ = 1.47), that is, the students scored 54.69 points (out of 100 points in total), on average, in writing self-efficacy; and the average score obtained by the participants in writing performance was 2.49 points (out of 5 points in total) (M = 2.49, $S.E.$ = 0.06). The Writing Self-Efficacy Scale (WSES; Pajares, 2007; Pajares & Valiante, 1999) was employed to assess students' writing self-efficacy, i.e., their confidence in their writing abilities/performance, and writing performance was measured by three different writing essays (on three different writing topics) scored on a scale of 0 to 5.

The findings in Chae's (2013) study were consistent with those obtained in Oh et al.'s (2015) study, which also found a significant positive relationship between writing self-efficacy and L2 writing performance. The students reporting that (i) they could spell words correctly (SEitem01, M = 4.72, SD = 1.24, r = .409, p < .01), thus meaning that they saw themselves as being more competent in spelling (SEitem01) and (ii) they wrote grammatically correct sentences (SEitem04, M = 4.78, SD = 1.37, r = .409, p < .01), thus meaning that they saw themselves as being more competent in grammar (SEitem04), had a higher level of confidence and showed better L2 writing performance, i.e., they performed significantly better in L2 essay writing. This study examined the effects of planning, L2 linguistic knowledge and individual differences (self-efficacy, motivation and L2 writing strategy use) on L2 writing. In this study, a total of 72 Korean EFL university students enrolled in college English writing courses performed an argumentative essay in order to measure their L2 writing performance (evaluated in terms of four criteria, including content, grammar, vocabulary and mechanics) and the Writing Self-Efficacy Scale (WSES; Pajares, 2007; Pajares & Valiante, 1999) was employed to assess students' writing self-efficacy, as in Chae's (2013) study. Using a 7-point Likert scale ranging from 1 (not at all confident) to 7 (absolutely confident), with a total of 10 items, participants were asked (i) to judge how confident they are in their ability to successfully write a well-organised paragraph as well as a well-organised essay, and (ii) to provide judgements of their confidence in their ability to use correct grammar and mechanics (including spelling and punctuation). A regression analysis showed that L2 writing was significantly predicted by writing self-efficacy (SEitem01, β = .069, t = .722, p = .473; SEitem04, β = .253, t = 2.480, p < .05). Writing self-efficacy items were shown to make significant contributions to the content and grammar of L2 writing (in general, those students with more confidence received higher essay scores in their writings, and more specifically as mentioned above, those students who perceived themselves as having a higher ability in spelling (SEitem01) and grammar (SEitem04), had a higher level of confidence, and they also explained significant variances in vocabulary and mechanics. That is, those students who had more confidence in writing grammatical sentences (SEitem04) showed better L2 writing performance in content. Furthermore, those students who had more confidence in their spelling competence (SEitem01) performed better in L2 writing grammar (i.e., in overall quality of grammar use), thus making a significant impact on grammar. Those students who had more confidence in their ability (i) to stay focused on the topic they are asked to write about, considering the rules of the writing language, that is, capitalisation, punctuation and spelling, and (ii) to write about the topic (SEitem10), performed better in L2 writing mechanics. Finally, those students with more confidence in spelling (SEitem01) performed better in vocabulary. Moreover, the study by Chae (2011) found that Korean college EFL learners' self-efficacy beliefs were significant predictors of L2 writing performance at the beginning of the semester, although their writing self-efficacy did not last to the end of the semester.

Woodrow's (2011) study looked at the relationships between writing anxiety, writing self-efficacy and writing performance (with a total of 738 Chinese EFL university students), and the results indicated a significant and moderate relationship between writing self-efficacy and writing performance (.43), but a strong negative relationship between writing anxiety and writing performance (-.71). Furthermore, it was found that writing self-efficacy mediated the relationship between writing anxiety and writing performance. These findings are consistent with those obtained in Chen and Lin's (2009) study, which also found that there is a relationship between anxiety, self-efficacy and language performance/achievement. This study indicated that writing self-efficacy directly predicts writing performance, but writing anxiety does not.

However, contradicting findings were obtained in Al-Mekhlafi's (2011) study on the association between Arab EFL trainee-teachers' writing self-efficacy and their writing performance/achievement. No significant relationship was found between writing self-efficacy and writing performance. In this study, the subjects were given a 38-item questionnaire to measure sources of self-efficacy in writing, and writing performance was measured by the total score obtained from the writing course, thus including 20% from mid semester test, 20% from portfolio, 10% from participation, and 50% from the final test. This had an effect on the notion of self-efficacy which should be considered as task-specific due to the fact that the writing performance/achievement variable was divided into different components in order to measure it. Moreover, these findings are in line with those obtained in the study by Soleimani et al. (2020), which showed that although writing self-efficacy correlated positively and significantly with L2 writing (r (127) = .711 representing a large effect size, p = .000), writing self-efficacy was not found to be a significant predictor of global L2 writing performance (B = .045, *Beta* = .125, t = .962, p = .338, on the first step; B = .044, *Beta* = .121, t = .944, p = .347, on the second step).

In sum, the existing empirical research does report a positive (albeit mixed) connection between self-efficacy and L2 written performance, and it is in line with the tenets of the Social Cognitive Theory (Bandura, 1986) and align with multiple empirical studies that found positive links between self-efficacy and L1 writing performance (e.g., Klassen, 2002; Pajares, 2003; Pajares & Valiante, 2006; Prat-Sala & Redford, 2012; Schunk, 2003). Given the limited body of empirical work on affective and motivational IDs in L2 writing in general (but see, for instance, Jang & Lee, 2019; Rahimi & Zhang, 2019; Tahmouresi & Papi, 2021; Zabihi, 2018), and given the existing research on writing self-efficacy on L2 writing, the fourth aim of our study was to investigate potential writing self-efficacy effects on CAF measures of L2 written production.

Also, to shed further light on the relationship between writing self-efficacy and L2 writing, some existing empirical studies have explored the effects of writing anxiety as a function of either proficiency or task complexity. This research is reviewed in the two sections that follow, and it also provides the motivation for the fourth aim of our study.

III.4.3.2. Writing self-efficacy and L2 writing: Moderating effects of proficiency

Mixed and inconsistent research findings have been reported on the potential interactions between writing self-efficacy and proficiency in L2 writing performance (Bruning et al., 2013; Sanders-Reio et al., 2014). Sanders-Reio et al. (2014) reported that writing efficacy was not significantly related to writing proficiency. Nevertheless, some empirical research has provided evidence that self-efficacy effects on writing can vary depending on the level of proficiency. For instance, the study by Bruning et al. (2013) reported higher levels of efficacy in more advanced English classes. These results are in line with the study conducted by Lee et al. (2017). In this sense, the study by Lee et al. (2017) with a total of 1395 secondary Chinese EFL learners investigated secondary learners' L2 writing motivation in EFL writing and the influence of L2 proficiency, gender, and grade on learners' L2 writing motivation. It is worth mentioning that the students were classified into three bands (Band 1, Band 2, and Band 3) based on their academic abilities (Band 1 being the highest, and Band 3 being the lowest); Band 1 students had a high level of English proficiency (i.e., they were the most proficient in English), whereas Band 3 students had a low level of English (i.e., they were the least proficient in English).

In this respect, in Lee et al.'s (2017) study, in addition to (i) the significant interaction found between L2 proficiency and grade on learners' L2 writing motivation (showing that learners with higher L2 proficiency were more motivated to write in English), (ii) the significant difference among students from the three different bands in their L2 writing motivation (showing that Band 1 students reported higher scores than Band 2 and Band 3 students in L2 writing motivation), and (iii) the significant difference among learners in different grades (grades, 7, 9 and 11) in their L2 writing motivation (showing that Grade 7 learners were more motivated than Grade 9 and Grade 11 learners), further data analysis in this study revealed that this significant difference among students from the three different bands in their L2 writing motivation lies in learners' writing efficacy scale ($F = 29.490$, $p < .001$, n2 = .041) and their writing interest ($F = 8.615$, $p < .001$, n2 = .012). Band 1 students scored higher than Band 2 and Band 3 students in writing efficacy and interest in writing. Moreover, the findings revealed that the mentioned significant grade difference lies in the writing efficacy scale ($F = 10.302$, $p < .001$, n2 = .015), with those learners in Grade 7 obtaining a higher score in writing efficacy than learners in Grades 9 and 11. Even though the effect was small, the writing efficacy of learners decreased as they progressed in their education, that is, to a higher grade (Lee et al., 2017). In addition to being found to be more motivated to write, more proficient learners showed higher writing efficacy and greater writing interest. These are expected findings, as language proficiency has been found to directly influence writing performance, and previous research has found a correlation between motivation and performance in writing (Troia et al., 2013). Furthermore, a positive correlation has been reported between motivation and self-efficacy in motivation research (Walker et al., 2006; Yusuf, 2011). Moreover, Wang and Sun's (2020) recent meta-analysis showed that the interaction between self-efficacy beliefs and language proficiency in the EFL context was moderated by the cultural background of the students.

Given the mixed nature of these findings and the inconsistent interaction between proficiency and self-efficacy in relation to L2 writing, further research intended to shed light on this interaction between writing self-efficacy and proficiency effects on L2 written performance is justified. Therefore, motivated by these mixed findings and inconsistent interaction between proficiency and self-efficacy in relation to L2 writing, the fourth aim of our study also investigated whether any writing self-efficacy effects on CAF measures of L2 written production were moderated by proficiency.

III.4.3.3. Writing self-efficacy and L2 writing: Moderating effects of task complexity

To the best of our knowledge, only Teng and Zhan's (2023) recent study has been conducted on the moderating effects of task complexity (TC) on the relationship between writing self-efficacy and L2 writing. The findings revealed that task complexity and proficiency influenced writing performance, and self-efficacy mediated the role of TC in writing performance.

Given this lack of research on writing self-efficacy, task complexity and L2 writing, further research intended to shed light on this interaction between writing self-efficacy and task complexity effects on L2 written performance is justified. Thus, motivated by the limited research on affective and motivational IDs in general, and on the relationship between writing self-efficacy and L2 writing in particular, the fourth aim of our study also investigated whether any writing self-efficacy effects on CAF measures of L2 written production were moderated by task complexity.

III.4.3.4. Writing self-efficacy and L2 writing: Summary

To sum up, previous empirical studies have found positive links between self-efficacy and L2 writing performance, but the research is limited. As regards writing self-efficacy and proficiency, contradictory findings have been found, with some studies (Sanders-Reio et al., 2014) reporting an absence of interactive effects between L2 proficiency and writing self-efficacy, and other studies (Bruning et al., 2013) providing evidence that the effects of self-efficacy can vary depending on the level of proficiency. Concerning the potential interactions between writing self-efficacy and TC, more research is needed.

III.4.4. Affective and Motivational Individual Differences in L2 Writing: Writing Motivation

Waller and Papi (2017) define L2 writing motivation as "a measure of the amount of effort […] [learners] intend to invest in improving their L2 writing, their desire for doing so, and how intensely they are engaged in this pursuit" (Waller & Papi, 2017, p. 57). Motivation can be defined as a phenomenon that explains why learners do or do not take a certain course of action instead of others (direction), the intensity at which they pursue the action (vigour), and the length of time in which learners stay involved in that action (persistence) (Papi & Hiver, 2022). Albin et al. (1996) stated that "the interest derived from intrinsic motivation helps to improve writing performance" (as cited in Oh et al., 2015, pp. 53-54). However, Hidi and Anderson (1992) argued that such interest was not enough to ensure success in writing.

Abdel Latif (2021) classified writing motivation constructs into four types, which are the following: a) attitudinal/dispositional perceptions (e.g., writing apprehension, attitudes towards writing, and the perceived value of writing); b) situational feelings and actions (e.g., writing anxiety, and the motivational regulation of writing); c) writing ability beliefs (e.g., writing self-efficacy and self-concept); and d) writing learning goals (i.e., writing achievement goal orientations). In this respect, achievement goals have been researched in the field of motivation (Elliott & Dweck, 1988) and "have been found to lead to differences in cognitive, emotional, and behavioural patterns in learning (e.g., Elliott & Dweck, 1988)" (Papi, 2022, p. 156). According to this theory, individuals are motivated to achieve two types of goals in their pursuits, that is, a performance goal and a mastery (or learning) goal. Importantly, as noted in Papi (2022), mastery goals have been found to contribute to the writing complexity (Rahimi & Zhang, 2019, as cited in Papi, 2022) and quality of L2 writing and increased use of writing strategies (He, 2005, as cited in Papi, 2022). On the other hand, "performance goals […] have negatively predicted writing complexity (Rahimi & Zhang, 2019, as cited in Papi, 2022, p. 156).

In this respect, the beginning of writing motivation research dates back to the mid-1970s (Abdel Latif, 2021). As a result of the increasing body of research studies conducted on writing motivation since that time, as stated in Papi an Hiver's (2022) recent contribution to Li et al.'s (2022a) *handbook on IDs and SLA*, this ID variable has been represented in a growing number of writing motivation constructs which have been researched so far, and also in a wide range of theories and models, such as the integrative motive (e.g., Gardner, 1985), the L2 motivational self-system (Dörnyei, 2009), the self-determination theory (e.g., Noels, 2001), language mindsets (e.g., Waller & Papi, 2017), regulatory focus (Papi, 2018; Papi et al., 2019), feedback-seeking behaviour (Papi et al., 2019), directed motivational currents (Dörnyei et al., 2015), and buoyancy and resilience (Yun et al., 2018) (as cited in Papi, 2022). Papi and Hiver (2022) provide evidence of how these writing motivation theories, models, and constructs have contributed to our understanding of the different aspects of the complex and multidimensional notion of motivation.

III.4.4.1. Writing motivation and L2 writing: Empirical research

Some empirical research has been conducted using the notion of selves to explore general L2 motivation, but it is relevant to mention that only a few studies (Csizér & Tankó, 2015; Jang & Lee, 2019; Tahmouresi & Papi, 2021) have examined the role of selves in L2 writing motivation. Of relevance, most previous research has reported a significant positive connection between writing motivation and L2 written performance (Csizér & Tankó, 2015; Jang & Lee, 2019; Lee et al., 2017; Oh et al., 2015; Rahimi & Zhang, 2019; Soleimani et al., 2020; Tahmouresi & Papi, 2021; Yu et al., 2019). For instance, the findings of the recent empirical study by Soleimani et al. (2020) showed that writing motivation was positively and significantly correlated with global L2 writing performance (r (127) = .767 representing a large effect size, p = .000), but a negative (albeit significant) correlation was found between L2 writing anxiety and global L2 writing performance (r (127) = -.514 representing a large effect size, p = .000). The linear regression indicated that writing motivation emerged as the sole and significant predictor of global L2 writing performance (B = .083, Beta = .767, t = 13.470, p = .000), thus being the sole contributing variable to global L2 writing performance

-it showed significant contribution to the regression model on all three steps- (Soleimani et al., 2020).

The findings of Soleimani et al. (2020) are consistent with those found in the study by Oh et al. (2015), which found that intrinsic motivation was significantly correlated with L2 writing. A total of 72 intermediate Korean EFL learners (freshmen in five college English writing classes) participated in this study. Writing motivation was measured by a questionnaire on motivation for writing, adapted from Kim's (2011) questionnaire on motivation for reading, and L2 essays were scored in terms of content, grammar, mechanics and vocabulary. The motivation items made significant contributions to grammar and explained significant variances in mechanics and vocabulary use, but none of the motivation items made a significant contribution to the content of L2 writing. Those learners who reported to be good at writing in the English language, which encourages/motivates them to write more, had a better L2 writing performance (Mitem08, $r = .463$, $p < .01$; Mitem15, $r = -.397$, $p < .01$). That is, those learners with more intrinsic motivation (Mitem08) had a better performance in overall quality of grammar use, and those learners who performed better in vocabulary were those with more intrinsic motivation because of their confidence in their overall English writing ability (Mitem08) and those who responded negatively to refraining from writing English essays even when the topic is interesting (Mitem15). Therefore, the stepwise multiple regression that was run to examine the predictability of writing motivation (among other factors) on L2 writing performance showed that intrinsic motivation significantly contributed to L2 writing, as shown in the motivation items with a significantly predictive power (i.e., Mitem08 and Mitem15). In this sense, those L2 learners reporting to be good at L2 writing (Mitem08) and responding negatively to refraining from writing essays in English even when the topic is of interest to them (Mitem15) scored better in L2 writing, as mentioned above.

Furthermore, the study by Jang and Lee (2019) investigated the effects of ideal and ought-to L2 selves (two types of L2 self-related motivation drawn from Dörnyei's theory of the L2 Motivational Self System, 2005) on 68 Korean undergraduate EFL learners' writing strategy use and writing quality. EFL learners' L2 proficiency level was low. EFL learners' ideal and ought-to L2 selves and writing strategy use were measured through questionnaires, and their writing quality was gauged by a descriptive composition task that EFL learners were asked to complete. In this study, a significant positive effect of the ideal L2 self on writing outcomes and planning strategy use was found. As regards the ought-to L2 self, this type of L2 self-related motivation was only correlated with revising strategy use (Jang & Lee, 2019). The findings of Jang and Lee (2019) are in line with those findings obtained in Csizér and Tankó (2015) who found that ideal L2 self positively predicted writing quality. Also, Tahmouresi and Papi (2021) found that ideal L2 writing self and ought-to L2 writing self were positive predictors of L2 writing motivation. In this study, ideal L2 writing self was a positive predictor of L2 writing achievement and fluency, and ought-to L2 writing self negatively predicted L2 writing achievement. Furthermore, in the field of L2 writing, the study by Lin et al. (2015) found that learners' expectancy-value (theory of) motivation was a significant predictor of learners' self-regulation strategies and abstract-writing ability (as cited in Papi, 2022).

In sum, the existing empirical research does report a significant positive connection between writing motivation and written performance (e.g., Csizér & Tankó, 2015; Jang & Lee, 2019; Lee et al., 2017; Oh et al., 2015; Rahimi & Zhang, 2019; Soleimani et al., 2020; Tahmouresi & Papi, 2021; Yu et al., 2019). Given the limited body of empirical work on affective and motivational IDs in L2 writing in general (but see, for instance, Jang & Lee, 2019; Rahimi & Zhang, 2019; Tahmouresi & Papi, 2021; Zabihi, 2018), and given the existing research on writing motivation on L2 writing, the fifth aim of our study was to investigate potential writing motivation effects on CAF measures of L2 written production.

Also, to shed further light on the relationship between writing motivation and writing, some existing empirical studies have explored the effects of writing motivation as a function of either proficiency or task complexity. This research is reviewed in the two sections that follow, and it also provides the motivation for the fifth aim of our study.

III.4.4.2. Writing motivation and L2 writing: Moderating effects of proficiency

Few empirical research has investigated interaction of writing motivation with proficiency in L2 writing performance. The empirical study conducted by Park (2010) examined the effects of Korean EFL middle school students' writing motivation and writing knowledge on writing proficiency. The results revealed a significant (albeit mild) explanatory power for the effects of writing motivation on writing proficiency. Moreover, other empirical studies on motivation and writing strategies revealed that the more L2 learners know about writing strategies and use them effectively, the higher their writing proficiency will be (McDonough, 1999). More recently, the study by Lee et al. (2017) with a total of 1395 secondary Chinese EFL learners investigated secondary learners' L2 writing motivation in EFL writing and the influence of L2 proficiency, gender, and grade on learners' L2 writing motivation. In Lee et al.'s (2017) study, a significant interaction was found between L2 proficiency and grade regarding L2 writing motivation. Also, the findings reported significant difference among students from the three different bands in their L2 writing motivation, and the significant difference among learners in different grades (grades, 7, 9 and 11) in their L2 writing motivation. In general, learners were not motivated to write in English, being suggested that learners' writing environment and experience (e.g., the methods used by teachers for teaching writing) may be the possible causes of learners' low level of writing motivation. However, the findings of Lee et al.'s (2017) study revealed a significant interaction between L2 proficiency and grade in terms of L2 writing motivation (Roy's largest root: $F = 4.552$, $p < .001$, n2 = .023; Wilk's Λ: $F = 2.029$, $p = .001$, n2 = .010) when responding to the classroom writing context items ($F = 5.349$, $p < .001$, n2 = .015). Low L2 proficiency learners from different grades (7, 9 and 11) had a low level of L2 writing motivation as regards the writing context, and it is worth noting that the level of writing motivation of high L2 proficiency learners was found to decrease as the grades got higher, thus with learners in Grade 7 being more motivated to write in English than those learners in Grades 9 and 11.

Furthermore, the findings of this study by Lee et al. (2017) showed that students from the three different bands (Band 1, Band 2, and Band 3 students) differed significantly in their L2 writing motivation (Roy's largest root: $F = 16.297$, $p < .001$, n2 = .077; Wilk's Λ: $F = 9.030$, $p < .001$, n2 = .044), with those students from Band 1 scoring higher than Band 2 and Band 3 students in L2 writing motivation. In this study, it was found that more proficient learners were more motivated to write. This is an expected finding because language proficiency directly influences writing performance, and motivation has been found to be correlated with writing performance (Troia et al., 2013). A self-developed, bilingual (Chinese and English) writing motivation questionnaire was employed to measure learners' writing motivation, with the items (n =40) being adapted from already existing scales on L2 learning motivation and L2 writing motivation (see Dörnyei, 2005; Dörnyei & Csizér, 2002; Dörnyei & Ushioda, 2021; Troia et al., 2013).

In sum, the existing empirical research does point to an interaction between proficiency and writing motivation in relation to L2 writing, and motivated by the limited research on this topic, as well as on the limited research on affective and motivational IDs in L2 writing in general, the fifth aim of our study also investigated whether any writing motivation effects on CAF measures of L2 written production were moderated by proficiency.

III.4.4.3. Writing motivation and L2 writing: Moderating effects of task complexity

Few empirical studies have explored the moderating effects of TC on writing motivation and L2 writing. To the best of our knowledge, Rahimi and Zhang's (2019) study is the only study investigating the moderating effects of TC on the relationship between writing motivation and L2 writing. Rahimi and Zhang's (2019) study, with a total of 60 EFL learners (L2: English), found that the role of motivation (as well as anxiety) is more evident in the complex version of the writing task, thus supporting Robinson's (2001, 2011) Cognition Hypothesis; those learners with mastery goals were found to write with higher levels of complexity than those learner with performance goals. In this study, the Motivational Beliefs questionnaire adapted from Troia et al. (2012) was employed to measure writing motivation, and L2 writing performance was operationalised in terms of accuracy and syntactic complexity.

Given this limited research on writing motivation, task complexity and L2 writing, further research intended to shed light on this interaction between writing motivation and task complexity effects on L2 written performance is justified. Thus, motivated by this limited research on this topic, as well as by the limited research on affective and motivational IDs in general, the fifth aim of our study also investigated whether any writing motivation effects on CAF measures of L2 written production were moderated by task complexity.

III.4.4.4. Writing motivation and L2 writing: Summary

To sum up, most previous research has reported a significant positive connection between writing motivation and written performance (e.g., Jang & Lee, 2019; Rahimi & Zhang, 2019; Tahmouresi & Papi, 2021). Concerning writing motivation and proficiency, the empirical research that has investigated the interaction of writing motivation with proficiency in L2 writing performance is limited, and more research is required. For writing motivation and TC, although positive results have been obtained, the research is limited.

CHAPTER IV. INDIVIDUAL DIFFERENCES, TASK COMPLEXITY, AND L2 WRITING

This chapter provides an account of the role of cognitive task complexity (TC) in L2 writing performance. We start with a section on the relevance of looking into TC in the area of writing. We then provide a brief summary of the TC models of the Trade-Off Hypothesis (Skehan, 2009, 2014) and the Cognition Hypothesis (Robinson, 2001, 2011) reviewed in Chapter II as these have constituted the frameworks informing TC studies in writing. Previous empirical SLA-oriented L2 writing research on TC is then reviewed, with special attention to research investigating the potential interaction between TC and proficiency in L2 writing, which is the dimension relevant for our own empirical study.

IV.1. TASK COMPLEXITY EFFECTS IN L2 WRITING

We already mentioned in Chapter II that TC refers to "the cognitive load of a second language (L2) communication [or performance] task" (Sasayama, 2016, p. 231). As discussed in Chapter II, TC has been posited to have potential effects in L2 learning.

Notwithstanding TC is a central TBLT concept, it has been recently posed as an issue when applied to writing (cf. Manchón, 2014b; Tavakoli, 2014). A limitation in the field of TBLT is that oral production has been given priority over written production (Byrnes & Manchón, 2014a, 2014b; Manchón, 2014b), thus neglecting the written mode. This limitation is important if we consider the distinctive nature of the language learning potential of L2 writing (Harklau, 2002; Leow & Manchón, 2021; Manchón, 2011, 2020, 2023; Manchón & Williams, 2016; Williams, 2012). In this regard, potential language learning opportunities are represented by the use of both oral and written language (Byrnes & Manchón, 2014a, 2024b; Manchón, 2011, 2014; Manchón & Williams, 2016; Ortega, 2012; Williams, 2012); therefore, the importance of investigating language learning across modalities, and, as a consequence, the relevance of investigating task complexity effects in speaking and writing.

In accordance with these mentioned ideas, it has been argued that more mode-integrative and sensitive TBLT research is needed (Gilabert et al., 2016; Vasylets & Gilabert, 2022) and consideration should be given to more deeply understand the learning benefits that can derive from each mode, separately or in mutual interaction.

IV.2. TASK COMPLEXITY STUDIES IN WRITING: THEORETICAL FRAMEWORKS

Following general research on TC in SLA studies, much of the research on TC in writing has been guided by two influential theoretical models informing TC known as the Trade-Off Hypothesis (Skehan, 2009, 2014) and the Cognition Hypothesis (Robinson, 2001, 2011), which, as noted in Chapter II, were originally designed to account primarily for the oral mode of production rather than for written production (Byrnes & Manchón, 2014b; Tavakoli, 2014). These frameworks are best known for their competing predictions concerning the effects of TC on L2 learners' performance and learning. Until recently, the empirical evidence for Robinson`s claims has been available mainly in oral performance, with the results being rather mixed and inconclusive (Jackson & Suethanapornkul, 2013). Nevertheless, some voices have suggested that the conditions of written language could be even more beneficial than speech for the deployment of TC effects (Johnson, 2017, 2022; Vasylets et al., 2017), as writing has the potential to channel TC effects in a specifically effective way (Manchón, 2014b). This is due to the self-paced nature and visible output in writing, thus offering more possibilities of time control and recursive implementation of production processes and strategies (Byrnes & Manchón, 2014b; Manchón, 2014b; Manchón & Williams, 2016; Williams, 2008, 2012).

In addition to a body of empirical work, there have been important theoretical developments that have also tried to expand the notion of task complexity in its application to writing. Specially relevant are Johnson's (2023) and Vasylets and Marín's (2022) proposals.

Johnson (2023) examined the potential of formal knowledge of a specific genre as a resource-dispersing feature of TC in writing. In his paper, Johnson (2023) came to suggest that various types of genre may impose different cognitive demands on the L2 writer's WM resources. This led Johnson (2023) to the conclusion that formal genre-specific knowledge played a facilitating role in the writing process of translation of ideas into linguistic forms, thus resulting in facilitative effects on L2 written production of complex forms in terms of fluency and accuracy. In this respect, Johnson (2023) emphasised the demands on WM resources made by the writing process of translation and he continued to acknowledge the additional WM demands which are placed by writing in a genre in which the L2 writer is not familiar with. Tardy's (2012, as cited in Johnson, 2023) proposal suggested that "genres provide contexts for learning new lexicogrammatical features or discourse structures in a second language" (p. 5). Accordingly, Johnson (2023) noted that L2 writers' practice with the conventions and linguistic resources of various genres will automatise their lexical and syntactic retrieval of forms and they will be better able to transfer formal knowledge among genres, thus resulting in "the fluent production of complex forms that conform to the norms of the genre" (p. 5).

Along similar lines, Vasylets and Marín (2022) have proposed that writing modality (i.e., pen-and-paper versus computer-based writing) can be conceptualised as a new dimension of task complexity. In this proposal, Vasylets and Marín (2022) draw on the comparison of the general characteristics of pen-and-paper versus computer-mediated writing, the role of modality in writing theories, and the previous empirical evidence on the differential involvement of paper and computer-mediated writing in learning and performance, as a justification of the fact that writing modality could be a TC factor. Thus, given the intrinsic differences in the characteristics of pen-and-paper writing and computer-mediated writing, these writing modalities can pose different demands on cognitive resources. This justifies Vasylets and Marín' (2022) proposal that pen-and-paper versus computer-mediated writing modality can be conceptualised as a cognitive TC factor. They argued that pen-and-paper writing could be conceptualised as a simple task, whereas computer-mediated writing could be conceptualised as a complex task.

These are recent developments that so far have not informed TC studies in writing. In what follows we present a synthesis of previous work.

IV.3. TASK COMPLEXITY AND L2 WRITING: A SYNTHESIS OF RESEARCH FINDINGS

Findings of TC studies in written production are inconclusive (as reviewed in Johnson, 2017, 2022). Yet, an overall finding is that the manipulation of cognitive TC can enhance the language learning potential of L2 writing tasks, thus producing more effective linguistic behaviours in writing tasks which are complex (Manchón & Vasylets, 2019). Thus, Kuiken et al.'s (2005) study found that after manipulating resource-directing task demands, written performance during the more cognitively demanding task was more accurate, but no TC effects were observed for syntactic and lexical complexity. However, the study carried out by Ishikawa (2007) showed "significant positive effects for increased task demands on complexity, accuracy and fluency of L2 production" (as cited in Manchón & Vasylets, 2019, pp. 348-349). Similar findings were reported by Johnson (2017), who suggested that "L2 writers may respond to cognitively more complex tasks not only by producing more complex, more accurate language, but also by producing language more fluently" (as cited in Manchón & Vasylets, 2019, p. 349). We can see how the hypothesis that the decrease in fluency when increasing TC may be accompanied by an increase in accuracy and complexity of L2 written production does not apply to writing due to the fact that L2 writers' performance is enhanced in these three different measures at the same time.

Johnson's (2017) synthesis on L2 writing research on cognitive TC reported that the existing findings on the cognitive TC effects on L2 writing are inconclusive and sometimes contradictory and they offered no clear support for the theoretical perspectives of the Cognition Hypothesis (Robinson, 2001, 2011) or the Limited Attentional Capacity Model (Skehan, 2009, 2014). In fact, neither Robinson nor Skehan's TC models ever explicitly discussed if and how their theoretical predictions could apply to the L2 written mode of production. Nevertheless, Johnson (2017) acknowledged that previous findings might indicate that TC facilitates attention to the writing systems of formulation ad monitoring associated with Kellogg's (1996) WM model in L1 writing. Furthermore, Johnson (2022) recently revisited this issue, providing a more recent account of TBLT-informed L2 writing research. He concluded that replicating existing research would be recommended in order to better understand the cognitive TC effects on L2 written production.

IV.4. TASK MODALITY, TASK COMPLEXITY, AND L2 WRITING: A SYNTHESIS OF RESEARCH FINDINGS

The empirical evidence that we have about Robinson's predictions comes mainly from oral production studies and the results are mixed and inconclusive in both oral and written modes (Jackson & Suethanapornkul, 2013; Kormos & Trebits, 2011; Niwa, 2000; Révész, 2011). These studies made use of oral production tasks, whose nature is totally different from written production tasks in terms of their temporal dimension and visibility of the written text (Manchón, 2014b). In this regard, Vasylets et al. (2017) concluded that, despite the fact that the Cognition Hypothesis (Robinson, 2001, 2011) was originally designed for oral production, some of its principles were more applicable to written production compared to speech in the L2. For this reason, the proposed interaction relationship between IDs and task complexity, which could also be applied to written production, must be empirically examined. Kormos and Trebits (2012) have examined this assumption by investigating the role of linguistic ability in both oral and written tasks at different levels of complexity. The pattern in the results obtained was complex, although there was evidence of different degrees of interaction of the linguistic ability factor in writing tasks with different levels of complexity. This study, however, focused only on language proficiency. Therefore, more research is needed to determine the interaction between TC and other IDs, both cognitive and affective, in L2 writing tasks. Accordingly, although several empirical studies have been conducted on TC and L2 writing production (e.g., Vasylets et al., 2017; Zalbidea, 2017), IDs have not been examined so much in these investigations (but see Manchón et al., 2023; Michel et al., 2019; Zalbidea, 2017, for writing modality; Awwad & Tavakoli, 2022; Kormos & Trebits, 2011, for oral modality). For instance, Zalbidea's (2017) study with Spanish L2 learners investigated the effects of WM in speaking and writing as a function of TC, and the results revealed that writing was more complex and accurate than speaking, with the dimension of accuracy being the only one related to WM.

More recently, Vasylets and Gilabert (2022) synthesised some previous studies on task modality and L2 writing that have also explored TC, with the results globally reporting that the role of TC differs in speech and writing. Furthermore, as Vasylets and Gilabert (2022) noted, Kuiken and Vedder's (2011) study with a total of 135 Dutch L2 learners of Italian examined the TC effects on task modality, and the results showed that TC effects were largely the same in oral and written production. In addition, learners were found to produce fewer errors in the simple version of the task. In this study, participants performed a simple and a complex version of an argumentative task, and L2 production was assessed in terms of complexity (both lexical and syntactic) and accuracy. These findings are consistent with those found in Cho (2018), with a total of 39 Korean undergraduate EFL students. In this study, participants performed four argumentative tasks differing int their level of cognitive complexity, in both in the oral and the written mode. In this study, the TC effects were similar in both modes, and it was also found that in the complex task, learners produced less accurate and more syntactically complex language in both modes, as compared to simple tasks (as cited in Vasylets & Gilabert, 2022).

Furthemore, Zalbidea (2017) found no interactions between TC and task modality in L2 performance. However, some empirical studies (e.g., Kormos & Trebits, 2012) and Tavakoli (2014) found that TC effects were found in oral and written mode. For instance, findings in Kormos and Trebits (2012) with a total of 44 Hungarian EFL learners showed different TC effects on speech and writing. That is, learners produced more complex language in the task placing demands on conceptualization in the writing mode. On the other hand, learners produced more complex language in the task placing demands on conceptualization and more accurate language on formulation (as cited in Vasylets & Gilabert, 2022). Similarly, Tavakoli (2014) found that TC played a greater role in the oral mode, as learners produced more subordinate sentences and grammatical units of greater length in the complex task condition (as cited in Vasylets & Gilabert, 2022). Finally, Vasylets et al. (2017) found that TC effects were greater in the written mode in the complex task, with learners producing more accurate, complex and fluent language in this version of the task.

IV.5. TASK COMPLEXITY AND L2 WRITING: RESEARCH ON THE INTERACTION BETWEEN TASK COMPLEXITY AND PROFICIENCY

The aim in this PhD of examining the association between potential ID effects on the CAF dimensions of the text written by higher and lower proficiency L2 writers, and the complexity of the task to be performed, was motivated not only by the mixed and at times contradictory findings and the limited research (as well as the inconclusive nature of past research) on ID and L2 writing, but also by the consideration of previous SLA work on the interaction between TC effects on language use and L2 user's proficiency level.

General findings show that L2 learners produce more accurate texts in more complex tasks (e.g., Kuiken et al., 2005; Kuiken & Vedder, 2007). Thus, Kuiken et al. (2005) study found that after manipulating resource-directing task demands, written performance during the more cognitively demanding task was more accurate, but no TC effects were observed for syntactic and lexical complexity (except for lexical diversity). Moreover, no interaction between TC and proficiency was found in this study. However, the study carried out by Ishikawa (2007) showed "significant positive effects for increased task demands on complexity, accuracy and fluency of L2 production" (as cited in Manchón & Vasylets, 2019, p. 348-349), as well as a significant interaction between TC and proficiency. Thus, concerning complexity, more consistent findings have been reported for this measure, especially lexical complexity, given that the studies by Ishikawa (2007) and Kuiken and Vedder (2007) reported that L2 proficiency moderates the potential TC effects on the lexical complexity of L2 written production. Similar findings were reported by Johnson (2017), who suggested that "L2 writers may respond to cognitively more complex tasks not only by producing more complex, more accurate language, but also by producing language more fluently" (as cited in Manchón & Vasylets, 2019, p. 349). It can be observed that the hypothesis in oral production studies that the decrease in fluency when increasing TC may be accompanied by an increase in accuracy and complexity of L2 written production does not apply to writing due to the fact that L2 writers' performance is enhanced in these three different measures at the same time.

Manchón and Vasylets (2019) acknowledged the importance of writing tasks in L2 development. Despite their observations related to the limited research on TC and writing and the variation in research methodology in terms of considerations regarding the operationalisation of TC, participants characteristics (such as their L1, writing expertise, or L2 proficiency level), the operationalisation of the tasks and production measures used and the study design employed, Manchón and Vasylets (2019) came to the conclusion that TC might potentially enhanced language learning through writing. In addition, Manchón and Vasylets (2019) emphasised the crucial relevance of examining the interaction of variables in order to bring about learning through writing and feedback processing. In addition, Manchón and Vasylets (2019) noted that the manipulation of cognitive TC can enhance the language learning potential of L2 writing tasks, thus producing more effective linguistic behaviours in writing tasks which are complex, despite the inconclusive and mixed findings on TC and writing reported above (e.g., Kuiken et al., 2005; Ishikawa, 2007; Johnson, 2017).

Given these contradictory findings reported in the literature, we were motivated to investigate the interactive effects of IDs, task complexity, and proficiency in our study.

PART II. THE EMPIRICAL STUDY

CHAPTER V. AIMS AND RESEARCH QUESTIONS

In this chapter we begin by providing a synthesis of relevant previous work and subsequently contextualise our study in this previous research. This will lead us to the formulation of the research questions and hypotheses guiding our study.

V.1. AIMS OF THE STUDY AND MOTIVATION

The general purpose of the present study was to analyse potential independent and interactive effects of a set of cognitive (i.e., language aptitude and working memory) and affective/motivational variables (i.e., writing anxiety, writing self-efficacy, and writing motivation) and the complexity of the task on various dimensions (complexity -lexical and syntactic-, accuracy and fluency. CAF measures) of the written texts produced (in individual, paper-based writing conditions) by users of English as a second language (L2) with diverse linguistic proficiency levels (upper-intermediate and advanced). This global research can be broken up into two specific aims:

1) The first aim was to investigate potential independent and interactive effects of cognitive variables (WM and LA) on CAF measures, as well as the potential moderating role of task complexity and L2 proficiency in any observed effects.

2) The second aim was to investigate potential independent and interactive effects of affective variables (writing anxiety, writing self-efficacy and writing motivation) on CAF measures, as well as the potential moderating role of task complexity and L2 proficiency in any observed effects.

In what follows we provide the motivation for each of these specific aims.

Aim 1: Investigate the independent and interactive effects of cognitive variables (WM and LA) on CAF measures, as well as the potential moderating role of task complexity and L2 proficiency in any observed effects.

Regarding the independent and interactive effects of language aptitude, working memory, L2 proficiency and task complexity on L2 written performance although some studies have examined the independent effects of WM and/or LA as a function of either learner-related variables (basically, proficiency) or task-related variables (focusing primarily on task complexity), as detailed in the review of the literature, there is a scarcity of studies as well as contradictory findings on the interaction between LA and proficiency (e.g., Hummel, 2009; Li, 2019), LA and task complexity (e.g., Kormos & Trebits, 2012), and on both the interaction between working memory effects and task complexity (e.g., Kormos & Trebits, 2011; Zalbidea, 2017) and on the L2 proficiency-dependency of WM effects (e.g., Kormos & Sáfár, 2008; Lu, 2015; Vasylets & Marín, 2021). Furthermore, motivated by these mixed findings and the limited research on the topic (as also reviewed in Ahmaddian & Vasylets, 2021; Granena, 2019, 2023; Kormos, 2023; Li, 2022, 2023; Papi et al., 2022), our first aim was additionally motivated by the consideration of previous empirical evidence on (a) the role of task complexity in L2 written performance (e.g., Johnson, 2022; Vasylets et al., 2017; Zalbidea, 2017); (b) the proficiency-dependency of L2 users' perception of task complexity (Sasayama, 2016) and of task complexity effects (e.g., Ishikawa, 2007; Kuiken et al., 2005; Kuiken & Vedder, 2008); and as mentioned above, (c) the limited research and (at times contradictory) available empirical findings on the task complexity-dependency of WM effects (e.g., Kormos & Trebits, 2011; Zalbidea, 2017), and on the interaction between L2 proficiency and WM effects (Kormos & Sáfár, 2008; Lu, 2015; Vasylets & Marín, 2021) in the writing domain.

Aim 2: Investigate potential independent and interactive effects of affective variables (writing anxiety, writing self-efficacy and writing motivation) on CAF measures, as well as the potential moderating role of task complexity and L2 proficiency in any observed effects.

With our second research aim we intended to add to previous work on the role of affective/motivational factors in L2 writing. More specifically, we intended to contribute to and expand on (a) the limited previous empirical research on both the interaction between writing anxiety effects and task complexity (e.g., Rahimi & Zhang, 2019; Révész, 2011; Robinson, 2007b; Trebits, 2016; Zabihi et al., 2018), and on the mediation of proficiency in writing anxiety effects (e.g., Rodríguez-Sabiote et al., 2017); (b) the limited previous empirical findings on the interaction between writing self-efficacy and proficiency (e.g., Yilmaz, 2010), and on the mediation of task complexity in self-efficacy effects; (c) the scarce research on the interaction between L2 writing motivation and task complexity, and on the influence of proficiency on L2 writing motivation effects (e.g., Lee et al., 2017) in L2 written performance.

Our decision to focus on the three affective/motivational variables of writing anxiety, writing self-efficacy and writing motivation was based on theoretical considerations regarding the role of affective factors on task performance (essentially, Robinson, 2011) and on empirical studies of affective/motivational individual differences (IDs) and L2 writing (e.g., Fitrinada et al., 2018; Jang & Lee, 2019; Rahimi & Zhang, 2019; Soleimani et al., 2020; Tahmouresi & Papi, 2021; Zabihi, 2018). This research suggests that there is a connection between L2 writers' affective IDs and their written performance, although few have investigated whether such effects may be moderated by task complexity factors. Those that have investigated task complexity effects have found that the role of affective/motivational factors (writing motivation and writing anxiety) was more clearly manifest in complex L2 writing task performance (Rahimi & Zhang, 2019). This confirms Robinson's (2011) prediction that the role of affective/motivational individual differences related will be more apparent in learners' performance of cognitively complex tasks.

In the following section, we will provide the research questions and hypotheses that guided our study.

V.2. RESEARCH QUESTIONS AND HYPOTHESES

Based on the above-described theoretical considerations and on the empirical research reviewed in preceding sections, the research questions and hypotheses that guided our study were as follows:

RQ 1: What are the potential independent and interactive effects of working memory, L2 proficiency, and task complexity on L2 written performance in terms of CAF measures?

1.1. To what extent does working memory affect L2 written performance, operationalised in terms of complexity, accuracy, and fluency indices?
1.2. Do any observed working memory effects on L2 written performance vary as a function of writers' L2 proficiency?
1.3. Do any observed working memory effects on L2 written performance vary as a function of the cognitive complexity of the writing task?

Given the existence of solid theoretical justification (Hayes, 2012; Kellogg, 1996, 2001. See also Olive 2022) and empirical evidence (albeit tentative because of its mixed and diverse nature), we hypothesised a positive connection between WM and L2 written performance, as assessed by CAF indices (RQ 1.1.). Given the contradictory theoretical predictions (Hambrick & Engle, 2002) and the mixed nature of empirical findings (Komos & Sáfár, 2008; Lu, 2015; Vasylets & Marín, 2021), a non-directional hypothesis was formulated concerning the role of WM in L2 written performance as mediated by L2 proficiency. Therefore, we hypothesised that L2 proficiency would mediate WM effects on L2 writing (RQ 1.2.). In accordance with Robinson's (2011) Cognition Hypothesis regarding the likelihood of a more prominent role of IDs within complex tasks and taking into consideration the extant literature on the interaction between WM and TC (e.g., Kormos & Trebits, 2011; Michel et al., 2019; Zalbidea, 2017), we hypothesised that WM would play a more significant role in the complex task (RQ 1.3.).

RQ 2: What are the potential independent and interactive effects of language aptitude, L2 proficiency, and task complexity on L2 written performance in terms of CAF measures?

2.1. To what extent does language aptitude affect L2 written performance, operationalised in terms of complexity, accuracy, and fluency indices?
2.2. Do any observed language aptitude effects on L2 written performance vary as a function of writers' L2 proficiency?
2.3. Do any observed language aptitude effects on L2 written performance vary as a function of the cognitive complexity of the writing task?

Given the positive nature of previous empirical findings (Mujtaba et al., 2021; Yang et al., 2019), we hypothesised a positive link between LA and L2 writing performance, as assessed by CAF measures (RQ 2.1.). Provided the existence of previous empirical findings (Vasylets & Marín, 2021) reporting differential involvement of cognitive resources in L2 writing depending on the level of L2 proficiency, we hypothesised that L2 proficiency would moderate the effects of LA on L2 written performance (RQ 2.2.). In accordance with Robinson's (2011) Cognition Hypothesis regarding the likelihood of a more prominent role of IDs within complex tasks, we hypothesised that LA would play a more significant role in the complex task (RQ 2.3.).

RQ 3: What are the potential independent and interactive effects of writing anxiety, L2 proficiency, and task complexity on L2 written performance in terms of CAF measures?

3.1. To what extent does writing anxiety affect L2 written performance, operationalised in terms of complexity, accuracy, and fluency indices?
3.2. Do any observed writing anxiety effects on L2 written performance vary as a function of writers' L2 proficiency?
3.3. Do any observed writing anxiety effects on L2 written performance vary as a function of the cognitive complexity of the writing task?

Given the negative effects of anxiety on L2 written performance reported in previous empirical findings (Cheng, 2004; Fitrinada et al., 2018; Rahimi & Zhang, 2019; Soleimani et al., 2020; Tahmouresi & Papi, 2021; Trebits, 2016; Xiao & Wong, 2014; Zabihi, 2018), we hypothesised a negative connection between writing anxiety and L2 written performance (RQ 3.1.). The existence of empirical evidence reporting a negative relationship between anxiety and L2 proficiency (Teimouri et al., 2019) and the absence of interactive effects between L2 proficiency and writing anxiety in relation to L2 writing quality (Zhang, 2019) make it feasible to hypothesise no interaction between writing anxiety and L2 proficiency in L2 writing (RQ 3.2.). In accordance with Robinson's (2011) Cognition Hypothesis predicting a more prominent role of affective factors in the more complex tasks, we hypothesised that writing anxiety would play a more significant role in the complex task (RQ 3.3.).

RQ 4: What are the potential independent and interactive effects of writing self-efficacy, L2 proficiency, and task complexity on L2 written performance in terms of CAF measures?

4.1. To what extent does writing self-efficacy affect L2 written performance, operationalised in terms of complexity, accuracy, and fluency indices?
4.2. Do any observed writing self-efficacy effects on L2 written performance vary as a function of writers' L2 proficiency?
4.3. Do any observed writing self-efficacy effects on L2 written performance vary as a function of the cognitive complexity of the writing task?

Given the existence of solid theoretical justification (Social Cognitive Theory, Bandura, 1986) and previous empirical evidence reporting a positive link between writing self-efficacy and L1 writing performance (e.g., Klassen, 2002; Pajares, 2003; Pajares & Valiante, 2006; Prat-Sala & Redford, 2012; Schunk, 2003), we hypothesised a positive connection between writing self-efficacy and L2 writing performance (RQ 4.1.). Given the existence of solid theoretical justification (Social Cognitive Theory, Bandura, 1986) and empirical evidence (albeit tentative because of the mixed nature of the results), we hypothesised writing self-efficacy would interact with L2 proficiency in L2 writing (RQ 4.2.). In accordance with Robinson's (2011) Cognition Hypothesis predicting a more prominent role of affective factors in the more complex tasks, we hypothesised that writing self-efficacy would play a more significant role in the complex task (RQ 4.3.).

RQ 5: What are the potential independent and interactive effects of writing motivation, L2 proficiency, and task complexity on L2 written performance in terms of CAF measures?

5.1. To what extent does writing motivation affect L2 written performance, operationalised in terms of complexity, accuracy, and fluency indices?
5.2. Do any observed writing motivation effects on L2 written performance vary as a function of writers' L2 proficiency?
5.3. Do any observed writing motivation effects on L2 written performance vary as a function of the cognitive complexity of the writing task?

Given the existence of previous empirical findings reporting positive effects of writing motivation on L2 written performance (e.g., Jang & Lee, 2019; Rahimi & Zhang, 2019; Tahmouresi & Papi, 2021), we hypothesised a significant positive connection between writing motivation and L2 written performance, as assessed by CAF measures of L2 written production (RQ 5.1.). Empirical evidence (albeit tentative because of its limited nature) makes it feasible to hypothesise an interaction between L2 proficiency and writing motivation in relation to L2 writing (RQ 5.2.). In accordance with Robinson's (2011) Cognition Hypothesis predicting a more prominent role of affective factors in the more complex tasks, we hypothesised that writing motivation would play a more significant role in the complex task (RQ 5.3.).

In the next chapter we provide a detailed account of the methodology that we employed in order to answer the research questions guiding this doctoral dissertation.

CHAPTER VI. METHODOLOGY

VI.1. INTRODUCTION

The aim of this chapter is to provide a detailed account of the methodological decisions taken in order to answer the research questions guiding this doctoral dissertation. Therefore, we first describe the participants and the context in which the study was carried out, which is followed by the report of the data collection, data coding and analysis procedures. Prior to that, we provide an overview of the design and the key elements of the study.

As detailed in the previous chapter, the aim of our study was to explore the independent and interactive effects of language aptitude, working memory, writing anxiety, writing self-efficacy and writing motivation on L2 written performance, (operationalised in terms of lexical and syntactic complexity, accuracy, and fluency -CAF indices), as well as the potential mediation of L2 proficiency and task complexity on any observed effects. Accordingly, our study was planned as a within-between-participant factorial design (i.e., a repeated-measures counterbalanced design), with (i) task complexity (two levels of task complexity -simple vs. complex) as the within-participant variable, and (ii) L2 proficiency, language aptitude, working memory, writing anxiety, writing motivation, and writing self-efficacy as between-participants variables. The outcome variable was L2 writing performance, assessed in terms of the CAF measures. Undergraduate students from an English Studies degree at a public university in Spain were asked to perform the simple and complex versions of the “Fire-Chief” writing task (Gilabert, 2007). The established hypotheses were tested in the repeated-measures, counterbalanced design mentioned above. Regarding task complexity, we followed Robinson’s (2007) suggestions for task design and finally opted for a task complexity variable that would be (a) useful for real-world task performance, and (b) operationally feasible (as cited in Vasylets et al., 2017). Task complexity was operationalised in terms of the resource-directing variable of +/- reasoning demands, and tasks were counterbalanced to avoid unwanted order effects. Participants completed the Oxford Placement Test, a series of ID questionnaires measuring writing anxiety (Cheng, 2004), writing motivation (Waller & Papi, 2017) and self-efficacy (Sanders-Reio, 2010), and tests measuring working memory (n-back test; Kane et al., 2007) and language aptitude (LLAMA tests; Meara, 2005).

VI.2. CONTEXT AND PARTICIPANTS

The study was carried out at the University of Murcia (Spain). A total of 76 participants (male n =17, female n =59) participated in the study. All participants were undergraduate students majoring in English Studies with different L2 proficiency levels (ranging from upper-intermediate to advanced) as measured by the Oxford Placement Test (Allen, 1992. See VI.3.3.). As a reward for taking part in the study, the participants were awarded credit points in one of their degree courses. Prior to their participation in our study, all participants signed a consent form. They were told that the data would be anonymised and kept confidential.

The majority of participants (n =73) were L1 speakers of Spanish, and none of the participants were native speakers of English. There were participants from Ukraine (n =1), Italy (n =1), Germany (n =1) and Poland (n =1). At the time of testing, all participants were residing in Spain. Our participants' mean age was 20 (ranging from 17 to 25; age: M = 19.8, SD = 1.9). The participants' level of proficiency was measured using the standardised Oxford Placement Test (OPT, Allen, 1992). Participants completed the Grammar section of the pen-and-paper version of the Oxford Placement Test (OPT). According to the scores obtained in the OPT, the participants' levels of proficiency ranged from upper-intermediate B2, to advanced C1 level, according to the Common European Framework of Reference for Languages (CEFRL).

VI.3. INSTRUMENTS AND PROCEDURES

VI.3.1. Overview

Given the independent, moderator, and outcome variables of the study, the data collection instruments employed were a (more/less complex) writing task (see VI.3.2.; see also Appendix 1 and Appendix 2), a proficiency test (see VI.3.3.), and various individual difference tests (aptitude, working memory, motivation and self -efficacy tests. See VI.3.4.). All instruments and procedures are fully explained in the sections that follow. Below we offer an overview of the entire data collection procedures. See also Table 8 for an outline of the independent variables used in our study and their corresponding instruments used to measure them.

Table 8. Operationalisation and measurement of the independent variables used in our study.

Independent variable	Test
L2 general proficiency	Oxford Placement Test (OPT) (Allen, 1992)
Task complexity	Simple and Complex "Fire-Chief" task (Gilabert, 2007)
Working memory	*N*-back task (Kane et al., 2007)
Language aptitude	LLAMA tests battery (LLAMA_B, LLAMA_D, LLAMA_E, LLAMA_F) (Meara, 2005)
Writing anxiety	Second Language Writing Anxiety Inventory (SLWAI; Cheng, 2004) (15 items adapted from the original SLWAI questionnaire by Cheng, 2004)
Writing self-efficacy	Writing Self-Efficacy Scale (Sanders-Reio, 2010), an expansion of Zimmerman and Bandura's (1994) Writing Self-Regulatory Efficacy Scale (60 items)
Writing motivation	L2 Writing Motivation Questionnaire from Waller & Papi (2017) (7 items on writing motivation taken from the original questionnaire by Waller & Papi, 2017)

The study took place in the first term of the 2019-20 academic year. As shown in Figure 5, the data collection entailed five 50-minute sessions, which were distributed over a total of four days. All phases of the data collection were completed during one of the students' regular classes.

Figure 5. Data collection procedure: Overview.

In the first session (day 1), with a duration of 50 minutes, the participants were invited to complete the classical pen-and-paper version of the OPT Grammar test (Allen, 1992), and then they all signed the consent form to participate in the study. The OPT test takes up to 50 minutes to complete, but the majority of the participants finished it within a range of 20 and 30 minutes. In session two (day 2), the following day, the writing tasks were administered to the participants individually in a quiet room at the university. The participants were asked to produce a written text in response to the "Fire-Chief" task (Gilabert, 2007) and were divided into two groups with half of the students completing the simple version of the task, and the remaining half completing the complex version. Task versions were counterbalanced to control for any possible order or practice effect: participants were provided with a DIN A4 coloured picture/task prompt [simple or complex]) and a blank writing sheet of paper on which to write their texts. The researcher read the instructions in the participants' L2, i.e., English, and then asked participants to complete the task in their L2. The instructions were written in English and participants had them with them during the completion of the task. The task was performed by hand and no access to dictionaries or any other external sources was available. To perform the task, participants received the following specific instructions:

1) Decide which actions you would take in order to save as many people as possible.
2) Describe and explain the order in which they would take the actions to rescue said people.
3) Justify why they would take these actions and this particular order.

Participants were asked to read the instructions carefully and to familiarise themselves with the picture in order to get an overall idea of the situation in the task before starting to write their compositions.

Participants were given a total of 50 minutes to compose their texts and they were not given pre-task planning time so as to ensure that the relationship between task complexity, language proficiency and the individual differences was not mediated by strategic planning. Time on task ranged from 5 to 33 minutes. Participants were not instructed to write a minimum or maximum of words for the simple and complex versions of the task.

In the third 50-minute session (day 3), which took place in the computer lab the following week, participants were invited back in order to complete a first set of individual difference tests targeting the cognitive individual differences that constituted our independent variables, thus including a battery of LLAMA language aptitude tests (Meara, 2005) and a working memory *n*-back test (Kane et al., 2007). In the first term of the 2018-19 academic year, both tests were piloted with a group of 18 participants. Both tests were carried out on a computer at the university and any student who could not provide his/her own laptop for the session was provided with a university laptop. First, participants started with a range of LLAMA tests (Meara, 2005) to measure their language aptitude. The majority of the participants finished the LLAMA tests within 25 minutes. As we mentioned above, these tests were carried out on a computer and they were taken in a university's room. The LLAMA subtests were completed individually, and they were taken by the participants in the following order: B, D, E and F. At the beginning of this session and for each LLAMA test, the researcher provided clear written and spoken instructions in Spanish (i.e., the L1 of the majority of participants) based on the LLAMA manual (Meara, 2005) before participants do each one of the LLAMA tests, and she was available during the entire session in case participants had questions on the tests and she re-explained the tests individually if it was necessary. Second, after completing the LLAMA tests, participants were asked to complete the working memory test known as the *n*-back task (Kane et al., 2007), with all the instructions appearing on the screen. To complete this test, participants were provided with a series of stimuli one-by-one, and they had to respond to this stimulus on the screen. In our study, we chose a 3-back task with 20 trials. Therefore, for each stimulus, participants were asked to decide whether or not the current stimuli they were seeing on the screen is the same as the one presented 3 trials ago. They were asked to press the M key if the stimulus was the same as 3 trials ago, and the N key if not. It took between 5 and 10 minutes to complete the WM test.

The fourth session (day 3) also took place in the computer lab on the same day as the third session and involved the collection of affective/motivational ID data through the completion of the second set of ID questionnaires that corresponded to the affective and motivational variables in the study, thus including writing anxiety, writing self-efficacy and writing motivation. In the first term of the 2018-19 academic year, these questionnaires measuring the three affective/motivational variables in our study were piloted with a group of 18 participants, the same group of participants with whom the cognitive tests (i.e., the battery of LLAMA language aptitude tests [Meara, 2005], and the working memory *n*-back test [Kane et al., 2007]) were piloted. The questionnaires were completed in the following order. First, writing anxiety was measured by the Second Language Writing Anxiety Inventory (SLWAI) (Cheng, 2004), with 15 items adopted from the original SLWAI questionnaire developed by Cheng, 2004 (all of which are answered on a five-point Likert Scale, ranging from 1 'totally disagree' to 5 'totally agree'), with a total duration of 15 minutes (the majority of the participants finished this writing anxiety questionnaire within 15 minutes).

Second, writing self-efficacy was measured by the newly developed Writing Self-Efficacy Scale (Sanders-Reio, 2010), with 60 items and a total duration of 20 minutes (it took between 10 and 20 minutes to complete this writing self-efficacy questionnaire). Finally, L2 writing motivation was measured by the L2 Writing Motivation Questionnaire from Waller and Papi (2017), with the 7 items measuring writing motivation adopted from the original questionnaire developed by Waller and Papi (2017), and a total duration of 10 minutes; for the completion of the 7 items assessing writing motivation, participants finished this writing motivation questionnaire within a range of 2-5 minutes. These three tests consisted of a set of Likert scale questionnaires ranging from 1 to 5 (from totally disagree to totally agree). All participants received detailed instructions and information about how to answer the ID questionnaires employed for this session of the data collection. Participants were asked to answer the questions truthfully and the instructions highlighted the fact that there were no right or wrong answers.

The fifth and final session (day 3) took place on the same day as the third and fourth sessions. This final session consisted in inviting the participants back to complete their second composition, with tasks being counterbalanced between this and the first writing session. This time, any student who had completed the complex task in the first writing session, was asked to complete the simple task and vice versa; therefore, counter-balancing the complexity of the tasks by providing all participants with the opportunity to complete both versions of the writing prompt. By using the counterbalancing technique as a way of dealing with order effects, the participant sample is divided in half, with one half of participants completing the two conditions of the experimental task in one order and the other half of participants completing the conditions in the reverse order. This way the same participants take part in each condition, which means that each condition of the task includes the same group of participants.

In the following sections we describe in more detail the instruments used in the study.

VI.3.2. The Writing Task

The experimental task used was the "Fire Chief" task (Gilabert, 2007), of which there are 2 versions which differ in terms of cognitive task complexity, operationalised as reasoning demands. The "Fire-Chief" task is a problem-solving, picture-based writing task in which participants are presented with an image of a burning building from which numerous people need to be rescued (for the prompt of the task, see Figure 6 and Figure 7 for the simple and complex version, respectively). According to the instructions in Gilabert (2007), in order to complete the task participants are asked to look at the image of this burning building and provide a description in which they had to decide and explain (i) which actions they would take in order to save as many people as possible from the burning building; (ii) in what sequence they would rescue said people; and (iii) why they would take these actions. The instructions of the writing task are identical in both the simple and complex conditions.

Accordingly, and following Gilabert (2007), task complexity was experimentally manipulated by increasing the number of requirements to be considered during the decision-making process when taking actions in order to save as many people as possible. The structure of the task was exactly the same in both the complex and simple versions of the task, as both versions of the task represent a visual prompt with the short instructions in English. (i.e., participants' L2). The only distinction between the simple and the complex version is in terms of the visual cues. In this respect, the simple version represents a simple scenario of a problem-solving situation whereas a complex scenario of the problem-solving situation is represented in the complex version of the task. The two versions of the task were administered and completed in a counterbalanced manner for each group of participants in order to avoid unwanted practice effects (Révész, 2011).

In terms of the specific operationalisation of task complexity, Gilabert (2005) argues that the simple version of the "Fire-Chief" task (Gilabert, 2007) did not require participants to know the specific roles played by those human characters who are trapped in the building as these people do not have particular roles and are exposed to the similar level of risk. In contrast, in the complex version of this task, specific roles (e.g., a pregnant woman with children, an elderly man and an injured person) are held by those people shown in the picture prompts and it should be noted that the decisions taken previously may condition the following ones. In other words, in the simple version of the task there is no necessary sequence or order in which steps must be followed whereas the complex version of the task requires participants "to follow a strictly chained sequence in which one step must be performed before another" (Robinson, 2007b, p. 7). Moreover, the resources of which participants can make use to rescue those people in the picture are much more limited in the complex version of the "Fire-Chief" task (Gilabert, 2007) than in the simple one, in which there are plenty of resources (two fire-trucks and a helicopter) and the situation is not critical. In the complex version of the task, in contrast, there are less resources (only one fire-truck) and the situation is critical due to the fact that the fire is getting closer to people. Therefore, in the represented problem-solving scenario in the simple version of the task, the connection between the factors that are involved is loose, and the decisions required by the task (i) are not constrained by a cause-and-effect relationship, and (ii) are not time-dependent. By contrast, the complex version of the task is expected to pose higher cognitive demands on the learners.

Additionally, in the problem-solving scenario represented in the complex task, complex relations between the involved factors are created and the task is made dynamic and time-dependent. Consequently, these two versions of the "Fire-Chief" writing task (Gilabert, 2007) are thought to pose different degrees of complexity to learners. In the complex task, all these already mentioned factors are expected to make learners prioritise and clearly justify the actions that they will take in order to save as many people as possible and the sequence that they have decided to follow, thus making a greater effort at mental computation related to reasoning. In order to successfully complete this task, the participants not only had to rely on their language skills, but they also had to use their decision-making skills to decide which actions they would take in order to save as many people as possible, the sequence in which they would carry out those actions, and the justification as to why they would take these actions and order.

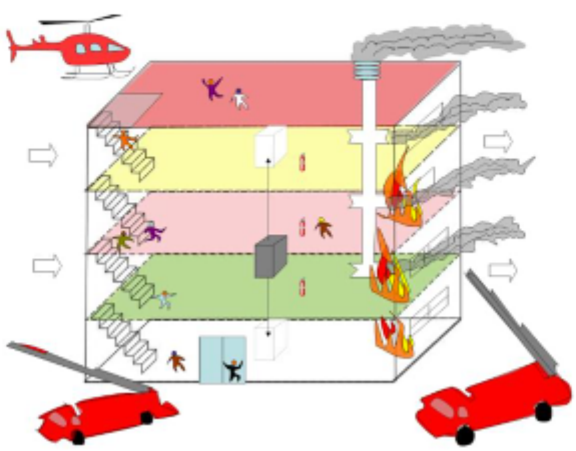

Figure 6. "Fire-Chief" Simple task (adapted from Gilabert, 2007).

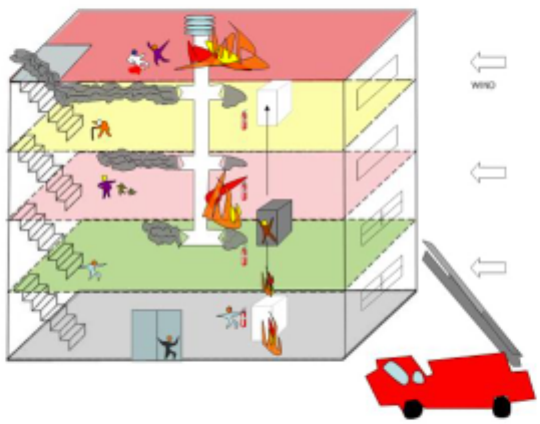

Figure 7. “Fire-Chief” Complex task (adapted from Gilabert, 2007).

The “Fire-Chief” task (Gilabert, 2007) qualifies as a task since there is a communicative goal to resolve and meaning is primary (Skehan, 1998), thus resembling a real-world language task. In fact, the design of the “Fire-Chief” task (Gilabert, 2007) is based on a needs analysis (Gilabert, 2005) in which a team of experts on the domain of crisis management in public relations made a description of the way in which scenario planning works when a situation of crisis occurs and it has to be managed. Therefore, teams of experts together with emergency teams who are non-expert on this domain of crisis management in public relations gather in order to make predictions about potential institutional crises and those communicative plans that must be elaborated in case of crisis and the related actions that must be followed according to these communicative plans. It should be noted that during scenario planning, the team of experts are responsible for carrying out an analysis about what makes a problem-solving task more or less difficult (e.g., combining events and people who are involved, and the different levels of risk) (Vasylets, 2017). Quesada et al. (2005) stated that a complex problem-solving task is: “(1) dynamic, because early actions determine the environment in which subsequent decisions must be made and features of the task environment may change independently of the solver’s actions; (2) time-dependent, because decisions must be made at the correct moment in relation to environmental demands; and (3) complex, in the sense that most variables are not related to each other in a one-to-one manner” (as cited in Gilabert & Barón, 2013, p. 51).

The rationale for selecting this decision-making problem-solving "Fire-Chief" task (Gilabert, 2007) for our study rests on several considerations. First, this task was selected as it has been previously used (and found to be effective, feasible and relevant to the targeted student population in our research) in several other studies conducted within our research team (Cerezo et al., 2019; Vasylets et al., 2017) as well as in a number of previous investigations (e.g., Gilabert, 2007; Salimi & Dagashpour, 2012; Shiau & Adams, 2011). Second, this task has been empirically validated in terms of the cognitive complexity of each version of the task (Gilabert, 2007): by using dual-task methodology and self-ratings, it was found by Révész et al. (2016) that the complex version of the "Fire-Chief" task imposed a higher cognitive load in comparison with its counterpart (i.e., the simple version of the task). Participants in Révész et al.'s (2016) study performed the tasks in the oral mode, but the results obtained are thought to be relevant for the task implementation in the written mode in our study. Accordingly, Vasylets et al. (2017) also used the "Fire-Chief" task (Gilabert, 2007) in both modalities, i.e., oral and written, and their participants were invited to self-assess the cognitive load of the task by means of a 9-point Likert scale (as cited in Manchón et al., 2023). The findings in Vasylets et al.'s (2017) study revealed that participants rated the cognitive load of the complex task significantly higher than that of the simple task in both oral and written modalities (as cited in Manchón et al., 2023). Hence, these findings provide evidence that the "Fire-Chief" task (Gilabert, 2007) is empirically validated for its use in both the oral and written modes (Vasylets et al., 2017, as cited in Manchón et al., 2023).

Moreover, we assumed that using a task that includes a clear aim, with the only difference being on the cognitive load of the task would enable the written output to be interpreted in a more equal manner, as opposed to what may be the outcome of a more open-ended task, such as an essay for instance. Thirdly, we chose this task because Foster and Skehan (1996; Skehan & Foster, 1997), in different studies investigating various task types, found that a "decision-making" task yielded the most consistent patterns for the general linguistic measures: accuracy and linguistic complexity (as cited in Révész, 2011, p. 169). Lastly, we selected this task due to the fact that decision-making tasks are common in communicative classrooms and are, in fact, frequently used in the participants' English language classes.

VI.3.3. Measure of L2 Proficiency: Oxford Placement Test (Allen, 1992)

The participants' level of L2 proficiency was measured using the pen-and-paper version of the standardised Oxford Placement Grammar Test (OPT) (Allen, 1992), which is a standardised, reliable proficiency test that allows to establish correspondence with the CEFR levels.

The Oxford Placement Test (OPT) (Allen, 1992) is assumed to measure learners' L2 explicit knowledge. As mentioned above, the OPT was administered to the participants in the first data collection session, and it took between 20 and 30 minutes to be completed, although participants were given 50 minutes to complete it. We used the pen-and-paper version of the grammar section of the OPT consisting of 100 questions on grammar knowledge, including fill-in-the-gap exercises and multiple-choice questions (a maximum score of 100), which assess learners' proficiency level according to the Common European Framework of Reference for Languages. More specifically, the Grammar section of the OPT requires learners to select the appropriate answer to three-option multiple-choice items targeting a range of English grammatical structures or elements including prepositions, tense, aspect, or gender and number agreement. The scoring system of the test allows to establish an equivalence between the test scores and the levels of Common European Framework of Reference (CEFR) (Council of Europe, 2001), i.e., the results obtained from the test can range from an A1 level to a C2 level. The participants obtained an average proficiency score of 77.48 (*SD* = 9.59), with the OPT scores ranging from 45 to 95, which corresponded from B2 to C1.

VI.3.4. Individual Differences Tests and Their Analysis

Participants completed a battery of cognitive and affective IDs tests, as detailed in the following sections.

VI.3.4.1. Tests of language aptitude: LLAMA tests (Meara, 2005)

The participants were asked to complete a range of LLAMA tests (Meara, 2005) to measure their language aptitude (LA) and hence be able to assess which dimension(s) of LA contributed to the overall L2 writing performance. These four LLAMA tests (i.e., LLAMA B, LLAMA D, LLAMA E and LLAMA F) were completed in a computer room at the University of Murcia.

We selected the LLAMA Tests (Meara, 2005) as the LA testing instrument as these tests have been widely used in numerous empirical studies (e.g., Artieda, & Muñoz, 2016; Bokander & Bylund 2020; Granena, 2019; Rogers et al., 2017; Yalçın et al., 2016) and have proven to be a reliable instrument for testing LA irrespective of leaners' first L1. Each LLAMA test corresponds to a specific item considered to be representative of a learner's language aptitude and, as we have mentioned above, it includes the LLAMA_B which relates to vocabulary learning, LLAMA_D which corresponds to sound recognition, LLAMA_E which measures sound-symbol correspondence and, finally, LLAMA_F which is related to students' grammatical inference. Previous studies on LA in L2 writing have mainly focused on measuring just one component of LA: namely, language analytic ability. In contrast, we measured the four components of LA, including the ability to match and memorise sound-written symbol correspondence (measured with LLAMA_E).

The instructions for completing the four subtests were taken from the LLAMA Manual (Meara, 2005) and the LLAMA subtests were taken in the following order: B, D, E and F. At the beginning of the session, for each LLAMA test, the researcher provided careful written and spoken instructions in Spanish (i.e., the L1 of the majority of participants) based on the LLAMA manual (Meara, 2005). The four LLAMA tests "were designed to be independent of test takers' L1 by using picture stimuli along with words derived from a northwest British Columbian indigenous language of Canada assumed to be unknown to most people" (Bokander & Bylund, 2020, p. 12), and it is important to mention that the LLAMA tests report only a total percentage correct score for each subtest (Bokander & Bylund, 2020).

The first test (LLAMA_B) is a vocabulary learning task that measures rote memory (see Figure 8) in which test takers are asked learners to memorise the associations between shapes and sound combinations. More specifically, it presents subjects with twenty objects on the screen for which they had two minutes to learn their names (i.e., to learn word-picture pairings; names are visible when a participant clicks on an image). Once this learning phase is over, in the test phase, subjects are then tested on their knowledge and are asked to identify the object (i.e., the picture) that corresponds to the word presented on screen by selecting one of the twenty picture stimuli. Scores are rewarded for each correct answer (five points) and final scores can range from 0 to 100.

Figure 8. LLAMA_B. Ability to learn sign-meaning associations. Source: Meara (2005).

The second test (LLAMA_D) is a sound recognition task which measures phonetic recognition (see Figure 9) where test takers listen to some syllables and subsequently have to discriminate between old and new syllables. More specifically, in the learning or exposure phase, test takers listen carefully to a sequence of 10 sounds (i.e., ten short spoken phrases) based on the names of objects in an unknown language (i.e., in a British Columbian Indian language). In the following testing phase, students listen to another set of sounds (a total of 30 sounds), which includes both previously heard (i.e., familiar) sounds in the learning phase, as well as new sounds they had not heard before. No time is allowed to study test materials and the sound sequences were only played once, one after the other. In this testing phase, subjects are asked to indicate when they hear a sound that they have heard in the learning phase (thus clicking on a happy face as they recognised the sound) and when they do not hear a sound that has not been heard before (thus clicking on a sad face as they did not recognise the sound) (this is a two-choice forced response format). In other words, participants have to decide which of 30 spoken phrases are familiar from the exposure phase and which are new because they have not been heard before. The LLAMA_D stage takes around five minutes and again scores are recorded between 0-100, with five points rewarded for each correct answer as well as penalisations for guessing.

Figure 9. LLAMA_D. Ability to recognise repeated sounds. Source: Meara (2005).

The third test (LLAMA_E), a sound-symbol correspondence task (see Figure 10) which measures sound-symbol associations, works in a similar way to LLAMA_B. In this test, participants are given two minutes (in the practice phase) to click on a series of symbols, this time 24 buttons, and listen to the spoken syllable that corresponded to each button. In the following testing phase, subjects hear spoken syllables and are asked to decide which of the two buttons (spellings) corresponded to the sound heard (this is a two-choice forced response format). Overall, for this test, learners memorise symbols and their pronunciations, and they have to connect the spoken syllables to alphabet-like symbols. Again, five points are rewarded for correct answers. However, in this subtest, five points are also deducted for any incorrect answers.

Figure 10. LLAMA_E. Ability to learn sound-symbol correspondence. Source: Meara (2005).

Finally, in the fourth test (LLAMA_F), a grammatical inferencing task (see Figure 11) which measures inductive language learning ability/language analytic ability, learners see pictures and sentences describing these pictures and learn grammar rules. More specifically, in the learning phase, subjects were presented with a picture which depicted a variety of shapes and objects. Alongside this image, there was an artificial sentence in an unknown language. Participants had five minutes to view the images and their corresponding sentence before moving on to the testing phase. Subjects were then shown one image and two possible sentences and had to decide which sentence best represented the image (this is a two-choice forced response format). Overall, in this LLAMA test, participants have to work out (i.e., infer or induce) the grammatical relations or rules in a language unknown to them by studying pictures and sentences which describe these pictures (this set of language materials is presented visually). Again, five points are rewarded for corrected answers and five points deducted for incorrect answers, with all LLAMA tests scoring from 0 to 100.

Figure 11. LLAMA_F. Grammar inferencing ability. Source: Meara (2005).

VI.3.4.2. Measure of working memory capacity: N-back task (Kane et al., 2007)

To assess working memory (WM), we employed the *n*-back working memory test (Kane et al., 2007), with a total duration of 10 minutes. We used the web-based service PsyToolkit https://www.psytoolkit.org/ (Stoet, 2010, 2017) to set up and run our online experiment. Participants were asked to access it online in order to complete the experiment, and then the data was downloaded in spreadsheet format after collection. We selected PsyToolkit because (i) it is a free resource, which allowed to resolve financial limitations; (ii) it is specifically designed for running online questionnaires and cognitive psychological; and (iii) the technical barriers are minimal in the sense that technical issues are handled by the PsyToolkit server automatically. The computerised version of the *n*-back test was selected over other WM tests since it taps into the maintenance and temporary storage, continuous updating, and processing of information in WM (Gajewski et al., 2018), which represent the functionality of WM relevant for writing. The *n*-back working memory test has been used and validated in previous cognitive research in psychology and neuroscience fields (e.g., Goo, 2012; Yilmaz, 2013), and has been found to be an appropriate instrument for measuring WM (see Conway et al., 2005; Jaeggi et al., 2010; Kane et al., 2007).

Similar to other WM test used in previous research (e.g., Kim et al., 2021), the *n*-back working memory test consists of providing participants with a sequence of stimuli one-by-one (each lasting a few seconds) in the form of letters, and they have to respond to this stimulus on the screen. It should be noted that the higher the number of trials, the more difficult the task becomes. In our study, we chose a 3-back task with 20 trials. Therefore, for each stimulus, participants were required to decide whether or not the current stimulus they were presented with on the screen was the same letter they had viewed three trials previously (3-back test); that is, the subject had to indicate when the stimulus on screen corresponded to the stimulus he/she had seen 3-n steps earlier in the sequence (see Figures 12 and 13 for the on-screen instructions for the *n*-back task). For example, a 3-n back sequence could be the following: A B S D **B** E **D** P C **D** E **C**. The total stimulus set in the 3-back is 15 stimuli (letters) and each stimulus was presented for maximally 2000 milliseconds. A new stimulus was presented every 2500 milliseconds. The letters A, B, C, D, E, H, I, K, L, M, O, P, R, S, and T were employed. Performance is not only influenced by the *N*, but it is also reflected in the speed of presentation of each stimulus and it is dependent on the size of the set of stimuli. The participants had to respond to each stimulus by pressing a designated key on the keyboard when they believed they had seen a letter that corresponded to one they had seen three turns back. The participants were asked to press the M key if the stimulus was the same as 3 trials ago, and the N key if not. The letters **m** and **n** were chosen for practical reasons (that is, they can be easily memorised: m=memory, n=no). Finally, once the participant concluded the working memory test, the scores were automatically recorded at the end of the task.

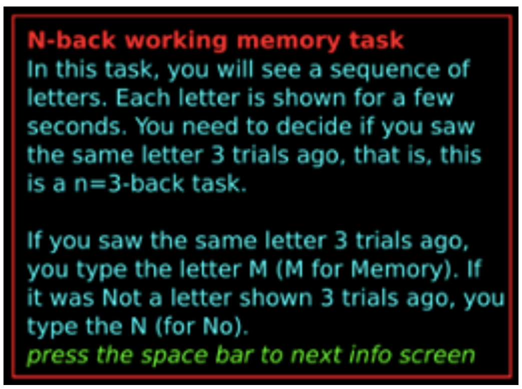

Figure 12. On-screen instructions for the *n*-back task. Source: PsyToolkit platform (Stoet, 2010, 2017).

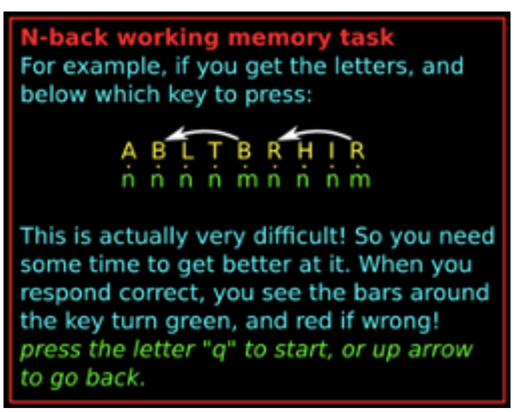

Figure 13. On-screen instructions for the *n*-back task. Source: PsyToolkit platform (Stoet, 2010, 2017).

Results for correct answers and errors made were computed by calculating the raw numbers of the correct responses and errors. The participants obtained a mean WM score of 1.03 (*SD* = .75; range .30 - 3.26).

VI.3.4.3. Measure of writing anxiety: The Second Language Writing Anxiety Inventory (SLWAI) (Cheng, 2004)

The questionnaire we delivered to our participants in order to measure writing anxiety (i.e., the anxiety student writers experience when writing in English) was based on The Second Language Writing Anxiety Inventory (SLWAI), developed by Cheng (2004). The SLWAI (Cheng, 2004) consists of 22 items which are scored on a 5-point Likert response scale which ranges from 1 (strongly disagree) to 5 (strongly agree) (Zhang, 2011).

We selected the SLWAI (Cheng, 2004) for two main reasons. First, because the 5-point Likert scale items used in this measurement instrument "were developed based on learners' reports of L2 writing anxiety experiences as well as with reference to other relevant anxiety scales" (Atay & Kurt, 2006, p. 105). Second, the SLWAI (Cheng, 2004) was selected because it has been proved to be a valid and reliable instrument to measure L2 writing anxiety (Zhang, 2011).

SLWAI (Cheng, 2004) measures cognitive, somatic, and behavioural components of L2 writing anxiety. Based on this, three categories of anxiety (already defined in Chapter III) were established in our study in order to divide the 15 items taken from the SLWAI. These three categories are the following: Cognitive Anxiety (as reflected in negative expectations and preoccupation with performance [Zabihi, 2018]; pertaining to this category the items 2, 6, 11, 15), Somatic Anxiety (as reflected in negative feelings such as tension [Zabihi, 2018]; pertaining to this category the items 1, 4, 5, 8, 10, 12, 14), and Avoidance Behaviour (as reflected in avoidance in writing [Zabihi, 2018]; pertaining to this category the items 3, 7, 9, 13). Additionally, the statements of the 15 items adopted from the SLWAI were translated into Spanish (the L1 of most of the participants in our study), in order to facilitate and determine students' understanding and reading of the items of the questionnaire and the provision of correct responses on their part.

The SLWAI (Cheng, 2004) enjoys high reliability, as indicated by the Cronbach's alpha internal consistency reliability coefficient of .91 (Cheng, 2004). Moreover, the Cronbach's alpha reliability coefficient for Cognitive Anxiety was .82, for Somatic Anxiety, .78, and for Avoidance Behaviour, .76, which means that the three reliability coefficients were acceptable.

For the purposes of this study, we adopted 15 items from the SLWAI developed by Cheng (2004) (see Table 9). To analyse the writing anxiety data, we summed up all the responses to the items to yield the total writing anxiety score for each participant. The maximum score for the writing anxiety questionnaire is 75. A higher score obtained on the subscales and on the total scale of the writing anxiety questionnaire showed a higher level of anxiety when writing in the L2 (Zhang, 2011). Writing anxiety scores ranged from 15 to 61 (M = 37.66, SD = 11.24) in our study.

Table 9. Items employed from The Second Language Writing Anxiety Inventory (SLWAI) (Cheng, 2004) in our study. Source: Cheng (2004).

Name:_______________________________________

Read the statements below very carefully. For each statement, among the choices 1, 2, 3, 4, and 5 circle the most suitable one for you. As the findings of this test are going to be used in for research, we kindly request you be honest while answering the questions.

		1 = "strongly disagree", **2** = "disagree", **3** = "no strong feelings either way", **4** = "agree", **5** = "strongly agree"				
1.	I feel my heart pounding when I write English compositions under time constraint.	1	2	3	4	5
2.	While writing English compositions, I feel worried and uneasy if I know they will be evaluated.	1	2	3	4	5
3.	I usually do my best to avoid writing English compositions.	1	2	3	4	5
4.	My mind often goes blank when I start to work on an English composition.	1	2	3	4	5
5.	I tremble or perspire when I write English compositions under time pressure.	1	2	3	4	5
6.	If my English composition is to be evaluated, I would worry about getting a very poor grade.	1	2	3	4	5
7.	I do my best to avoid situations in which I have to write in English.	1	2	3	4	5
8.	My thoughts become jumbled when I write English compositions under time constraint.	1	2	3	4	5
9.	Unless I have no choice, I would not use English to write compositions.	1	2	3	4	5

10.	I often feel panic when I write English compositions under time constraint.	1	2	3	4	5
11.	I am afraid that the other students would deride my English composition if they read it.	1	2	3	4	5
12.	I freeze up when unexpectedly asked to write English compositions.	1	2	3	4	5
13.	I would do my best to excuse myself if asked to write English compositions.	1	2	3	4	5
14.	I usually feel my whole body rigid and tense when write English compositions.	1	2	3	4	5
15.	I am afraid of my English composition being chosen as a sample for discussion in class.	1	2	3	4	5

VI.3.4.4. Measure of writing self-efficacy: Writing Self-Efficacy Scale (Sanders-Reio, 2010)

The questionnaire we delivered to our participants in order to measure writing self-efficacy was based on the Writing Self-Efficacy Scale developed by Sanders-Reio (2010) (see Table 12 below), which is at the same time an expansion of the original Zimmerman and Bandura's (1994) Writing Self-Regulatory Efficacy Scale (see Table 10). We selected the Writing Self-Efficacy Scale developed by Sanders-Reio (2010) (i) because it was newly developed and it was more recent than some of the other scales that exist, and (ii) because it has its roots on educational psychology. The Writing Self-Efficacy Scale adapted from Sanders-Reio (2010) in our study has a total duration of 20 minutes and consists of 60 items scored on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Zimmerman and Bandura (1994) employed the Writing Self-Regulatory Efficacy Scale to assess writing self-efficacy because it "was one of the few scales of the second generation of writing self-efficacy measures -those that comprehensively represented substantive as well as mechanical issues- used with undergraduates" (as cited in Sanders-Reio, 2010, p. 101). As observed in Table 10, the original Zimmerman and Bandura's (1994) Writing Self-Regulatory Efficacy Scale has 25 items which cover "writing processes, creative aspects of writing, and the self-management of writing projects" (Sanders-Reio, 2010, p. 101). The Cronbach's alpha obtained in Zimmerman and Bandura's (1994) Writing Self-Regulatory Efficacy Scale was 0.91, which means that the scale enjoys high reliability.

Table 10. Original Zimmerman and Bandura's (1994) Writing Self-Regulatory Efficacy Scale. Source: Sanders-Reio (2010).

1.	When given a specific writing assignment, I can come up with a suitable topic in a short time.
2.	I can start writing with no difficulty.
3.	I can construct a good opening sentence quickly.
4.	I can come up with an unusual opening paragraph to capture my readers' interest.
5.	I can write a brief, informative overview that prepares readers well for the main thesis of my paper.
6.	I can use my first attempts at writing to suit the needs of my audience.
7.	I can adjust the style of my writing to suit the needs of my audience.
8.	I can find a way to concentrate on my writing even when there are many distractions around me.
9.	When I have a pressing deadline on a paper, I can manage my time effectively.
10.	I can meet the writing standards of an evaluator who is very demanding.
11.	I can come up with memorable examples quickly to illustrate an important point.
12.	I can rewrite my wordy or confusing sentences clearly.
13.	When I need to make a subtle or an abstract idea more imaginable, I can use words to create a vivid picture.
14.	I can locate and use appropriate references sources when I need to document an important point.
15.	I can write very effective transitional sentences from one idea to another.
16.	I can refocus my concentration on writing when I find myself thinking about other things.
17.	When I write on a lengthy topic, I can create a variety of good outlines for the paper.

18.	When I want to persuade a skeptical reader about a point, I can come up with a convincing quote from an authority.
19.	When I get stuck writing a paper, I can find ways to overcome the problem.
20.	I can find ways to motivate myself to write a paper even when the topic holds little interest.
21.	When I have written a long or complex paper, I can find and correct all my grammatical errors.
22.	I can revise a first draft of any paper so that it is shorter and better organized.
23.	When I edit a complex paper, I can find and correct all my grammatical errors.
24.	I can find other people who will give critical feedback on early drafts of my paper.
25.	When my paper is written on a complicated topic, I can come up with a short, informative title.

Following Bandura's (1997) recommendation that self-efficacy scales should be adapted to suit the task at hand, Sanders-Reio (2010) opted for adding more items to the original Zimmerman and Bandura's (1994) Writing Self-Regulatory Efficacy Scale, thus developing the Writing Self-Efficacy Scale (Sanders-Reio, 2010), which is the questionnaire we employed in our study (see Table 12). These items that were added corresponded to the five categories of the scoring rubric employed in Sanders-Reio's (2010) study to evaluate the participants' skills on writing i.e., (a) substantive items, referring to (i) development, argumentation, persuasiveness, and analysis; (ii) clarity and audience awareness; (iii) organisation; and (iv) language; and (b) mechanical items, considering (v) grammar, punctuation and spelling (Sanders-Reio, 2010). Moreover, Sanders-Reio (2010) also added to the scale four additional self-regulatory questions on writing processes and a general item considering self-efficacy for completing the writing assignments participants commonly receive (see Table 11 for the additional substantive, mechanical, and other self-regulatory items to assess writing self-efficacy).

The Writing Self-Efficacy Scale (Sanders-Reio, 2010) employed in our study enjoys high reliability, as indicated by the Cronbach's alpha internal consistency reliability coefficient of .98 (Sanders-Reio, 2010). Moreover, the Cronbach's Alpha reliability coefficients for the items from the two subscales were acceptable: Substantive subscale (.98), and Mechanical subscale (.93). The Cronbach's alpha for the items from the original Zimmerman and Bandura's (1994) Writing Self-Regulatory Efficacy Scale was 0.94.

Table 11. Additional items assessing mechanical, substantive, and self-regulatory writing self-efficacy, added to the original Zimmerman and Bandura's (1994) Writing Self-Regulatory Efficacy Scale. Source: Sanders-Reio (2010).

Additional Substantive Items

Development, Argumentation, Persuasiveness, Analysis

- When I write, I can find enough to say.
- I can convince my reader of the points I'm trying to make.
- I can logically make the points I want to convey.
- I can figure out what to write about, what to say.
- I can determine what kind of evidence I need to support the points I'm making.

Clarity, Audience Awareness

- I know what type of arguments will convince my audience.
- I can easily understand what's expected of me regarding my writing assignments.
- I can write so people understand what I mean.
- I can write so that people don't have to ask a lot of questions about what I mean.
- I can tailor my paper to the demands of the assignment.
- I know how to determine what my audience wants to know about my topic.
- I can write so that people don't have to reread my papers to understand them.
- I know how to assess what my audience wants and needs.

Organization

- I can organize sentences into a paragraph so as to clearly express a theme.
- I can write a paper with good overall organization (e.g., ideas in order, effective transitions, etc.).

- I can focus my paper on the main ideas I'm trying to get across.
- I can select a format that will effectively convey my message.

Language

- I can put my ideas into words.
- I can find the words I need to convey my message.
- I can find the words to express my ideas.
- I can think of the right words for my ideas.
- I can select words that suit my writing project.

Additional Mechanical Items

Grammar, Punctuation, and Spelling

- I can correctly spell all of the words in the papers I write.
- I can correctly punctuate the papers I write.
- I can correctly use plurals, verb tenses, prefixes, and suffixes.
- I can fix my grammatical errors.
- I notice formatting errors when I revise.
- I can spot my mechanical errors when I revise.
- I can write a simple sentence with proper punctuation and grammatical structure.
- I can write compound and complex sentences with proper punctuation and grammatical structure.

Additional Other Items

Process

- I can outline my ideas.
- I can plan what I want to say before I start writing.
- I can revise my writing to make it better.
- I can revise my writing to make it easier to read.

General

- I can successfully complete the writing assignments I commonly receive.

To analyse the writing self-efficacy data in our study, we summed up all the participants' responses to the 60 items to yield the total writing self-efficacy score for each participant (i.e., we looked at all the items of the questionnaires and we added all the numbers marked in the Likert scale, thus calculating the total score). The maximum score for the writing self-efficacy questionnaire is 300. A higher score obtained on the questionnaire showed a higher level of self-efficacy when writing in the L2.

Writing self-efficacy scores ranged from 150 to 291 (M = 220.32, SD = 29.64) in our study.

Table 12. The Writing Self-Efficacy Scale (Sanders-Reio, 2010) used in our study. Source: Sanders-Reio (2010).

Name:___________________________

Read the statements below very carefully. For each statement, among the choices 1, 2, 3, 4, and 5 circle the most suitable one for you. As the findings of this test are going to be used in for research, we kindly request you be honest while answering the questions.

		1 = "strongly disagree", **2** = "disagree", **3** = "no strong feelings either way", **4** = "agree", **5** = "strongly agree"				
1.	When given a specific writing assignment, I can come up with a suitable topic in a short time.	1	2	3	4	5
2.	I can start writing with no difficulty.	1	2	3	4	5
3.	I can construct a good opening sentence quickly.	1	2	3	4	5
4.	I can come up with an unusual opening paragraph to capture my readers' interest.	1	2	3	4	5
5.	I can write a brief, informative overview that prepares readers well for the main thesis of my paper.	1	2	3	4	5
6.	I can use my first attempts at writing to suit the needs	1	2	3	4	5

	of my audience.					
7.	I can adjust the style of my writing to suit the needs of my audience.	1	2	3	4	5
8.	I can find a way to concentrate on my writing even when there are many distractions around me.	1	2	3	4	5
9.	When I have a pressing deadline on a paper, I can manage my time effectively.	1	2	3	4	5
10.	I can meet the writing standards of an evaluator who is very demanding.	1	2	3	4	5
11.	I can come up with memorable examples quickly to illustrate an important point.	1	2	3	4	5
12.	I can rewrite my wordy or confusing sentences clearly.	1	2	3	4	5
13.	When I need to make a subtle or an abstract idea more imaginable, I can use words to create a vivid picture.	1	2	3	4	5
14.	I can locate and use appropriate references sources when I need to document an important point.	1	2	3	4	5
15.	I can write very effective transitional sentences from one idea to another.	1	2	3	4	5
16.	I can refocus my concentration on writing when I find myself thinking about other things.	1	2	3	4	5
17.	When I write on a lengthy topic, I can create a variety of good outlines for the paper.	1	2	3	4	5
18.	When I want to persuade a skeptical reader about a point, I can come up with a convincing quote from an authority.	1	2	3	4	5
19.	When I get stuck writing a paper, I can find ways to overcome the problem.	1	2	3	4	5
20.	I can find ways to motivate myself to write a paper even when the topic holds little interest.	1	2	3	4	5
21.	When I have written a long or complex paper, I can find and correct all my grammatical errors.	1	2	3	4	5

22.	I can revise a first draft of any paper so that it is shorter and better organized.	1	2	3	4	5
23.	When I edit a complex paper, I can find and correct all my grammatical errors.	1	2	3	4	5
24.	I can find other people who will give critical feedback on early drafts of my paper.	1	2	3	4	5
25.	When my paper is written on a complicated topic, I can come up with a short, informative title.	1	2	3	4	5
26.	I can correctly spell all of the words in the papers I write.	1	2	3	4	5
27.	I can correctly punctuate the papers I write.	1	2	3	4	5
28.	I can write a simple sentence with proper punctuation and grammatical structure.	1	2	3	4	5
29.	I can correctly use plurals, verb tenses, prefixes, and suffixes.	1	2	3	4	5
30.	I can write compound and complex sentences with proper punctuation and grammatical structure.	1	2	3	4	5
31.	When I write, I can find enough to say.	1	2	3	4	5
32.	I can organize sentences into a paragraph so as to clearly express a theme.	1	2	3	4	5
33.	I can write a paper with good overall organization (e.g., ideas in order, effective transitions).	1	2	3	4	5
34.	I can outline my ideas.	1	2	3	4	5
35.	I can successfully complete the writing assignments that I commonly receive.	1	2	3	4	5
36.	I can convince my reader of the points I'm trying to make.	1	2	3	4	5
37.	I can focus my paper on the main ideas I'm trying to get across.	1	2	3	4	5
38.	I can put my ideas into words.	1	2	3	4	5
39.	I know what type of arguments will convince my	1	2	3	4	5

	audience.					
40.	I can easily understand what's expected from me regarding my writing assignments.	1	2	3	4	5
41.	I can plan what I want to say before I start writing.	1	2	3	4	5
42.	I can fix my grammatical errors.	1	2	3	4	5
43.	I can logically make the points I want to convey.	1	2	3	4	5
44.	I notice formatting errors when I revise.	1	2	3	4	5
45.	I can find the words I need to convey my message.	1	2	3	4	5
46.	I can figure out what to write about, what to say.	1	2	3	4	5
47.	I can revise my writing to make it better.	1	2	3	4	5
48.	I can write so people understand what I mean.	1	2	3	4	5
49.	I can determine what kind of evidence I need to support the points I'm making.	1	2	3	4	5
50.	I can write so that people don't have to ask a lot of questions about what I mean.	1	2	3	4	5
51.	I can tailor my paper to the demands of the assignment.	1	2	3	4	5
52.	I can find the words to express my ideas.	1	2	3	4	5
53.	I know how to determine what my audience wants to know about my topic.	1	2	3	4	5
54.	I can select a format that will effectively convey my message.	1	2	3	4	5
55.	I can spot my mechanical errors when I revise.	1	2	3	4	5
56.	I can think of the right words for my ideas.	1	2	3	4	5
57.	I can write so that people don't have to reread my papers to understand them.	1	2	3	4	5
58.	I can select words that suit my writing project.	1	2	3	4	5
59.	I can revise to make my paper easier to read.	1	2	3	4	5
60.	I know how to assess what my audience wants and needs.	1	2	3	4	5

VI.3.4.5. Measure of writing motivation: L2 Writing Motivation Questionnaire (Waller & Papi, 2017)

The L2 Writing Motivation Questionnaire developed by Waller and Papi (2017) was employed in our study to measure writing motivation. We selected this writing motivation questionnaire in our study (i) because the items that are included give a full picture of the students' intended efforts for writing in the L2, their desire to write in the L2, and their L2 motivational intensity; and (ii) because some of the items included focus on learners' writing motivation. This questionnaire contains 7 items measuring L2 writing motivation, which were adapted from the already developed and validated Taguchi et al.'s (2009) general L2 motivation measures (see Table 13).

Table 13. Writing motivation items adapted from Taguchi et al. (2009) in Waller and Papi (2017). Source: Waller and Papi (2017).

Original items (Taguchi et al., 2009)	Adapted items (Waller & Papi, 2017)
▪ I really enjoy learning English.	▪ I enjoy writing in English.
▪ Studying English is important to me.	▪ Writing in English is very important to me.
▪ I always look forward to my English classes.	▪ I always look forward to my ESL writing classes.
▪ I would like to spend lots of time studying English.	▪ I would like to spend lots of time learning to write in English.
▪ I would like to concentrate on studying English more than any other topic.	▪ I would like to concentrate on learning to write in English more than any other topic.
▪ I actively think about what I have learned in my ESL class.	▪ I actively think about what I have learned in my English writing class.
▪ I think that I am doing my best to learn English.	▪ I really try to learn how to write in English.

We adapted 7 items from Waller and Papi (2017) in our study (see Table 14 for the items taken from the L2 Writing Motivation Questionnaire by Waller and Papi (2017) in our study). Waller and Papi (2017) also adapted the items for their L2 Writing Motivation Questionnaire from other sources, i.e., from Taguchi et al. (2009). Therefore, the items that were included measured students' intended efforts for learning the L2, their desire to learn the L2, and their L2 motivational intensity. As shown in Table 13, Waller and Papi (2017) only made some minor changes and modified the 7 items simply just by replacing "learning" with "writing".

The developed L2 Writing Motivation Questionnaire (Waller & Papi, 2017) consists of 25 items (we only adapted the 7 writing motivation items) which were responded to using a 6-point Likert scale ranging from 1 (never) to 6 (always). However, we modified the 6-point Likert scale and established a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) so that the Likert scales in all questionnaires targeting the affective/motivational individual differences that are investigated in our study will follow the same pattern (i.e., a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree)). As mentioned above, in our study the 7 items were adapted from the original questionnaire by Waller and Papi (2017).

Table 14. Items taken from the L2 Writing Motivation Questionnaire (Waller & Papi, 2017) in our study. Source: Waller & Papi (2017).

Name:_________________________

Read the statements below very carefully. For each statement, among the choices 1, 2, 3, 4 and 5, circle the most suitable one for you. As the findings of this test are going to be used in for research, we kindly request you be honest while answering the questions.

		1 = "strongly disagree", **2** = "disagree", **3** = "no strong feelings either way", **4** = "agree", **5** = "strongly agree"				
1.	I enjoy writing in English.	1	2	3	4	5
2.	Writing in English is very important to me.	1	2	3	4	5
3	I always look forward to my English ESL writing classes.	1	2	3	4	5
4.	I would like to spend lots of time learning to write in English.	1	2	3	4	5
5.	I would like to concentrate on learning to write in English more than any other topic.	1	2	3	4	5
6.	I actively think about what I have learned in my English writing class.	1	2	3	4	5
7.	I really try to learn how to write in English.	1	2	3	4	5

To analyse the writing motivation data, we summed up all the participants' responses to the 7 items to yield the total writing motivation score for each participant (i.e., we looked at all the items of the questionnaires and we added all the numbers marked in the Likert scale, thus calculating the total score). The maximum score for the writing motivation questionnaire is 35. A higher score obtained on the questionnaire showed a higher level of motivation when writing in the L2. Furthermore, given that most participants spoke Spanish as their first language, the questionnaire was translated into Spanish. Moreover, we translated the questionnaire into Spanish so that the items would be easily understood by as many L2 learners as possible. The overall Cronbach's Alpha reliability coefficient for the questionnaire in our study was acceptable (a = .81).

Writing motivation scores ranged from 15 to 35 ($M = 26.20$, $SD = 5.26$) in our study.

VI.4. L2 WRITTEN PRODUCTION: ANALYSIS IN TERMS OF CAF MEASURES

In the present doctoral thesis, the dependent variable was the participants' written production as measured by CAF indices, i.e., measures of lexical and syntactic complexity, accuracy, and fluency. Regarding this dependent variable, it is a consensus in the field that CAF measures are (i) valid and reliable indicators of oral and written production in L2, (ii) L2 proficiency measures, and (iii) measures of the progress and development of L2 (Ellis, 2003; Ellis & Barkhuizen, 2005; Housen et al., 2012). Concerning the use of CAF measures to assess L2 written performance, Bulté and Housen (2014) stated that objective CAF measures reflected L2 writing development over time. Furthermore, CAF measures are believed to constitute "the main epiphenomenon of the psycholinguistics mechanisms and processes underlying the acquisition, representation and processing of L2 knowledge" (Housen & Kuiken, 2009, p. 462). This doctoral dissertation follows the normative approach in the field and what follows in this section is a detailed explanation of the operationalisation and measures of each of these CAF dimensions.

We were guided by several considerations and principles in the choice of these L2 written performance measures (see summary in Table 15). First of all, an important consideration was to choose measures that would suit our purposes and that would be adequate both for the L2 learner population and for the experimental task used (Norris & Manchón, 2012). Moreover, we were interested in assessing L2 performance multidimensionally (Housen et al., 2012; Norris & Ortega, 2009). Therefore, we opted for selecting a wide range of measures in order to tap into different aspects of performance. Finally, another important consideration was to avoid redundancy in the measurement of the constructs, which led us to choose various measures which are distinct and complementary. In light of this, according to Norris and Ortega (2009), "measures that are distinct and complementary can provide a valid assessment of L2 performance" (as cited in Vasylets, 2017, p. 167). Nonetheless, "redundant measures create multicollinearity in the analysis" (Norris & Ortega, 2009, as cited in Vasylets, 2017, p. 167), which is inappropriate, as stated by Tabachnik and Fidell (1996, as cited in Vasylets, 2017).

Table 15. Summary of CAF measures used in the study.

Lexical complexity	Syntactic complexity	Accuracy	Fluency
Lexical density (LD)	Mean length of T-unit (MLT)	Ratio of errors x 100	Total number of words
Lexical sophistication (LS2)	Mean length of clause (MLC)		Words per minute
Lexical diversity (UBER index)	Coordinate phrase per clause (CP/C)		
	Dependent clause per clause (DC/C)		
	Complex nominal per clause (CN/C)*		

*Following Lu (2011), complex nominals included (1) nouns plus adjective, possessive, prepositional phrase, adjective clause, participle, or appositive, (2) nominal clauses, and (3) gerunds and infinitives in subject position.

In what follows we describe each of the measures used in our study.

VI.4.1. Measures of Linguistic Complexity

Complexity refers to "the size, elaborateness, richness, and diversity" of the learner's linguistic L2 system (Housen & Kuiken, 2009, as cited in Michel, 2017, p. 50). Bulté and Housen (2012) define linguistic complexity as "the number of discrete components that a language feature or a language system consists of, and the number of connections between the different components" (p. 24). These authors distinguish between system complexity (i.e., lexical complexity) and structural complexity (i.e., morphological, syntactic, and phonological complexity), which constitute "separate and independent dimensions of L2 performance and L2 proficiency, rather than being different aspects of the same L2 performance-proficiency area" (Foster & Tavakoli, 2009; Skehan, 2009, as cited in Li &

Zhang, 2021, p. 193). Of these four linguistic sub-dimensions or sub-domains related to linguistic complexity, in this dissertation we analysed the sub-dimensions of lexical complexity and syntactic (structural) complexity, as detailed in what follows, using Synlex software (Lu, 2010).

❖ ***Measuring lexical complexity***

Following Read (2000), lexical complexity was conceptualised as a multidimensional feature consisting of several interrelated components, namely, lexical density, sophistication, and variation. Accordingly, three different measures of lexical density, lexical sophistication and lexical variation were included in the analysis.

To assess linguistic complexity, an automatic approach was adopted, "[since this approach] affords speed, flexibility and reliability" (Crossley & McNamara, 2014, as cited in Li & Zhang, 2021, p. 196). We did not opt for employing human raters (who may be better at analysing L2 written texts) to avoid subjectivity and error (Li & Zhang, 2021). After transcribing the L2 learners' written texts in the Word format, the English written compositions were introduced into the automated analyser Web-based Lexical Complexity Analyser (LCA) (Ai & Lu, 2010; Lu, 2010, 2012), and analysed according to 3 indices of lexical complexity measures: lexical density measure LD -lexical words/total number of words-, lexical diversity measure Uber Index, and lexical sophistication measure LS2. The single mode was selected and therefore, texts were analysed one by one for the three complexity measures that were selected. Prior to submitting the written texts for machine coding, and following previous work (e.g., Révész et al., 2016), misspellings and punctuation errors were corrected to guarantee proper functioning of the software.

In the following sections, the different measures of lexical complexity will be described in detail.

- ***Measuring lexical density***

Lexical density refers to "the proportion of content words or lexical words to the total number of words in a text" (Lu, 2012, as cited in Li & Zhang, 2021, p. 193), that is, it measures the ratio between lexical (i.e., semantically full words) and grammatical words (e.g., pronouns, prepositions, determiners and auxiliary verbs) (Kovacevic, 2019). It should be noted that the validity of this measure might be questioned, as no previous research has found significant correlations between lexical density and L2 written and oral production (Li & Zhang, 2021). In our study, lexical density (LD) was calculated by dividing the ratio of the number of lexical words (as opposed to grammatical words) by the total number of words in the written text. Following Lu (2012), in our present study, lexical words included nouns, adjectives, verbs (with the exception of modal verbs, auxiliary verbs, "be", and "have"), and lexical adverbs with adjective base, "including those that can function as both an adjective and adverb and those formed by attaching the *-ly* suffix to an adjective root" (Li & Zhang, 2021, p. 196).

- ***Measuring lexical diversity***

Lexical diversity, also known as lexical variation, refers to "the range of a learner's vocabulary as displayed in his or her language use [or production]" (Lu, 2012, as cited in Li & Zhang, 2021, p. 193), and it has been defined by Bulté and Housen (2014) as "variation in and number of word types used" in the text (p. 49). In short, the construct of lexical diversity refers to the number of different words and specific word types that are used in a language sample (Lu, 2012). Therefore, lexical diversity is measured in terms of statistical frequencies consisting of types and tokens, i.e., in terms of the rate of word repetition (Jarvis, 2013).

We calculated lexical diversity of words through the Uber Index (Dugast, 1979) within the web-based Lexical Complexity Analyser (Ai & Lu, 2010; Lu, 2010, 2012). Dugast's Uber Index (Dugast, 1979, as cited in Tweedie & Baayen, 1998) is a vocabulary measure, U, which is calculated with the formula $(logN)^2/(logN–logV)$ and has been found to provide accurate fits for Type-Token Ratio (TTR) versus N curves (Jarvis, 2002). N indicates the total number of word tokens, and V refers to the number of word types. According to

Dewaele (1993) and Tweedie and Baayen (1998), “this formula provides a relatively accurate measure of lexical variation” (as cited in Dewaele & Pavlenko, 2003, p. 129). We selected Uber because it is a valid overall index of lexical diversity (Jarvis, 2002); and it is especially suited for relatively small samples (McKee et al., 2000, as cited in Dewaele & Pavlenko, 2003) as is the case with our study. We did not opt for choosing the D measure, for example, because this measure is best suited for very large samples (McKee et al., 2000, as cited in Dewaele & Pavlenko, 2003).

- ***Measuring lexical sophistication***

Lexical sophistication, also labelled as lexical rareness, refers to the proportion of advanced or sophisticated words used by a learner, or, as defined by Read (2000), “the proportion of relatively unusual or advanced words in the learner’s text” (p. 203). According to Kyle and Crossley (2015), those words which are more frequent in natural language not only are normally learned earlier, but are also used much more frequently than less frequent words. Therefore, the use of advanced and rare words exemplifies a larger and more advanced and sophisticated vocabulary (Jarvis, 2013; Laufer & Nation, 1995; Vermeer, 2004). Moreover, in terms of the amount of information, non-frequent words can be argued to be more complex than frequent words as these non-frequent lexical items are claimed to carry higher amounts of information, thus implying higher complexity (Juola, 2008). On the other hand, frequent lexical items can be argued to be less complex than advanced or rare words due to the fact that these frequent words are claimed to carry lower amounts of information.

Lexical sophistication was analysed by choosing a type/type measure (LS2, i.e., lexical sophistication-II), which was computed by dividing the number of relatively sophisticated word types in the learner’s production by the total number of word types in a learner text (Laufer, 1994, as cited in Li & Zhang, 2021; Lu, 2012). In Synlex, words are considered to be sophisticated or advanced if they do not appear on the 2,000 most frequent words in the British National Corpus.

❖ **Measuring syntactic complexity**

Ortega (2003) defined syntactic complexity as "the range of forms that surface in language production and the degree of sophistication of such forms" (p. 492). As noted in Chen and Zechner (2011), syntactic complexity is often employed as an index of L2 learners' development and it has also been investigated as a predictor (found to be significant) of language proficiency in both L2 writing (e.g., Cooper, 1976; Henry, 1996; Larsen-Freeman, 1978; Lu, 2010; Ortega, 2003; Perkins, 1980) and speaking (Bernstein et al., 2010; Halleck, 1995; Iwashita, 2006). Additionally, a large range of quantitative measures have been adopted (as well as investigated) in L2 writing research (Lu, 2010, 2011) in order to gauge the syntactic complexity of written texts (for a comprehensive review of these measures, see Wolfe-Quintero et al., 1998). Norris and Ortega (2009) identified five sub-constructs of syntactic complexity: (i) overall or general complexity, (ii) complexity via coordination, (iii) complexity via subordination, (iv) sub-clausal complexity, and (v) syntactic variety and sophistication.

Following Ortega's (2015) recommendation, in order to measure syntactic complexity, we took into consideration the purpose for which syntactic complexity is assessed, the level of proficiency of the L2 learners that took part in the present study, and the mode of performance (i.e., in our case, the written mode).

In this doctoral dissertation, five measures were chosen in order to measure syntactic complexity drawing on recent work by Bulté and Housen (2012) and Norris and Ortega (2009). For syntactic complexity, Synlex (Ai & Lu, 2013; Lu, 2010, 2011; Lu & Ai, 2015) was used in our study (i) to calculate the mean length of T-Unit, which was employed as a general measure of complexity (MLT); (ii) to assess complexity via coordination (coordinate phrases/total number of clauses); and (iii) to measure complexity via subordination (dependent clauses/total number of clauses). Regarding nominal complexity, the mean length of clause (MLC) was calculated with the help of the Synlex software (Lu, 2010) to tap into phrasal complexity; also, the ratio of complex nominal structures (complex nominals/total number of clauses) was calculated. Following Lu (2011), "complex nominals include[d] (i) nouns plus adjective, possessive, prepositional phrase, adjective clause, participle, or appositive, (ii) nominal clauses; and (iii) gerunds and infinitives in subject […] position" (Xu, 2023, p. 4).

In the following sections, the different measures of syntactic complexity will be described in detail.

- ***Measuring overall syntactic complexity***

We calculated the mean length of T-units (T-units/tokens; Hunt, 1970) to measure overall syntactic complexity, that is, the general sophistication of multiple-clause units in a text (Li & Zhang, 2021). Hunt (1966) defined a T-unit as "one main clause plus whatever subordinate clauses [i.e., any dependent clause or non-clausal structure] happen to be attached to or embedded within it" (p. 735). Therefore, following previous task complexity studies in L2 writing research (e.g., Kuiken & Vedder, 2008), T-unit was adopted as the principal unit of analysis in our study. In the L2 writing domain, mean length of T-unit (MLT) seems to be the single most employed complexity measure (Ortega 2003; Wolfe-Quintero et al. 1998), and thus "global complexity seems to be prioritized over other dimensions of the construct" (Norris & Ortega, 2009, p. 566). One of the reasons why we selected the T-unit related measure of the mean length of T-unit (MLT) is because it has been found to be a significant indicator of L2 proficiency (Henry, 1996; Lu, 2010), which is a moderator variable in our study. Moreover, we chose the mean length of T-unit (MLT) instead of the mean length of sentence (MLS) due to the fact that "the accuracy of the latter can be affected by the existence of run-on sentences" (Li & Zhang, 2021, p. 196).

- ***Measuring coordination***

Coordinate phrases include coordinate adjective, adverb, noun, and verb phrases (Ai & Lu, 2013). In our study we chose the coordinate phrase per clause (CP/C) measure (i.e., a ratio measure) (Ai & Lu, 2013; Lu, 2011) in order to gauge complexity via coordination (and to obtain the ratio of coordinate phrases; CP/C). In addition, due to the fact that the coordinate phrase per clause (CP/C) is a length measure, it was also used in order to "capture specific means by which clauses get lengthened" (Li & Zhang, 2021, p. 194), as happens with complex nominals per clause (CN/C). In this regard, in our study, complexity by coordination was measured by a coordinate phrase in the numerator, and a clause in the denominator.

- ***Measuring subordination***

A dependent clause refers to "a finite adverbial, adjective, or nominal clause" (Cooper, 1976; Hunt, 1965, as cited in Ai & Lu, 2013, p. 254). Therefore, we chose the dependent clause per clause (DC/C) measure in order to gauge complexity via subordination (for which we calculated the ratio of dependent clauses; DC/C), which was proposed by Norris and Ortega (2009) as "a powerful index of complexification at intermediate level" (Li & Zhang, 2021, p. 194). Thus, based on this consideration and considering the fact that subordination (compared with coordination and sub-clausal complexity) is a powerful index of complexity at intermediate and upper-intermediate levels (Norris & Ortega, 2009), we decided to measure the complexity of L2 written texts in terms of subordination. Moreover, since our participants' level of L2 proficiency ranged from upper-intermediate to advanced, we assumed that subordination would a very reliable and appropriate measure of syntactic complexity. Norris and Ortega (2009) pointed out that the subordination measure "is of great value" when gauging structural complexity at both intermediate and upper-intermediate levels (p. 573). Moreover, subordination was appropriate considering the task design feature of +/- reasoning demands. More specifically, the experimental task (i.e., the "Fire-Chief" task, Gilabert, 2007) asked L2 learners to provide a justification of the actions that they would take in order to save as many people as possible, which would naturally require L2 learners to make use of subordination markers such as "because". This is also in line with Matthiessen and Thompson (1988) who pointed out that English subordinate clauses typically are indicators of cause or reason. In this sense, in our study, complexity by subordination was measured by a metric with clause (the dependent clause) in the numerator, and a clause in the denominator.

- ***Measuring nominal complexity***

Following Norris and Ortega's (2009) proposal, the mean length of clause (MLC) measure was employed to gauge subclausal complexity in our study, since "clause length taps complexification subclausally or at the phrasal level" (Li & Zhang, 2021, p. 194). A clause is defined as a structure which consists of a subject and a finite verb, including independent, adverbial, adjective, and nominal clauses (Hunt, 1965; Polio, 1997, as cited in Ai & Lu, 2013). It is important to mention that subclausal complexity via phrasal elaboration, despite being recently developed in both L1 and L2 research (Bulté, & Housen, 2014), has been established as a fundamental part of syntactic complexity drawing on findings not only from corpus-based analysis of oral and written discourses (e.g., Biber, 2006; Biber et al., 2011), but also from studies examining L2 development on syntactic complexity (e.g., Bulté & Housen, 2014; Crossley & McNamara, 2014; Mazgutova & Kormos, 2015). We also selected the mean length of clause (MLC) as it is a significant measure that highly correlates with L2 proficiency (Lu, 2010), thus being a significant predictor of L2 proficiency. The ratio of complex nominal structures (complex nominals/clauses) was also employed as a measure of nominal complexity in our study.

VI.4.2. Assessment of Accuracy

Although accuracy is considered the "most transparent [and consistent] construct" in the complexity, accuracy and fluency (CAF) triad (Housen & Kuiken, 2009; Pallotti, 2009, Wolfe-Quintero et al., 1998, as cited in Michel, 2017, p. 56), its definition and measurement can pose certain challenges. The dimension of accuracy is "a measure for the target-like and error-free use of language" (Michel, 2017, p. 50), that is, error-free speech or writing, and it refers to the degree of deviancy from a particular norm, being these deviations usually characterised as errors (Wolfe-Quintero et al., 1998, as cited in Michel, 2017). Following Lennon's (1991) definition, an error is any deviation from the norm, referring to one or a set of forms linguistic in nature which in the same context of production and under similar production conditions would not be produced by the native or proficient users of the target language. Therefore, since accuracy refers to "the degree of conformity [of the L2 learner's production] to certain norms [of the L1]" (Pallotti, 2009, p. 592), it is important to define (i) what constitutes an error, (ii) if different types of errors are distinguished (e.g., grammatical, lexical, spelling, punctuation, among others), and (iii) what constitutes the norm in L1 (e.g., Standard English). In this sense, the criteria to define an error were set against the criteria of Standard English.

With respect to the measurement of accuracy, this has been found to be problematic (Housen et al., 2012) and there is no much agreement among researchers on this topic concerning the analysis of accuracy (e.g., Evans et al., 2014; Polio, 1997; Wolfe-Quintero et al., 1998). One of the problematic issues refers to the criteria (or linguistic norm) that should be used (i) for evaluating accuracy and (ii) for identifying deviations from the norm, and at the same time considering the severity of a deviance from the norm due to the fact that agreement on what is accurate is not always reached among raters (cf. Kuiken & Vedder, 2014; Polio, 1997). However, Michel (2017) pointed out that even if agreement is reached concerning the linguistic norm that has been selected, the question of how far away a deviation from the selected norm is still remains to be seen. Housen et al. (2012) asserted the necessity of defining whether the criteria should be restricted to the standard linguistic forms or whether it should also take into consideration non-standard and non-native usages of a language, which are acceptable in some contexts. In light with this, Housen et al.'s (2012) proposal adds both acceptability and appropriateness as two criteria, in addition to accuracy, in order best to capture learners' oral and written performance. Moreover, another issue of concern relates to the selection of the type of measurements, thus taking into account which specific measures should be employed in order to best capture learners' performance within accuracy and the extent to which performance is grammaticality consistent, which stands for the adequate use of language structures (for a review, see Van Daele et al., 2007).

In this sense, in empirical work, accuracy has been analysed using holistic and analytic scales (e.g., Knoch, 2009; Polio, 1997; Shaw & Weir, 2007): holistic scales provide "a global impression [of accuracy] that takes into account the severity of errors" (Michel, 2017, p. 55), thus giving a single score to the written or spoken response as a whole (i.e., this holistic score integrates the assessment of different performance dimensions into one single score of overall L2 writing quality), whereas analytic scales give a single score for each rating category and learners receive several scores for a particular response; nevertheless, Polio (1997, as cited in Michel, 2017) stated that holistic scales do not make a clear distinction between the dimension of accuracy and the other dimensions like complexity. It should be noted that holistic and analytic scales are subject to the varying levels of subjectivity of the raters. Furthermore, in previous empirical research accuracy has also been analysed using global measures which quantify overall accuracy (e.g., calculating the number of error-free clauses, and the number of errors per 100 words) (e.g., Kormos & Trebits, 2012) and "make it possible to compare accuracy over different languages, populations, and tasks" (Michel, 2017, p. 55). However, Lambert and Kormos (2014) stated that caution should be taken when employing global measures, as such measures might not be able to reveal small changes in accuracy at higher levels of proficiency or when examining development after short-term interventions (as cited in Michel, 2017). In addition, in previous empirical research accuracy has also been gauged using specific measures which focus on a particular task, language, or intervention (Michel, 2017), for example, the number of noun-adjective-gender-agreement errors and the target-like-use of past *-ed*, thus revealing small differences in this dimension of accuracy; however, the disadvantage of this measure is that the findings are difficult to generalise to other contexts (Michel, 2017).

Finally, another measure of accuracy refers to the weighted ratio of accuracy (e.g., Foster & Wigglesworth, 2016; Wigglesworth & Foster, 2008), in which a clause is assigned a weight score based on its accuracy, thus creating different degrees of errors (Michel, 2017): the higher the severity of an error, the less weight is assigned to the clause (Foster & Wiggleworth, 2016; Wigglesworth & Foster, 2008). This approach is based on the fact that "different types of errors […] [influence] comprehensibility to various degrees" (Nas, 1975, as cited in Vasylets, 2017, p. 190). For instance, as pointed out by Michel (2017), first degree (referring to minor mistakes, such as omitted articles or spelling), second degree (concerning more severe mistakes, like word order), and third degree (referring to mistakes which make an utterance practically incomprehensible, such as combining wrong word choice, word order and omissions of compulsory constituents (cf. Foster & Wigglesworth, 2016; Kuiken & Vedder, 2008, as cited in Michel, 2017). The advantage of categorising errors in terms of their severity is that it allows comparisons across studies. Nonetheless, the disadvantage of this type of measure for accuracy is that "it includes making strong interpretative choices when defining the categories and assigning an error to a certain degree" (Michel, 2017, p. 55).

Based on these considerations, and drawing on evidence about the robustness of global measures of accuracy (Ellis & Barkhuzein, 2005; Ong & Zhang 2010), for the purposes of our study, we opted for analysing accuracy using a global measure (that is, the measure of the ratio of errors per 100 words) and we labelled as *errors* all types of errors which, following Polio's (1997, as cited in Vasylets, 2017) guidelines, included errors concerning word order and word choice, omissions of compulsory constituents, errors in articles, prepositions, pronouns, modals, number, aspect, tense, agreement, quantity words and pragmatic errors. In our analysis of the dimension of accuracy, all these types of errors were considered as indicators of inaccuracy in L2 learners' written compositions. Moreover, borrowings (i.e., L1 words are not adapted to the L2, either in terms of phonology or in morphology [Poulisse & Bongaerts, 1994]) and lexical inventions ("morpho-phonologically adapted to the target language lexemes that are never used by the native speakers" [Dewaele, 1998, as cited in Vasylets, 2017, p. 192]) were also counted as errors. In this respect, apart from considering errors in grammar and vocabulary (grammatical and lexical errors), spelling errors, and errors related to punctuation mechanics were also taken into account. Therefore, to assess L2 writing accuracy, all the mentioned errors (including grammatical, lexical, spelling and punctuation) were identified and the global measure of the ratio of errors per 100 words was calculated: (all errors/words × 100) because this is an objective and global measure of analysis that allows us to compare our results with previous studies in the literature.

Two coders analysed the data and inter-coder reliability for the identification and classification of errors was 96%. The data regarding the number of errors and words (counted manually by the researchers) were entered into an Excel spreadsheet and hence, Excel was used as the tool for the automated analysis of the measure of the ratio of errors per 100 words (accuracy). Furthermore, we based our decision of selecting this measure because of the advantage it has in compensating for differences in text length (Gilabert & Muñoz, 2010). Calculating the number of errors per 100 words is a measure often employed in psycholinguistic research (Gilabert & Muñoz, 2010), and there are other studies that have used this type of global measure for analysing accuracy, including Mehnert (1998), Fortkamp (1999), Sangarun (2005), and Ruiz-Funez (2015) (as cited in Vasylets, 2017). In the present study, following the analyses carried out by previous research on errors (for example, Truscott & Hsu, 2008; Van Beuningen et al., 2012), we identified the total number of errors and calculated the percentage of total errors in each written composition (i.e., the ratio of the total number of errors -calculated by dividing the total number of errors by the total number of words- multiplied by 100 words). In this sense, in terms of its measurement, objective measures of accuracy (e.g., number of errors per 100 words) could be considered to be preferred compared to the ratio of error-free units or accuracy scales, which have been shown to be problematic (Schenck & Daly, 2012; Wolfe-Quintero et al., 1998). In this respect, concerning data coding and scoring of the measure of accuracy, first of all, it should be noted that an adequate written text length from the participants was elicited by the task. L2 written texts were coded and scored by two raters who coded and rated five written texts (randomly selected) together at the same time to reach an agreement on the criteria that should be selected for the accuracy measure of written production. The two raters then coded and scored the remaining L2 written texts separately. Lastly, the raters compared their coding and scoring of the written texts, resulting in their clear understanding of both the coding and the scoring procedures and criteria that were selected. Consequently, the two raters discussed all the discrepancies (i.e., their remaining disagreements) and resolved them. Interrater reliability was measured as percent agreement. Therefore, interrater reliability was computed by dividing the total number of errors in agreement between the two raters (that is, 491) by the total number of errors -which refers to the possible errors in agreement- (that is, 509) and we get 0,96; this is converted to a percentage, that is, 96%. Therefore, the average percent of agreement used to measure inter-rater reliability was 96%. The written data were subsequently transcribed and analysed by the researcher.

VI.4.3. Fluency

The measure of fluency can be defined as a "smooth, rapid, effortless use of language" (Crystal, 1987, as cited in Kowal, 2014, p. 230). In the writing domain, the same components are considered when defining the measure of fluency. For instance, Wolfe-Quintero et al. (1998) defined fluency as "rapidity and ease within text execution" (as cited in Kowal, 2014, p. 230).

The dimension of fluency is first and foremost a measure of spoken language, but measures of fluency are also employed in the writing domain, where fluency is a more controversial construct because writing, due to its time nature, is a "reiterative process permits planning, monitoring, and editing" (Johnson et al., 2012; Wolfe-Quintero et al., 1998, as cited in Michel, 2017, p. 56). Fluency is a measure that refers to the smooth, easy, and eloquent production of speech or writing (Chambers, 1997; Freed, 2000; Koponen & Riggenbach, 2000; Lennon, 1990, as cited in Michel, 2017). The current conceptualisation of fluency (Housen et al., 2012) defines this construct as a multidimensional entity, consisting of three sub-dimensions: the speed or rate of fluency (measured by ratio and density of linguistic units, that is, by number of words per minute), the fluency in terms of restoration of production after a stop (measured by number, length and location of pauses), and repair fluency (measured by false starts, self-correction, and repetitions) (Foster & Tavakoli, 2009; Skehan, 2003, 2009; Tavakoli & Skehan, 2005; Tavakoli et al., 2016; Tavakoli et al., 2017).

Although these measures were originally designed for oral production, they have also been adapted for the written domain. Written fluency measures are considered of two types: product-based measures (e.g., syllables per minute, number of words) and process-based measures (e.g., pauses, length of stops) (Abdel Latif, 2013). This doctoral dissertation only focuses on product-based measures, i.e., measures related to the resulting text regardless of the way those texts are produced. We used ratio using words and minutes as the units of reference. Following previous research (Wolfe-Quintero et al., 1998) fluency measures were calculated by computing the total number of words written per minute (total number of words divided by total time) and total number of words written. Accordingly, task composition time was measured by noting down the exact time students commenced and finished writing (within the maximum 50-minute allocated writing time). Mean time spent on complex task amounted to 1133.6 seconds (*SD* = 393; range 300-1980); on the simple task, the participants spent an average of 976.5 seconds (*SD* = 332; range 360-1860). The data regarding task composition time (minutes were converted to seconds) and number of words were entered into an Excel spreadsheet for the automated analysis of the measure of words per minute (speed fluency).

VI.4.4. Summary of the Measures Used in This Study

Table 15 summarised the CAF measures used in the study of the present dissertation. As we mentioned in section 4.4.1., we opted for selecting these three CAF measures (lexical and syntactic complexity, accuracy and fluency) in order to be able to evaluate L2 written performance multidimensionally (Housen et al., 2012; Norris & Ortega, 2009), but, simultaneously, avoiding redundancy in the measurement of the constructs. Moreover, we strived to select measures that would be adequate both for the L2 learner population and for the experimental task used (Norris & Manchón, 2012). Lastly, we opted for selecting objective measures, which allows us to quantify and interpret these measures in a straightforward way. Furthermore, choosing objective measures allows us to compare our results with previous studies in the literature.

CAF measures were employed to assess the quality of L2 written texts. To assess accuracy, we calculated the ratio of errors per 100 words (all errors/words x 100). Then, total number of words and words per minute (total words/total time) were employed as the measures of fluency (Wolfe-Quintero et al., 1998). For lexical complexity, we employed Synlex software (Lu, 2010) to obtain automated measures of lexical density, sophistication and diversity. We also employed Synlex to obtain automated measures of syntactic complexity, including mean length of T-unit as a general measure of complexity, coordinate phrase per clause as a measure of coordination, dependent clause per clause to assess subordination; for nominal complexity, mean length of clause and the ratio of complex nominal per clause were calculated.

VI.5. STATISTICAL ANALYSES

In the current study, we wanted to explore the effect of cognitive (i.e., language aptitude and working memory) and affective/motivational individual difference variables (i.e., writing anxiety, writing self-efficacy and writing motivation) on L2 written performance and explore whether this effect was different in the performance of tasks with different levels of complexity and composed by L2 learners of diverse L2 proficiency level. In this regard, the different research questions that guided our research were answered through various statistical analyses, i.e., descriptive statistics, Pearson correlations, and multiple linear regression analysis. All statistical analyses in our study were performed employing the Statistical Package for the Social Sciences (SPSS IBM v28).

Firstly, before running the main analyses for the present study, we calculated descriptive statistics (means, standard deviations, min-max, skewness, and kurtosis) for (i) all of the independent (i.e., for learner-related variables -L2 proficiency [OPT], as a moderator variable, and both cognitive and affective/motivational variables, including working memory, language aptitude, writing anxiety, writing self-efficacy, and writing motivation [individual differences tests]) and (ii) all of the dependent variables -L2 writing performance- (i.e., the measures of lexical complexity, syntactic complexity, accuracy and fluency) in the simple and complex tasks, separately, at the group level (n =76).

We then performed Pearson correlations between the independent variables (i.e., OPT [measure of L2 proficiency as a continuous variable], language aptitude, working memory, writing anxiety, writing self-efficacy and writing motivation). We also carried out Pearson correlations (as a preliminary analysis) to analyse the role of L2 proficiency (as a continuous variable) and of the cognitive and affective/motivational ID traits in the CAF measures of simple and complex L2 writings. Thus, a series of Pearson correlations were performed between the predictor variables of working memory, language aptitude (LLAMA B, D, E and F), writing anxiety, writing self-efficacy, writing motivation and L2 proficiency, and the dependent variables (CAF measures of L2 writing production) across the two writing task conditions (simple and complex). In our study correlation coefficients of .25 were considered as small, .40 as medium, and .60 as large (Plonsky & Oswald, 2014). Cohen's *d* value was calculated as a measure of effect size. We followed Plonsky and Oswald's (2014) interpretation of effect size, i.e., small (0.4), medium (0.70) and large (1.00).

Finally, we performed several multiple regressions. These regressions included the following predictors: (i) working memory, (ii) L2 proficiency, (iii) the interactions between working memory and L2 proficiency, (iv) LLAMA B test score, (v) LLAMA E test score, (vi) LLAMA F test score, (vii) the interactions between LLAMA B and L2 proficiency, (viii) the interactions between LLAMA E and L2 proficiency, (ix) the interactions between LLAMA F and L2 proficiency, (x) writing anxiety, (xi) the interactions between writing anxiety and L2 proficiency, (xii) writing self-efficacy, (xiii) the interactions between writing self-efficacy and L2 proficiency, (xiv) writing motivation, and (xv) the interactions between writing motivation and L2 proficiency. The dependent variables included within the regressions were the CAF measures for which significant correlations had been obtained. We ran a separate multiple regression analysis for each of the dependent variables (i.e., for each dimension of the CAF indices) and performed separate regressions for the simple and complex tasks.

CHAPTER VII. RESULTS

This chapter presents the results for each of the research questions that guide the present study.

As just mentioned in section VI.5. Statistical analyses, before running the main analyses, we performed the descriptive analysis and then correlations between the independent variables (i.e., OPT, language aptitude, working memory, writing anxiety, writing self-efficacy and writing motivation). As seen in Table 16, Pearson product-moment correlations showed a small negative correlation between OPT and WM, which was non-significant (r = -.133). Moreover, OPT correlated positively with LLAMA E (a moderate significant correlation of r = .374), negatively with writing anxiety (a moderate significant correlation of r = -.353) and positively with writing self-efficacy (a moderate significant correlation of r = .362). A small positive correlation was found between OPT and writing motivation, but it was not significant (r = .149).

WM significantly correlated with LLAMA B (a moderate positive correlation of r = .349) and writing motivation (a moderate positive correlation of r = .333). LLAMA B was significantly and positively related to LLAMA E and LLAMA F: moderate correlations of r = .368 and r = .421, respectively. Additionally, LLAMA B significantly correlated with writing motivation (a moderate positive correlation of r = .300). LLAMA E significantly correlated with writing-self-efficacy (a moderate positive correlation of r = .262); and LLAMA F significantly correlated with writing self-efficacy and writing motivation (moderate positive correlations of r = .240 and r = .237, respectively).

Correlations also showed that writing anxiety significantly correlates with writing self-efficacy and writing motivation (moderate negative correlations of r = -.470 and r = -.417, respectively); and a significant correlation was found between writing self-efficacy and writing motivation (a strong positive correlation of r = .613).

Table 16. Pearson correlations between OPT (proficiency), working memory test, language aptitude tests, writing anxiety, writing self-efficacy, and writing motivation (*n* =76).

	OPT	WM test	LLAMA B	LLAMA D	LLAMA E	LLAMA F	WritAnxiety	WritSelf-Efficacy	WritMotivation
OPT	1								
WM test	-.060	1							
LLAMA B	.097	.349**	1						
LLAMA D	.066	.011	-.065	1					
LLAMA E	.374**	.108	.368**	.017	1				
LLAMA F	.220	.229	.421**	.029	.143	1			
WritAnxiety	-.353**	-.226	-.186	.029	-.119	-.135	1		
WritSelf-Efficacy	.362**	-.015	.219	.103	.262*	.240*	-.470**	1	
WritMotivation	.149	.333*	.300**	-.077	.081	.237*	-.417**	.613**	1

Note. *, **. Significant levels (two-tailed) at 0.05 and 0.01.

Table 17 presents the descriptive statistics for the 6 independent variables for the whole group of participants (*n* =76), and Tables 18 and 19 display the descriptive statistics for the 10 dependent measures of L2 writing performance in the simple and complex tasks, respectively. Overall, as can be seen from the mean values, the participants obtained rather similar values across the simple and complex task conditions on all CAF measures, except for the measure of nominal complexity (ratio of complex nominals per clause), which was significantly higher in the simple task condition ($M = 1.05$) as compared to the complex task ($M = .54$), according to the paired samples t-test ($t = -6.260$, $df = 75$, 95% confidence interval [-0684, 0.354], $p = .001$).

Table 17. Descriptive statistics for OPT (proficiency), working memory test, language aptitude tests, writing anxiety, writing self-efficacy, and writing motivation (*n* =76).

Variables	Mean	SD	Min	Max	Skewness (SE)	Kurtosis (SE)
OPT	77.48	9.59	45.00	95.00	-.626 (-.27)	.673 (.54)
WM test	1.03	.75	.30	3.26	.85 (.32)	.118 (.63)
LLAMA B	55.53	22.99	10	95	.001 (.27)	-.511 (.54)
LLAMA D	34.08	24.70	5	100	.691 (.27)	.372 (.54)
LLAMA E	74.61	20.21	20	100	-.849 (.27)	.357 (.54)
LLAMA F	38.29	28.64	10	100	.281 (.27)	-.918 (.54)
Writing anxiety	37.66	11.24	15.00	61.00	.063 (.27)	-.791 (.54)
Writing self-efficacy	220.32	29.64	150	291	-.103 (.27)	-.025 (.54)
Writing motivation	26.20	5.26	15.00	35.00	-.095 (.27)	-1.012 (.54)

Note. OPT = Oxford Placement Test; WM test = working memory test. Max writing anxiety score: 75; Max writing self-efficacy score: 300; Max writing motivation score: 35.

Table 18. Descriptive statistics for L2 writing performance (CAF) in the simple task (*n* =76).

CAF variables	Mean (SD)	Min-Max	Skewness (SE)	Kurtosis (SE)
Ratio of errors	10.86 (4.83)	2.37-24.79	.822 (.276)	.497(.545)
Lexical density	.43 (.03)	.36-.52	.360 (.276)	.340 (.545)
Lexical variety (UBER)	13.73 (5.20)	5.40-23.19	-1.743(.276)	2.813 (.545)
Lexical sophistication	.15 (.03)	.03-.25	-.076 (.276)	-.101 (.545)
Length of T-unit	21.38 (5.63)	11.62-34.33	.373 (.276)	-.411 (.545)
Coordinate clause per clause	.22 (.14)	.03-.80	1.110 (.276)	2.633 (.545)
Dependent clause per clause	.44 (.14)	.07-.71	-.337 (.276)	-.384(.545)
Complex nominal per clause	1.05 (.38)	.44-2.50	1.818 (.276)	4.376 (.545)
Words per minute	12.45 (3.44)	4.53-20.31	.133 (.276)	-.478 (.545)
Total number of words	196 (72)	64-385	.622 (.276)	.079 (.545)

Table 19. Descriptive statistics for L2 writing performance (CAF) in the complex task (*n* =76).

CAF variables	Mean (SD)	Min-Max	Skewness (SE)	Kurtosis (SE)
Ratio of errors	10.32 (5.50)	1.26- 29.17	1.223 (.276)	1.469 (.545)
Lexical density	.44 (.02)	.37-.52	-.062 (.276)	.304 (.545)
Lexical variety (UBER)	14.90 (3.00)	.50-18.50	-3.259(.276)	14.82 (.545)
Lexical sophistication	.13 (.06)	.06-.27	-1.033 (.276)	.307 (.545)
Length of T-unit	22.30 (5.93)	10.49-41.00	.812 (.276)	.889 (.545)
Coordinate clause per clause	.24 (.14)	.14 -.86	1.119 (.276)	3.088 (.545)
Dependent clause per clause	.43 (.13)	.13-6.7	-.470 (.276)	.582(.545)
Complex nominal per clause	.54 (.53)	.01-2.29	2.044 (.276)	6.898 (.545)
Words per minute	12.49 (.43)	6.26-24.44	.589 (.276)	.648 (.545)
Total number of words	223 (77)	74-625	2.051 (.276)	8.885(.545)

In what follows we report the results according to the five main research questions that guide the present study. Tables 20 and 21 summarise Pearson product-moment correlations among the OPT scores, WM test, LLAMA tests, writing anxiety, writing self-efficacy, writing motivation, and the CAF variables in simple and complex tasks, respectively.

Table 20. Pearson correlations between the CAF measures of L2 writing production, OPT (proficiency), working memory test, LLAMA tests, writing anxiety, writing self-efficacy, and writing motivation in the simple task (*n* =76).

	Participants (*n* =76)									
	Simple task; CAF variables									
ID variables	Ratio errors	Lexical density	Lexical variety	Lexical sophist.	Length T-unit	Coord. clause/ clause	Depend. clause/ clause	Complex nominal/ clause	Words/ minute	Total number of words
OPT	-.573**	.166	.314**	.261*	-.104	-.078	-.032	-.080	.251*	.295**
WM test	-.046	-.154	.071	-.214	-.006	-.061	.154	.131	-.169	.011
LLAMA B	-.096	.043	.263*	.013	-.076	-.065	-.021	.019	.052	.174
LLAMA D	-.004	-.095	.097	-.008	-.079	.044	.064	.122	-.052	.012
LLAMA E	-.290*	.253*	.281*	.270*	-.083	.014	-.099	.106	.068	.372**
LLAMA F	-.116	.148	.230*	-.002	-.113	-.052	-.001	-.101	.017	.208
Writing anxiety	.096	-.153	-.161	.016	.040	-.077	.113	-.037	-.285*	-.192
Writing self-efficacy	-.119	-.028	.209	.025	-.020	-.114	.019	-.171	.355**	.238*
Writing motivation	.071	-.095	.095	.012	-.024	-.203	.037	-.224	.192	.172

Note. *, **. Significant levels (two-tailed) at 0.05 and 0.01.

Table 21. Pearson correlations between the CAF measures of L2 writing production, OPT (proficiency), working memory test, LLAMA tests, writing anxiety, writing self-efficacy, and writing motivation in the complex task (*n* =76).

	Participants (*n* =76)									
	Complex task; CAF variables									
ID variables	Ratio errors	Lexical density	Lexical variety	Lexical sophist.	Length T-unit	Coord. clause/ clause	Depend. clause/ clause	Complex nominal/ clause	Words/ minute	Total number of words
OPT	-.696**	.335*	.010	-.065	-.065	.169	-.202	-.312**	.245*	.204
WM test	.067	.001	-.128	.050	-.011	.007	.096	.153	-.115	-.040
LLAMA B	-.126	.099	.027	-.030	-.014	.285*	.059	.070	.019	.102
LLAMA D	.043	-.068	.088	.156	-.105	-.111	.092	.013	-.004	.139
LLAMA E	-.274*	.135	.072	.040	-.001	.045	.003	.125	.085	.244*
LLAMA F	-.065	.194	.126	.201	.023	.214	-.010	-.039	.063	.270*
Writing anxiety	.203	-.214	-.070	-.131	.175	-.151	-.025	-.029	-.047	-.133
Writing self-efficacy	-.157	-.018	.063	.101	-.161	-.009	.076	.095	.222	.043
Writing motivation	.039	.025	.091	.120	-.069	.142	.144	.040	-.009	.188

Note. *, **. Significant levels (two-tailed) at 0.05 and 0.01.

VII.1. RESEARCH QUESTION 1. EFFECTS OF WORKING MEMORY (WM)

Our first RQ asked about the implication of working memory (WM) in written language production (1.1.), as well as about potential interactions between WM and L2 proficiency (1.2.) and WM and task complexity (1.3.).

There were no significant correlations between WM test and CAF measures of L2 writing production for any of the two versions of the writing task. However, it is worth noting that for ratio of errors, lexical density, lexical variety (UBER), lexical sophistication, coordination, and total number of words, the size and nature of the correlations with WM score were different in the simple and complex tasks (see Tables 20 and 21, respectively). In contrast to WM which did not correlated with L2 written performance, L2 proficiency level (as measured by the OPT) was the measure which correlated the most with L2 writing performance indices. Concerning the correlations between L2 proficiency (OPT) and CAF measures of writing production, the most consistent findings were obtained for the accuracy (ratio of errors per 100 words) and fluency (words per minute) measures. Specifically, strong negative correlations of $r = -.573$ and $r = -.696$ were observed between OPT and ratio of errors in the simple and complex tasks, respectively. Additionally, there was a small positive correlation between OPT and the measure of fluency (words per minute) ($r = .251$ and $r = .245$ in simple and complex task conditions, respectively).

On the basis of the results obtained in the correlational analyses conducted in the present study, we performed separate regressions for simple and complex task conditions. The dependent variables included within the regression analysis were the CAF measures for which significant correlations had been obtained, and the predictors included were OPT scores (L2 proficiency), WM test score, and the interaction measure between WM and OPT scores. A test of multicollinearity was conducted to control the interrelationships among variables. Resulting VIF values were all under 2, which implies little threat of multicollinearity in the regression analyses conducted. In the regression analysis we first explored the scores for the OPT, and then we entered the scores for WM and the interaction variable between OPT and WM in order to explore whether these additional variables contributed significantly to the predictive capacity of the model.

In the first step of the regression analysis with OPT as a predictor of the ratio of errors in the simple task, the model was significant (F (1,74) =14.057, $p \leq .001$), with the OPT explaining 21% of variance in the ratio of errors ($\beta = -.48$, $p \leq .001$) (see Table 29). However, in a second step, when WM score was added, the model lost its significance ($p = .383$) and, accordingly, there were no noticeable changes in the explained variance (R Square Change (ΔR^2) = .012); the significance of the model was at $p = .501$ when the interaction between OPT and WM was added as another predictor.

A similar pattern of findings was observed for the ratio of errors in the complex task condition, in which the model was significant with the OPT as a single predictor (F (1,74) =37.483, $p \leq .001$), with the OPT explaining 41% of variance in the ratio of errors ($\beta = -.65$, $p \leq .001$) (see Table 22). The addition of the predictors of WM and the interaction variable between WM and OPT did not produce noticeable changes in the variance explained, with the model losing its significance.

Table 22. Regression models explaining ratio of errors in simple and complex tasks with OPT as a predictor.

Dependent Variable	R	R square	Adjusted R Square	Std. error of estimate	Sig.
Ratio of errors simple task	.48	.23	.21	3.89	$p = .004$
Ratio of errors complex task	.65	.42	.41	4.19	$p \leq .001$

Additionally, a hierarchical multiple regression analysis was also conducted to analyse the potential contribution of OPT, WM, and the interaction between OPT and WM to the fluency measures of words per minute and total number of words written, as well as to the measures of lexical density, lexical variety, lexical sophistication, coordination, and nominal complexity in simple and complex tasks. In all these separate regression models, the OPT scores emerged as a single significant predictor. When the additional predictors of WM and the interaction between OPT and WM scores were added to the model, such model lost its significance. Thus, acting as a sole predictor, the OPT scores explained 6% of variance in the measure of words per minute (fluency) in the simple task (F (1,74) = 4.969, $\beta = .25$, $p \leq .05$); similarly, 6% of variance in words per minute was explained by the OPT in the complex task (F (1,74) = 4.735, $\beta = .24$, $p \leq .05$). The OPT scores also explained 8% of variance in the number of words (fluency) in the simple task (F (1,74) = 7.037, $\beta = .29$, $p \leq .01$); but the model was not significant in the complex task ($p = .07$) (see Table 23).

Table 23. Regression models explaining words per minute and the total number of words (measures of fluency) in the simple and complex tasks with OPT as a predictor.

Dependent Variable	R	R square	Adjusted R Square	Std. error of estimate	Sig.
Words per minute simple task	.25	.08	.06	3.35	$p = .029$
Words per minute complex task	.24	.07	.06	3.08	$p = .033$
Number of words simple task	.29	.09	.08	69.59	$p = .01$
Number of words complex task	.20	.04	.03	76.23	$p = .07$

Thus, the addition of WM and the interaction variable between WM and OPT to explain words per minute and the total number of words (measures of fluency) in the simple task did not produce noticeable changes in the variance explained, with the model losing its significance (for words per minute, p = .832 when WM was added as a predictor, and p = .067 when the interaction between OPT and WM was added as another predictor; for total number of words, p = .130 when WM was added as a predictor, and p = .207 when the interaction between OPT and WM was added as another predictor). When WM score was added to explain words per minute in the complex task the model lost its significance (p = .768) and, accordingly, there were no noticeable changes in the explained variance. However, the model was significant (p = .001) when the interaction between OPT and WM was added as another predictor.

In the simple task, the OPT also correlated positively with lexical diversity. The regression analysis showed that the OPT scores explained 10% of variance of lexical diversity in the simple task (F (1,74) = 8.100, β = .314, $p \leq .01$), while the model was not significant for lexical diversity in the complex task (p = .56) (see Table 24).

Table 24. Regression models explaining lexical diversity in simple and complex tasks with OPT as a predictor.

Dependent Variable	R	R square	Adjusted R Square	Std. error of estimate	Sig.
Lex. diversity simple task	.31	.10	.09	.95	p = .006
Lex. diversity complex task	.22	.05	.04	.98	p = .056

Thus, when WM score was added to explain lexical diversity in the simple task, the model lost its significance (p = .591) and, accordingly, there were no noticeable changes in the explained variance; the significance of the model was at p = .118 when the interaction between OPT and WM was added as another predictor.

In the simple version of the task, the OPT also correlated positively with the measure of lexical sophistication. The regression analysis showed that the OPT scores explained 7% of variance of lexical sophistication in the simple task (F (1,74) = 5.414, β = .26, $p \leq .05$), while the model was not significant for lexical sophistication in the complex task (p = .57) (see Table 25).

Table 25. Regression models explaining lexical sophistication in simple and complex tasks with OPT as a predictor.

Dependent Variable	R	R square	Adjusted R Square	Std. error of estimate	Sig.
Lex. sophistication simple task	.26	.08	.07	.03	p = .023
Lex. sophistication complex task	.06	.01	.01	.06	p = .576

Thus, when WM score was added as another predictor to explain the measure of lexical sophistication in the simple task, the model lost its significance (p = .456) and, accordingly, there were no noticeable changes in the explained variance; the significance of the model was at p = .604 when the interaction between OPT and WM was added as another predictor.

For some measures, the role of the OPT scores was more prominent in the complex task condition: the OPT scores explained 11% of variance of lexical density in the complex task (F (1,74) = 9.344, β = .33, $p \leq .01$), while the model was not significant in the simple task (p = .152) (see Table 26).

Table 26. Regression models explaining lexical density in simple and complex tasks with OPT as a predictor.

Dependent Variable	R	R square	Adjusted R Square	Std. error of estimate	Sig.
Lex. density simple task	.16	.02	.01	.03	$p = .152$
Lex. density complex task	.33	.09	.11	.02	$p = .003$

When WM score was added as another predictor to explain lexical density in the complex task, the model lost its significance ($p = .256$) and, accordingly, there were no noticeable changes in the explained variance; the significance of the model was at $p = .134$ when the interaction between OPT and WM was added as another predictor.

Also, the regression analysis showed a negative relationship between the OPT scores and nominal complexity in the complex task (F (1,74) = 7.968, $\beta = -.31$, $p \leq .01$), while the model was not significant in the simple task ($p = .48$) (see Table 27).

Table 27. Regression models explaining nominal complexity in simple and complex tasks with OPT as a predictor.

Dependent Variable	R	R square	Adjusted R Square	Std. error of estimate	Sig.
Nominal complexity simple task	.08	.01	.00	.38	$p = .489$
Nominal complexity complex task	.31	.09	.08	.50	$p = .006$

When WM score was added as another predictor to explain nominal complexity in the complex task, the model lost its significance (p = .226) and, accordingly, there were no noticeable changes in the explained variance; the significance of the model was at p = .692 when the interaction between OPT and WM was added as another predictor.

In sum, WM did not appear as a significant predictor of L2 writing performance, but instead, L2 proficiency (OPT) emerged as a significant predictor at both levels of task complexity, and significantly predicted ratio of errors, lexical variety, lexical sophistication, words per minute, and total number of words in the simple task; and ratio of errors, lexical density, complex nominals per clause, and words per minute in the complex task.

VII.2. RESEARCH QUESTION 2. EFFECTS OF LANGUAGE APTITUDE (LA)

Our second RQ asked about the implication of language aptitude (LA) in written language production (2.1.), as well as about potential interactions between LA and L2 proficiency (2.2.) and LA and task complexity (2.3.).

Moderate negative correlations of r = -.290 and r = -.274 were observed between LLAMA E (sound-symbol correspondence) and ratio of errors in the simple and complex tasks respectively, which were significant. Moderate positive correlations of r = .253, r = .281 and r = .270 were found between LLAMA E and lexical density, lexical variety and lexical sophistication, respectively, in the simple task. LLAMA E was significantly correlated with fluency (total number of words) in simple and complex tasks. Moderate positive correlations of r = .372 and r = .244 were found in simple and complex tasks, respectively.

There was an expected moderate positive correlation between LLAMA B (vocabulary learning) and lexical diversity in the simple task, which was significant (r = .263); the correlation between LLAMA B and lexical diversity in the complex task was non-significant (r = .027). A moderate positive correlation between LLAMA B and coordination was observed in the complex version of the writing task, which was significant (r = .285); the correlation in the simple task was not significant.

There were a number of significant correlations between LLAMA F (grammar learning) and the CAF measures. Small negative correlations of r = -.116 and r = -.065 were observed between LLAMA F and ratio of errors in the simple and complex tasks, respectively. For lexical complexity, LLAMA F significantly correlated with lexical diversity (UBER) (moderate positive correlation of r = .230) in the simple task. This correlation, albeit positive (but small; r = .126), was not found to be significant in the complex task. No significant correlations were observed between LLAMA F and the measures of syntactic complexity. A moderate positive correlation of r = .270 was observed between LLAMA F and fluency (total number of words) in the complex task. This correlation (albeit moderate and positive; r = .208) was not significant in the simple task.

No significant correlations have been observed between the CAF measures and LLAMA D either in simple or complex tasks.

On the basis of the results obtained in the correlational analyses conducted in the present study, we performed separate regressions for LLAMA B, E and F and the CAF variables, for simple and complex tasks. In the regression analysis, for LLAMA B, for instance, we first explored the scores for the LLAMA B, and then we entered the scores for OPT and then scores for the interaction variable between OPT and LLAMA B test was added to explore whether these additional variables contributed significantly to the predictive capacity of the model. The same procedure was done for the regressions for LLAMA E and F. Separate regressions were done for simple and complex task conditions. A test of multicollinearity was conducted to control the interrelationships among variables. Resulting VIF values were all under 2, thus implying little threat of multicollinearity in the regression analyses conducted.

In the simple and complex tasks, LLAMA E correlated negatively with the ratio of errors. Acting as a sole predictor, the LLAMA E scores explained 7% of variance in the measure of error ratio in the simple task (F (1,74) = 6.796, β = -.290, $p \leq .05$); similarly, 6% of variance in error ratio was explained by LLAMA E in the complex task (F (1,74) = 6.022, β = -.274, $p \leq .05$) (see Table 28).

Table 28. Regression models explaining ratio of errors in simple and complex tasks with LLAMA E as a predictor.

Dependent Variable	R	R square	Adjusted R Square	Std. error of estimate	Sig.
Ratio of errors simple task	.29	.08	.07	0.96	p = .011
Ratio of errors complex task	.27	.07	.06	0.97	p = .016

In the regression analysis in which we tested interactions between LLAMA E and OPT, when OPT score was added as another predictor, the model lost its significance (*p* = .375), and thus no noticeable changes were observed in the explained variance. When the interaction between OPT and LLAMA E was added as an additional predictor, the model also lost its significance (*p* = .747). In the model, OPT emerged as the single significant predictor of the ratio of errors in the simple task (*p* = <.001). Moreover, in the second step of the regression analysis with LLAMA E as a predictor of error ratio in the complex task, when OPT score was added as another predictor, the model lost its significance (*p* = .877) and, accordingly, there were no noticeable changes in the explained variance. When the interaction variable between OPT and LLAMA E was added as an additional predictor, the model also lost its significance (*p* = .076). In the model, OPT emerged as the single significant predictor of the ratio of errors in the complex task (*p* = <.001). Notably, acting as a sole predictor, OPT explained 21% of variance in the simple task (F (1,74) = 14.057, β = -.46, $p \leq .001$), and 41% of variance in the ratio of errors in the complex task (F (1,74) = 37.483, β = -.64, $p \leq .001$).

LLAMA E also correlated positively with the measure of lexical diversity (UBER) in the simple task. The regression analysis showed that the LLAMA E scores explained 7% of variance of lexical diversity in the simple task (F (1,74) = 6.364, β = .281, $p \leq .05$), while the model was not significant for lexical diversity in the complex task (*p* = .539) (see Table 29).

Table 29. Regression models explaining lexical diversity in simple and complex tasks with LLAMA E as a predictor.

Dependent Variable	R	R square	Adjusted R Square	Std. error of estimate	Sig.
Lex. diversity simple task	.28	.08	.07	.97	*p* = .014
Lex. diversity complex task	.07	.00	-.01	1.00	*p* = .539

However, in a second step of the regression analysis in the simple task, when OPT score was added as another predictor, the model lost its significance (p = .159), and therefore no noticeable changes were observed in the explained variance. When the interaction between OPT and LLAMA E was added as an additional predictor, the model also lost its significance (p = .377). In the model, OPT appeared as the unique significant predictor of lexical diversity in the simple task (p = .036). In the second step of the regression analysis with LLAMA E as a predictor of lexical diversity in the complex task, when OPT and the interaction variable between OPT and LLAMA E were added, the model was non-significant as well (p = .784 and p = .351, respectively), as in the first step of the regression analysis. OPT did not emerge as a significant predictor of lexical diversity in the complex task (p = .061).

Acting as a sole predictor, OPT explained 10% of variance (F (1,74) = 8.100, β = -.314, $p \leq .01$) of lexical diversity in the simple task.

Also, LLAMA E correlated positively with lexical density in the simple task. The regression analysis showed a positive relationship between the LLAMA E scores and lexical density in the simple task (F (1,74) = 5.052, β = .253, $p \leq .05$), with LLAMA E scores explaining 5% of variance of lexical density in the simple task condition, while the model was not significant in the complex task (p = .244) (see Table 30).

Table 30. Regression models explaining lexical density in simple and complex tasks with LLAMA E as a predictor.

Dependent Variable	R	R square	Adjusted R Square	Std. error of estimate	Sig.
Lex. density simple task	.25	.06	.05	.97	p = .028
Lex. density complex task	.13	.02	.00	1.00	p = .244

However, in a second step of the regression analysis in the simple task, when OPT score was added as another predictor, the model lost its significance (p = .099), and thus no noticeable changes were observed in the explained variance. When the interaction between OPT and LLAMA E was added as an additional predictor, the model also lost its significance (p = .548). In the model, OPT did not appear as a significant predictor of lexical density in the simple task (p = .467). In the second step of the regression analysis with LLAMA E as a predictor of lexical density in the complex task, when OPT and the interaction variable between OPT and LLAMA E were added, the model was non-significant as well (p = .807 and p = .069, respectively), as in the first step of the regression analysis. OPT emerged as the unique significant predictor of lexical density in the complex task (p = .004).

LLAMA E also correlated positively with the measure of lexical sophistication in the simple task. The regression analysis showed that the LLAMA E scores explained 6% of variance of lexical sophistication in the simple task (F (1,74) = 5.826, β = .270, $p \leq .05$), while the model was not significant for lexical sophistication in the complex task (p = .732) (see Table 31). Lexical sophistication also correlated with OPT in the simple task, acting as a sole predictor, OPT explained 7% of variance (F (1,74) = 5.414, β = .26, $p \leq .05$).

Table 31. Regression models explaining lexical sophistication in simple and complex tasks with LLAMA E as a predictor.

Dependent Variable	R	R square	Adjusted R Square	Std. error of estimate	Sig.
Lex. sophistication simple task	.27	.07	.06	.97	p = .018
Lex. sophistication complex task	.04	.00	-.01	1.00	p = .732

However, in a second step of the regression analysis in the simple task, when OPT score was added as another predictor, the model lost its significance (p = .144), and therefore no noticeable changes were observed in the explained variance. When the interaction between OPT and LLAMA E was added as an additional predictor, the model also lost its significance (p = .369). In the model, OPT did not appear as a significant predictor of lexical density in the simple task (p = .107). In the second step of the regression analysis with LLAMA E as a predictor of lexical sophistication in the complex task, when OPT and the interaction variable between OPT and LLAMA E were added, the model was non-significant as well (p = .839 and p = .656, respectively), as in the first step of the regression analysis. OPT emerged as the unique significant predictor of lexical density in the complex task (p = .116).

Also, LLAMA E correlated positively with the measure of fluency (total number of words) in the simple and complex tasks. The LLAMA E scores explained 13% of variance in the measure of the total number of words (fluency) in the simple task (F (1,74) = 11.911, β = .372, $p \leq .01$); similarly, 5% of variance in the total number of words was explained by LLAMA E in the complex task (F (1,74) = 4.701, β = .244, $p \leq .05$) (see Table 32). Total number of words (fluency) also correlated with OPT in the simple task, acting as a sole predictor, OPT explained 8% of variance (F (1,74) = 7.037, β = .29, $p \leq .01$).

Table 32. Regression models explaining the total number of words (measures of fluency) in the simple and complex tasks with LLAMA E as a predictor.

Dependent Variable	R	R square	Adjusted R Square	Std. error of estimate	Sig.
Number of words simple task	.37	.14	.13	.93	p =<.001
Number of words complex task	.24	.06	.05	.98	p = .033

Nevertheless, in a second step of the regression analysis in the simple task, when OPT score was added as another predictor, the model did not lose its significance (p = .007). However, when the interaction between OPT and LLAMA E was added as an additional predictor, the model lost its significance (p = .284), and thus no noticeable changes were observed in the explained variance. In the model, OPT did not emerge as a significant predictor of coordination in the simple task (p = .148). In the second step of the regression analysis with LLAMA E as a predictor of the total number of words in the complex task, when OPT and the interaction variable between OPT and LLAMA E were added, the model was non-significant as well (p = .095 and p = .525, respectively).

In the simple task, LLAMA B also correlated positively with the measure of lexical diversity (UBER). The LLAMA B scores explained 6% of variance of lexical diversity in the simple task (F (1,74) = 5.514, β = .263, $p \leq .05$), while the model was not significant in the complex task (p = .815) (see Table 33).

Table 33. Regression models explaining lexical diversity in simple and complex tasks with LLAMA B as a predictor.

Dependent Variable	R	R square	Adjusted R Square	Std. error of estimate	Sig.
Lex. diversity simple task	.26	.07	.06	.97	p = .022
Lex. diversity complex task	.03	.00	-.01	1.00	p = .815

In a second step of the regression analysis in the simple task, when OPT score was added as another predictor, the model did not lose its significance (p = .046). However, when the interaction between OPT and LLAMA B was added as an additional predictor, the model lost its significance (p = .467), and therefore no noticeable changes were observed in the explained variance. In the model, OPT did appear as a significant predictor of lexical diversity in the simple task (p = .010). In the second step of the regression analysis with LLAMA B as a predictor of lexical diversity in the complex task, when OPT and the interaction variable between OPT and LLAMA B were added, the model was non-significant as well (p = .929 and p = .793, respectively), as in the first step of the regression analysis. OPT did not emerge as a significant predictor of lexical diversity in the complex task (p = .060).

LLAMA B also correlated positively with the measure of coordination (coordinate clause per clause) in the complex task. The regression analysis showed a positive relationship between the LLAMA B scores and coordination in the complex task (F (1,74) = 6.550, β = .285, $p \leq .05$), with LLAMA B scores explaining 7% of variance of coordination in the complex task condition, while the model was not significant in the simple task (p = .578) (see Table 34).

Table 34. Regression models explaining coordination in simple and complex tasks with LLAMA B as a predictor.

Dependent Variable	R	R square	Adjusted R Square	Std. error of estimate	Sig.
Coordination simple task	.06	.00	-.01	1.00	p = .578
Coordination complex task	.28	.08	.07	.96	p = .013

In a second step of the regression analysis in the complex task, when OPT score was added as another predictor, the model did not lose significance (p = .013). However, when the interaction between OPT and LLAMA B was added as an additional predictor, the model lost its significance (p = .364), and thus no noticeable changes were observed in the explained variance. In the model, OPT did not emerge as a significant predictor of coordination in the complex task (p = .161). In the second step of the regression analysis with LLAMA B as a predictor of coordination in the simple task, when OPT and the interaction variable between OPT and LLAMA B were added, the model was non-significant as well (p = .656 and p = .793, respectively), as in the first step of the regression analysis. OPT did not emerge as a significant predictor of coordination in the simple task (p = .546).

In the simple task, LLAMA F also correlated positively with the measure of lexical diversity (UBER). The LLAMA F scores explained 4% of variance of lexical diversity in the simple task (F (1,74) = 4.116, β = .230, $p \leq .05$), while the model was not significant in the complex task (p = .279) (see Table 35).

Table 35. Regression models explaining lexical diversity in simple and complex tasks with LLAMA F as a predictor.

Dependent Variable	R	R square	Adjusted R Square	Std. error of estimate	Sig.
Lex. diversity simple task	.23	.05	.04	.98	p = .046
Lex. diversity complex task	.13	.02	.00	1.00	p = .279

Nevertheless, in a second step of the regression analysis in the simple task, when OPT score was added as another predictor, the model lost its significance (p = .145), and therefore no noticeable changes were observed in the explained variance. When the interaction between OPT and LLAMA F was added as an additional predictor, the model also lost its significance (p = .633). In the model, OPT appeared as the unique significant predictor of lexical density in the simple task (p = .015). In the second step of the regression analysis with LLAMA F as a predictor of lexical density in the complex task, when OPT and the interaction variable between OPT and LLAMA F were added, the model was non-significant as well (p = .508 and p = .464, respectively), as in the first step of the regression analysis. OPT did not emerge as a significant predictor of lexical density in the complex task (p = .073).

LLAMA F also correlated positively with the measure of fluency (total number of words) in the complex task. The LLAMA F scores explained 6% of variance of fluency (total number of words) in the complex task (F (1,74) = 5.807, β = .270, $p \leq .05$), while the model was not significant in the simple task (p = .072) (see Table 36).

Table 36. Regression models explaining the total number of words (measure of fluency) in the simple and complex tasks with LLAMA F as a predictor.

Dependent Variable	R	R square	Adjusted R Square	Std. error of estimate	Sig.
Number of words simple task	.21	.04	.03	.98	$p = .072$
Number of words complex task	.27	.07	.06	.97	$p = .018$

In a second step of the regression analysis in the complex task, when OPT score was added as another predictor, the model did not lose its significance ($p = .035$). However, when the interaction between OPT and LLAMA F was added as an additional predictor, the model lost its significance ($p = .141$), and thus no noticeable changes were observed in the explained variance. In the model, OPT did not emerge as a significant predictor of the total number of words in the complex task ($p = .271$). In the second step of the regression analysis with LLAMA F as a predictor of the total number of words in the simple task, when OPT was added, the model was non-significant as well ($p = .153$), as in the first step of the regression analysis; but when the interaction variable between OPT and LLAMA F was added, the model was marginally significant ($p = .037$). OPT emerged as a significant predictor of the total number of words in the simple task ($p = .047$).

In sum, LA contributed to L2 written performance less as compared to L2 proficiency (OPT), but its contribution was not negligible. There was a nuanced involvement of LA in written performance. In particular, LLAMA E emerged as the most relevant predictor in writing. Thus, LLAMA E contributed significantly to writing accuracy; notably, the size of this contribution was similar in simple and complex task conditions and did not vary across different proficiency levels. However, there were indications that LA contributed differently depending on the level of task complexity. That is, LLAMA E, B and F contributed to lexical diversity, but only in the simple task condition. LLAMA E contributed to lexical sophistication, but only in the simple task. LLAMA E contributed to writing fluency (measured as the total number of words) to a higher degree in the simple task condition; conversely, the contribution of LLAMA F to writing fluency was more prominent in the complex task condition. LLAMA D was not found to be relevant for written performance, neither in simple nor in complex tasks.

VII.3. RESEARCH QUESTIONS 3, 4, AND 5. EFFECTS OF WRITING ANXIETY, WRITING SELF-EFFICACY, AND WRITING MOTIVATION

Our third, fourth and fifth RQs asked about the implication of writing anxiety, writing self-efficacy and writing motivation, respectively, in written language production (3.1., 4.1., and 5.1.), as well as about potential interactions between writing anxiety/L2 proficiency, writing self-efficacy/L2 proficiency, and writing motivation/L2 proficiency (3.2., 4.2., and 5.2.) and writing anxiety/TC, writing self-efficacy/TC, and writing motivation/TC (3.3., 4.3., and 5.3.).

The only significant correlations were found between writing anxiety, writing self-efficacy and fluency in the simple task. Writing anxiety correlated negatively with the fluency measure of words per minute (a moderate significant correlation of r = -.285). Writing self-efficacy was also significantly correlated with fluency (moderate positive correlations of r = .355 and r = .238 for words per minute and total number of words, respectively, in the simple task).

There were no significant correlations between writing anxiety, writing self-efficacy, writing motivation and the accuracy and lexical and syntactic complexity measures of L2 writing production for any of the two versions of the task. However, despite not being significant, positive correlations of r = .096 and r = .203 were found between writing anxiety and the ratio of errors in the simple and complex tasks, respectively. Additionally, there were small negative correlations of r = -.119 and r = -.157 between writing self-efficacy and the ratio of errors in both simple and complex task conditions, respectively. Small positive correlations of r = .071 and r = .039 were found between writing motivation and error rates in simple and complex tasks, respectively. The nature and size of the correlations between writing anxiety, writing self-efficacy, writing motivation and the three measures of lexical complexity (lexical density, lexical variety, and lexical sophistication) were very similar in simple and complex tasks.

For syntactic complexity, the nature of the correlations is also very similar, but there are some differences and unexpected findings which are worth noting. There were small negative correlations of r = -.077 and r = -.151 between writing anxiety and the measure of coordination in the simple and complex tasks, respectively. Small negative correlations of r = -.114 and r = -.009 were also observed between writing self-efficacy and coordination in the simple and complex tasks, respectively. For writing motivation, the nature of correlations is different in simple and complex tasks, being (moderate and) negative in the simple task (r = -.203) but (small and) positive (r = .142) in the complex task. The nature of the correlations is different for the measure of subordination (dependent clause/clause) in the simple tasks as compared to the measure of coordination. Small positive correlations of r = .113, r = .019 and r = .037 were observed between writing anxiety, writing self-efficacy and writing motivation, respectively, and the measure of subordination in the simple version of the writing task. The same nature of small positive correlations was found between writing self-efficacy, writing motivation (r = .076 and r = .144, respectively), and the measure of subordination in the complex task. However, the nature of the correlation between writing anxiety and subordination in the complex task differed from the correlation observed in the simple task, being (small and) negative in the complex task (r = -.025) and positive in the simple task (r = .113). Additionally, it is worth noting the contrasting nature of correlations between writing self-efficacy and nominal complexity (the ratio of complex nominals per clause), which was negative (r = -.171) in the simple task condition, but positive (r = .095) in the complex task. This contrasting nature of correlations is also observed between writing motivation and the measure of nominal complexity, being negative (r = -.224) in the simple task condition, but positive (r = .040) in the complex task.

On the basis of the results obtained in the correlational analyses conducted in the present study, we performed separate regressions for writing anxiety, writing self-efficacy and the CAF variables for the simple task condition. The dependent variables were the CAF measures for which significant correlations had been obtained and the predictors were OPT scores (L2 proficiency), writing anxiety score, writing self-efficacy score, the interaction measure between writing anxiety and OPT scores, and the interaction measure between writing self-efficacy and OPT scores. A test of multicollinearity was conducted to control the interrelationships among variables. Resulting VIF values were all under 2, thus implying little threat of multicollinearity in the regression analyses conducted. In the regression analysis, for writing anxiety, for instance, we first explored the scores for the OPT, and then we entered the scores for writing anxiety and the scores for the interaction variable between OPT and writing anxiety to explore whether these additional variables contributed significantly to the predictive capacity of the model. The same procedure was done for the regressions for writing self-efficacy.

Writing anxiety correlated negatively with the measure of fluency (words per minute) in the simple task. The writing anxiety scores explained 7% of variance in the measure of words per minute (fluency) in the simple task (F (1,74) = 6.527, β = -.285, $p \leq .05$ (see Table 37).

Table 37. Regression models explaining words per minute (measure of fluency) in the simple task with writing anxiety as a predictor.

Dependent Variable	R	R square	Adjusted R Square	Std. error of estimate	Sig.
Words per minute simple task	.28	.08	.07	.96	p = .013

Nevertheless, in a second step of the regression analysis in the simple task, when OPT score was added as another predictor, the model lost its significance (p = .064), and therefore, no noticeable changes were observed in the explained variance. Also, when the interaction between OPT and writing anxiety was added as an additional predictor, the model lost its significance (p = .783).

In the regression analysis with writing anxiety as a predictor of words per minute in the complex task, when OPT and the interaction variable between OPT and writing anxiety were added, the model was non-significant as well (p = .715 and p = .922, respectively), as in the first step of the regression analysis. OPT emerged as the unique significant predictor of words per minute in the complex task (p = .043).

Writing self-efficacy correlated positively with the measure of fluency (words per minute) in the simple task. The writing self-efficacy scores explained 11% of variance in the measure of words per minute (fluency) in the simple task (F (1,74) = 10.684, β = -.355, $p \leq$ .01). Also, writing self-efficacy correlated positively with the measure of fluency (total number of words) in the simple task. The writing self-efficacy scores explained 4% of variance in the measure of the total number of words (fluency) in the simple task (F (1,74) = 4.450, β = .238, $p \leq$ .01 (see Table 38).

Table 38. Regression models explaining words per minute and the total number of words (measures of fluency) in the simple task with writing self-efficacy as a predictor.

Dependent Variable	R	R square	Adjusted R Square	Std. error of estimate	Sig.
Words per minute simple task	.35	.13	.11	.94	p = .002
Number of words simple task	.24	.06	.04	.98	p = .038

However, in a second step of the regression analysis for words per minute in the simple task, when OPT score was added as another predictor, the model lost its significance (p = .012), and thus no noticeable changes were observed in the explained variance. When the interaction between OPT and writing self-efficacy was added as an additional predictor, the model also lost its significance (p = .996).

Furthermore, in a second step of the regression analysis for the total number of words in the simple task, when OPT score was added as another predictor, the model lost its significance (p = .197) and, accordingly, there were no noticeable changes in the explained variance. When the interaction between OPT and writing self-efficacy was added as an additional predictor, the model also lost its significance (p = .744). In the model, OPT did not emerge as a significant predictor of the total number of words in the simple task (p = .048).

In sum, for the affective variables, the only significant relationships were found between writing self-efficacy and fluency (words per minute and the total number of words) and writing anxiety and fluency (words per minute) in the simple task.

CHAPTER VIII. DISCUSSION

In this chapter we present a discussion of the main results obtained according to the five research questions guiding the study. This is preceded by a summary of the main results obtained, as well as a final section where the results are interpreted from a more global perspective.

VIII.1. SUMMARY OF MAIN RESULTS

Our study investigated (i) how working memory (WM), language aptitude (LA), writing anxiety, writing self-efficacy, and writing motivation may be implicated in L2 written performance, and (ii) whether learner L2 proficiency and task complexity moderated any potential cognitive and affective/motivational ID effects.

Our findings point to both independent and interactive effects of the predictor variables. Thus, the results of the correlations indicated that L2 proficiency (as measured by the OPT) appeared as a stronger predictor of L2 writing performance as compared to language aptitude (LA) (although significant effects were found), working memory capacity (WM), writing anxiety, writing self-efficacy and writing motivation, independently of the level of complexity of the task. The results of the regressions confirmed the results obtained in the correlations. That is, the regression analysis showed that OPT (L2 proficiency/knowledge) and LA (in particular, LLAMA B, E, and F) played an important role in the characteristics of the texts written by the participants. In contrast, and contrary to our expectations, WM did not appear as a significant predictor of L2 writing performance. Few correlations were observed between affective variables and measures of L2 writing production. The only significant correlations were found between writing self-efficacy and fluency (words per minute and total number of words) and writing anxiety and fluency (words per minute) in the simple version of the task. No significant correlations were observed between writing motivation and measures of L2 written production.

No interactions were observed between proficiency and cognitive and affective individual differences. Nevertheless, our data can be interpreted as suggesting that L2 proficiency (OPT) could minimally interact with task complexity, that is, that the role of proficiency in L2 writing may vary depending on the cognitive complexity of the writing task. In this sense, L2 proficiency explained 21% of variance in the measure of accuracy (on the account of OPT as a predictor) in the simple task, but 41% of variance in the complex task. In addition, depending on the level of task complexity, proficiency played a different role for some measures of lexical and syntactic complexity (for example, lexical density, lexical variety, lexical sophistication, and nominal complexity) as well as for the fluency measure, i.e., the total number of words produced in the L2 learners' written texts. Thus, higher L2 proficiency correlated positively with higher number of words and higher lexical density and lexical sophistication only in the complex task, whereas the opposite tendency was observed for nominal complexity. Importantly, the results of the regressions confirmed the results obtained in the correlations. Also, there was a higher number of positive significant correlations between language aptitude components and CAF dimensions in the simple task, indicating intricate involvement of cognitive traits in performance.

In what follows we interpret these findings in terms of each of the research questions guiding the study. As advanced above, we shall also provide a more global interpretation in the final section of the chapter.

VIII.2. THE ROLE OF WORKING MEMORY IN L2 WRITING: INDEPENDENT WORKING MEMORY EFFECTS AND INTERACTIVE EFFECTS OF WORKING MEMORY, L2 PROFICIENCY, AND TASK COMPLEXITY

Our first RQ asked to what extent working memory (WM) affects L2 written performance, the latter operationalised in our study in terms of complexity, accuracy, and fluency (CAF) measures, as well as whether any observed working memory effects on L2 written performance vary as a function of writers' L2 proficiency and the cognitive complexity of the writing task.

Regarding **independent effects**, and contrary to our expectations, it was found that WM did not appear as a significant predictor of L2 writing performance, as no significant WM effects on text characteristics (in terms of CAF measures) were observed. This finding is not in line with most previous research reporting a connection between WM and L2 written performance (Adams & Guillot, 2008; Bergsleithner, 2010; Kormos & Sáfár, 2008; Mavrou, 2020; Michel et al., 2019; Mujtaba et al., 2021; Peng et al., 2022; Révész et al., 2017; Vasylets & Marín, 2021; Yi & Ni, 2015; Zabihi, 2018; Zalbidea, 2017), but it is in line with others that did find either insignificant or null WM effects on L2 writing (Cho, 2018; Kim et al., 2021; Lu, 2015).

Our first research question also asked about potential **interactions** between working memory and proficiency, on one hand, and working memory and task complexity, on the other. No significant interaction between WM and task complexity was found as WM effects did not differ in the 2 task complexity conditions, or between WM and L2 proficiency. These null interactive effects are in line with the results reported in Lu (2015), who also found a null interaction of WM and L2 /proficiency in L2 writing. In contrast, Vasylets and Marín (2021) found interactive effects of WM and L2 proficiency only for the selected dimensions of performance (in particular, accuracy and lexical sophistication), and not in others (syntactic complexity, lexical diversity, and fluency). These various tendencies have also been observed in studies of WM effects in the oral domain. Thus, whereas Serafini and Sanz's (2016) found WM effects in morphosyntactic only at low levels of L2 proficiency, the opposite tendency was observed in Gilabert and Muñoz (2010), who found that WM effects were obtained only for higher levels of proficiency.

As already discussed in Manchón et al. (2023), three potential explanations for the observed lack of independent and interactive WM effects in our study are methodological in nature and relate to (i) the instrument used in our research to measure WM; (ii) the characteristics of the participants who provided the data; and (iii) time-on task considerations.

As for the **instrument** used to measure our participants WM capacity, our research measured WM via the online n-back test (Kane et al., 2007), an instrument that, although not used in previous L2 writing research, it is similar to the L2 running span task employed in other L2 writing studies, such as Kim et al. (2021), a study that also reported no WM effects. In fact, as Manchón et al. (2023) note, the WM tests employed in studies reporting no WM effects (including our own study) were different from those tests that were employed in the majority of studies that did find WM effects on written texts as measured by CAF indices. These considerations led Manchón et al. (2023) to the conclusion that the WM test employed in L2 writing research ought to be seen as a key methodological consideration in future WM studies, something also echoed in several contributions to Manchón and Sanz's recent guest edited issue on working memory and L2 writing (Manchón & Sanz, 2023a).

As for the **task-related and learner-related considerations**, and in line with the conclusions in Manchón et al. (2023), the lack of interaction between WM, task complexity, and proficiency in our study could be attributed to the extended time conditions in our study (50 minutes), which likely allowed our participants to complete the simple and complex versions of the experimental task relying solely on their L2 knowledge and literacy skills, thus neutralizing any potential WM or task complexity effects. In fact, with the exception of the measure of nominal complexity, CAF indices hardly varied across the complex and simple versions of the task. Additionally, time-on task considerations might also explain why participants could attend to all the demands of the complex task condition and thus end up writing longer texts.

These observations related to research methodology are central in current disciplinary debates, as attested by the central role of methodological considerations in the contributions to Manchón and Sanz's (2023a) recent guest edited issue on working memory and L2 writing mentioned earlier. Thus, when discussing the theoretical papers in the special issue (Granena, 2023; Kormos, 2023; Li, 2023b), in their own introduction to the volume Manchón and Sanz (2023b) comment on the relevance of precisely the three methodological issues mentioned above as potential explanations of the results obtained in our own study. Thus, regarding working memory test, they argue that "a key implication from the three theoretical articles in this issue is the need to carefully choose the model, the construct, and the operationalization of WM in future research" (p. 612), adding that, considering all the contributions to the volume, a general agreement "is that the measurement of predictor variable—namely, WM and its subcomponents—requires close scrutiny" (p. 614). Manchón and Sanz (2023b) make a specific suggestion for future research:

> Future L2 writing research should explicitly address and justify the choice of theoretical and methodological approaches to WM available in the literature and empirically test their predictions. In other words, to increase the explanatory and predictive power of WM in L2 writing, researchers should consider the relationship between WM as a construct and the tests used to operationalize it, followed by the implications of their choices and the limits that their choices set on their interpretation of the relationships between L2 writing and learners' WM capacity. (p. 614)

As regards participants and task-related considerations, Li (2023b) and Manchón and Sanz (2023b) coincide in pointing to the need to (i) consider sample characteristics not only when selecting participants but also when interpreting results; (ii) take stricter measures in terms of task selection; (ii) validate task complexity more rigorously (Li, 2023b) and, importantly in terms of our own study, (iv) assess task complexity considerations from the perspective of the participants' themselves in terms of level of L2 proficiency, as well as level of writing expertise. Importantly, the interaction of task-related factors and learner-related factors (including writing expertise) is central in Kormos's (2023) "task-mediated cognitive model of L2 writing and writing to learn". In Manchón and Sanz's (2023b) own words:

> When in a given study the results suggest that WM does not differentially affect writing in more and less complex tasks, the question to be asked is whether the tasks really differ enough in complexity and, even more important, whether the task is complex enough for the specific sample's level, both of proficiency and of expertise. This is why Li recommends empirically validating task complexity in future research. Therefore, just as researchers have to carefully choose and justify their choice of WM construct and operationalisation, they should put as much care on their task selection, always in relation with their sample's level of proficiency and of expertise, aware of the limits their choices set on their results and their interpretation. (p. 615)

VIII.3. THE ROLE OF LANGUAGE APTITUDE IN L2 WRITING: INDEPENDENT LANGUAGE APTITUDE EFFECTS AND INTERACTIVE EFFECTS OF LANGUAGE APTITUDE, L2 PROFICIENCY, AND TASK COMPLEXITY

Our second RQ asked about the implication of language aptitude (LA) in written language production (2.1.), as well as about potential interactions between LA and L2 proficiency (2.2.), and LA and task complexity (2.3.).

Our findings showed that the most prominent contribution to writing performance was made by LLAMA E, which taps into the ability to learning written sign-meaning correspondence. Contribution of LLAMA E was followed by LLAMA B (vocabulary learning) and LLAMA F (grammar inferencing). All the detected effects were positive and enhanced the quality of writing performance. LLAMA D, which tests the ability to recognise new sounds, did not appear as relevant to writing quality. Overall, these findings showed that language aptitude is an important cognitive asset that can contribute positively to the quality of writing production. Importantly, this contribution varied according to the subdimension of language aptitude and a subdimension of writing performance. Our findings provide evidence that aptitude represents a conglomerate of differentiated abilities which target different writing dimensions. This complex and nuanced pattern of connections is in line with most recent theoretical views, which posit that the role of language aptitude in SLA is intricate and can be mediated by a host of other factors, such as task type, type of instruction (Kormos, 2012; 2023; Robinson, 2005; Skehan, 2002), or even medium (paper versus computer writing) in which a writing task is performed (Vasylets et al., 2022).

The most important contribution to writing quality was made LLAMA E, which contributed significantly to writing accuracy; notably the size of these contributions was similar in the simple and complex tasks and did not vary across proficiency levels. A similar pattern of contribution was detected for the measure of fluency (total number of words), to which LLAMA E contributed to a similar degree in both the simple and complex task conditions. In the simple task, LLAMA E also contributed to lexical density, variety, and lexical sophistication, but no such connections were detected in the complex task condition.

All the detected contributions of LLAMA E were positive, as they enhanced written performance. These findings are in line with previous empirical investigations. For example, Yang et al. (2019) found moderate positive correlations between LLAMA E and L2 writing quality as assessed holistically based in the measures of content, organization, sentence structure, vocabulary choice, and coherence. Similarly, Mujtaba et al. (2021) reported positive association with L2 writing quality, which was also assessed holistically. Our findings for LLAMA E also showed that aptitude resources were geared towards three different performance dimensions (accuracy, lexical complexity and fluency). It is interesting to note that in the dimensions of accuracy and lexical complexity, LLAMA E explained a comparable amount of variance which ranged from 5% to 7%. The biggest amount of variance of 13% was explained by LLAMA E in the area of fluency (total number of words) in the simple task. The nature of our findings precludes us from suggesting firm conclusions about which performance dimension benefited the most from LLAMA E. Although the variance explained by LLAMA E was higher for the dimension of fluency in the simple task (13% as opposed to 5%-7% in other dimensions), there was a significant link only with of the fluency measures (total number of words). On the other hand, LLAMA E contributed to three discrete measures of lexical complexity, including density, variety and sophistication; but this contribution was significant only in the simple task condition. Finally, 6%-7% of variance was explained in the accuracy, but in both task conditions. The only firm conclusion which can be drawn is that LLAMA E effects was distributed among accuracy, lexical complexity and fluency, with more notable effects detected in the simple task condition.

Previous research has suggested that LLAMA E taps into associative learning ability combined with analytic learning ability; also, it has been taken as an indicator of metalinguistic awareness (Granena, 2013b; Kormos & Trebits, 2012). This can explain the important contribution of this aptitude subdimension to L2 writing quality. In our study, we obtained evidence that learners with higher LLAMA E scores were able to create more lexically complex texts, better monitor their text, and write more fluently. These findings are in line with Kormos's (2012) claim that high levels of aptitude can support the translation and revision processes in writing, assisting lexical and syntactic encoding, and monitoring of errors.

Other aptitude components that contributed (albeit to a lesser degree) to the quality of L2 writing in our study were LLAMA B and LLAMA F. Thus, a small, but significant contribution was found for LLAMA B, which was positively linked to lexical variety in the simple task and to coordination in the complex task; the size of these contributions was comparable. LLAMA F, which measures the ability to infer the rule of an unknown language, significantly contributed to lexical variety in the simple task and fluency (total number of words) in the complex task. These findings are also in line with Kormos`s (2012, 2023) theoretical predictions that learners with higher language aptitude would handle lexical and grammatical encoding more efficiently. These findings also align with some recent empirical studies. For example, a recent large-scale study conducted with bilingual children by Peng et al. (2022) reported that morphological awareness and productive vocabulary were positively related to linguistic quality.

No interactions between language aptitude and proficiency was detected. That is, the effects of language aptitude on performance did not vary at different proficiency levels. This finding is at odds with previous findings in literature, which reported differential involvement of cognitive resources in L2 writing depending on the level of L2 proficiency. For example, Vasylets and Marín (2021) found that working memory played the role in writing accuracy at lower levels of performance, while for higher proficient learners, working memory enhanced lexical sophistication of writing. More research with larger samples, wider ranges of L2 proficiency levels, and employing various types/genres of writing tasks and writing conditions (e.g., timed vs untimed, absence or use of external sources, etc.) is required.

Concerning the interactions of language aptitude and task complexity, a higher number of correlations were obtained between aptitude subdimensions and the CAF measures in the simple task condition. This relationship was rather intricate. Thus, while language aptitude played a comparable role in terms of writing accuracy in both the simple and complex tasks, its impact on other performance dimensions was greater in the simple task. Thus, the effect of LLAMA E on fluency in the simple task was greater, as it explained 13% of variance in the total number of words as compared to the 5% variance explained in the complex condition. Indication of greater contribution of LLAMA E to the performance in the simple task is even more visible when we consider findings for lexical complexity: in the simple task, LLAMA E explained from 5% to 7% of variance in three discrete measures of lexical complexity, namely lexical density, variety and sophistication, while no such links were observed in the complex task condition. Greater involvement of aptitude in the lexical complexity in the simple task is further supported from the findings for LLAMA B and F: While both of these aptitude subcomponents contributed to lexical variety in the simple task, no such links were observed in the complex task. Instead, in the complex task condition, LLAMA B was related to coordination and LLAMA F to fluency (total number of words). It is important to highlight that, given the relatively small amount of variance that aptitude explained in writing performance, our findings of greater involvement of aptitude in the simple task should be treated with caution.

The indication of greater aptitude effects in the simple task is at odds with the predictions of the Cognition Hypothesis. Nevertheless, it is important to highlight that our findings for aptitude point in the same direction as our findings for the interactions between task complexity affective variables (anxiety and self-efficacy, in particular). In the discussion below, we will return to the issue of the interactions between task complexity and individual differences.

VIII.4. THE ROLE OF AFFECTIVE AND MOTIVATIONAL INDIVIDUAL DIFFERENCES IN L2 WRITING

Our third, fourth, and fifth RQs asked about the implication of writing anxiety, writing self-efficacy, and writing motivation, respectively, in written language production (3.1., 4.1., and 5.1.), as well as about potential interactions between writing anxiety/L2 proficiency, writing self-efficacy/L2 proficiency, and writing motivation/L2 proficiency (3.2., 4.2., and 5.2.) and writing anxiety/TC, writing self-efficacy/TC, and writing motivation/TC (3.3., 4.3., and 5.3.). The results showed few significant links between these affective variables and written production. Thus, the only significant correlations were found between writing anxiety and writing fluency, and between writing self-efficacy and fluency in the simple task. There were no significant correlations between motivation and the CAF measures. Below we discuss our findings for each set of affective variables separately.

VIII.4.1. The Role of Writing Anxiety in L2 Writing: Independent Writing Anxiety Effects and Interactive Effects of Writing Anxiety, L2 Proficiency, and Task Complexity

Our third RQ asked to what extent writing anxiety affects L2 written performance, the latter operationalised in our study in terms of complexity, accuracy, and fluency (CAF) indices, as well as whether any observed writing anxiety effects on L2 written performance vary as a function of writers' L2 proficiency and the cognitive complexity of the writing task. Concerning the relationship with other learner-related variables, writing anxiety had negative links with L2 proficiency, self-efficacy and motivation.

These relationships are predictable and point to the same direction as the available empirical findings. Thus, a negative relationship between anxiety and L2 proficiency was reported in numerous previous studies, attesting to the detrimental effects of anxiety on L2 performance and achievement (Teimouri et al., 2019). Concerning links between anxiety and motivation, a negative relationship between these two traits is posited in Dörnyei (2005), and the empirical findings confirm this supposition (see, for example, Gregersen & Horwitz, 2002; Horwitz et al., 1986). Concerning the relationship with self-efficacy, similar findings were obtained in MacIntyre and Gardner (1991) who reported that higher anxiety was related to lower self-confidence and lower performance.

In terms of the effects of anxiety on L2 writing performance, the only significant results we obtained was a negative correlation between writing anxiety and a measure of fluency (words per minute) in the simple task. The regression analysis showed that writing anxiety scores explained 7% of variance in the measure of words per minute (fluency) in the simple task. At the same time, no significant effects of writing anxiety on accuracy and lexical and syntactic complexity of the texts were found. On the basis of these findings, we can conclude that, for the population under study and the task used, the effects of writing anxiety on L2 written performance were negative, as the writers with higher anxiety scores wrote slower in the simple task condition; at the same time, anxiety effects on the performance were limited, as other dimensions of performance, such as accuracy or complexity, were not affected.

Our findings for the negative effects of anxiety are in line with previous studies, which also reported negative connection between anxiety and written performance (Cheng, 2004; Fitrinada et al., 2018; Rahimi & Zhang, 2019; Soleimani et al., 2020; Tahmouresi & Papi, 2021; Trebits, 2016; Xiao & Wong, 2014; Zabihi, 2018). Negative effects of anxiety on performance can be explained through various psychological and cognitive mechanisms. Thus, anxiety by can trigger psychological arousal and cognitive interference, which can disrupt the cognitive processes in writing by impairing lexical searchers, syntactic processes and discourse organization, which can result in poorer writing quality. Also, high levels of anxiety can lead to attention narrowing and impaired cognitive flexibility, making it difficult for writers to generate ideas and express them coherently (Eysenck & Calvo, 1992). Additionally, anxiety can interfere with meta-cognitive skills, such as goal-setting or strategic planning (Flavel, 1979; Pressley & Afflerbach, 1995). Consequently, L2 writers may struggle to implement appropriate writing strategies, monitor their progress or adapt their approach to writing tasks under conditions of anxiety, leading to suboptimal writing outcomes.

We also explored potential interactions between writing anxiety and proficiency, on the one hand, and writing anxiety and task complexity, on the other. Our findings showed an absence of interactive effects between L2 proficiency and writing anxiety in relation to L2 writing quality. This finding is in line with previous research. For example, the meta-analysis by Zhang (2019) reported that the negative correlation of anxiety with L2 performance remained stable across groups with different proficiency levels.

Finally, our findings provided an indication (albeit tentative) that the effects of anxiety on writing performance can differ depending on the level of task complexity. In particular, we found that the anxiety negatively affected speed fluency in the simple task, but not in the complex task. This finding is at odds with the Cognition Hypothesis (2011) which predicts a more prominent role of affective factors in the more complex tasks. Overall, cumulative findings on the interactions between individual differences and tasks complexity are rather mixed (e.g., Awwad & Tavakoli, 2022; Kormos & Trebits, 2011, 2012; Michel et al., 2019; Yang et al., 2019; Zalbidea, 2017). Of previous studies, one of the most relevant investigations for our investigation is the one by Rahimi and Zhang (2019) who explored the effects of reasoning demands on L2 writing performance, motivational beliefs and anxiety. In their general conclusion, the authors report that motivation and anxiety played a more prominent role in the complex task condition. However, a closer examination of their results shows that the effects of anxiety was limited: thus, the correlations between anxiety and accuracy was not significant (a finding which concurs with the results in our study), and the only significant result was a moderate negative correlation between anxiety and the mean length of T-unit (r = -.28) in the complex condition. The limited nature of these effects precludes us from forming firm conclusions about interactions between anxiety and task complexity, and more research is required.

VIII.4.2. The Role of Writing Self-Efficacy in L2 Writing: Independent Writing Self-Efficacy Effects and Interactive Effects of Writing Self-Efficacy, L2 Proficiency, and Task Complexity

Our fourth RQ asked to what extent writing self-efficacy affects L2 written performance, as well as whether any observed writing self-efficacy effects on L2 written performance vary as a function of writers' L2 proficiency and the cognitive complexity of the writing task. Although we found multiple links between self-efficacy and other learner-variables, the connections of this trait to L2 writing performance was rather limited. Thus, in terms of its links to other individual differences, self-efficacy correlated positively with L2 proficiency, language aptitude (LLAMA E and LLAMA F) and motivation. There was also a negative correlation between self-efficacy and anxiety (see also Razavi et al., 2017; Tahmassian & Jalali-Moghadam, 2011).

Concerning the effects of self-efficacy on L2 writing performance, we found significant positive links between writing self-efficacy and fluency (words per minute and the total number of words) in the simple version of the task. At the same time, there were no links between self-efficacy and accuracy and complexity. In short, the effects of self-efficacy on writing performance were positive; at the same time, these effects were rather limited as they were constrained only to one writing performance dimension (fluency) and to one task condition (simple task). Our finding for the positive (although limited) effects of efficacy are in line with the tenets of the Social Cognitive Theory (Bandura, 1986) and align with multiple empirical studies which found positive links in L1 writing performance (e.g., Klassen, 2002; Pajares, 2003; Prat-Sala & Redford, 2012).

Positive connections between writing self-efficacy and performance could be attributed to numerous factors. For example, individuals with high self-efficacy in writing are more likely to be motivated to engage in writing tasks and persist in the face of challenges (this is confirmed by a strong positive correlation between motivation and self-efficacy in our study). Writers with enhanced self-efficacy tend to believe in their ability to overcome obstacles and achieve desired outcomes, which encourages them to invest time and effort in the writing process. This motivation and persistence can lead to more extensive planning, drafting, revising, and editing, resulting in higher-quality writing. Also, self-efficacious writers tend to be better at setting realistic goals and developing effective writing plans (Schunk, 2003). Thus, we personally speculated that self-efficacious writers have confidence in their ability to execute the necessary steps to achieve their writing objectives, such as generating ideas, organizing thoughts, and revising drafts. This goal-directed behaviour and strategic planning may contribute to a more coherent, well-structured, and polished final product. Also, individuals with high self-efficacy in writing are more likely to exert effort and engage actively in the writing process. They approach writing tasks with a sense of confidence and enthusiasm. This active engagement may induce them to explore different writing strategies, experiment with language and style, ultimately leading to higher-quality writing outcomes (see also Pajares, 2003).

We also investigated potential interactions between writing self-efficacy and proficiency. The analysis showed an absence of interactive effects between L2 proficiency and writing self-efficacy. This result resonates with Sanders-Reio et al. (2014), who reported that writing efficacy was not significantly related to writing proficiency. However, other studies have provided evidence that the effects of self-efficacy can vary depending on the level of proficiency. For example, Bruning et al. (2013) reported higher levels of efficacy in more advanced English classes. The mixed nature of the results provides an indication that interactions between efficacy and language proficiency may not be consistent and that this relationship may be moderated by study characteristics and students` characteristics (Multon et al., 1991). A recent meta-analysis by Wang and Sung (2020) has shown that the estimated effect size for the relationship between language proficiency and self-efficacy beliefs with East Asian and Middle Eastern students were larger than that with students from the Western culture, suggesting that self-efficacy effects in the EFL context may vary depending on the cultural background. More research is warranted to uncover the potential links between self-efficacy and language proficiency in writing.

Concerning the interactions with the level of task complexity, we found an indication that the role of efficacy can change depending on the cognitive load posed by the task. In particular, we found positive links between efficacy and writing fluency, but only in the simple condition. Interestingly, this finding aligns with our finding for anxiety, which affected speed fluency in the simple condition, but not in the complex. Also, there was an indication of a greater involvement of language aptitude in the simple task condition as opposed to the complex task. Such an indication of a greater involvement of both cognitive and affective variables in the simple task is at odds with the Cognition Hypothesis (2011) which offers a reversed prediction. At the same time, previous empirical evidence is contradictory (Kormos & Trebits, 2011, 2012; Zalbidea, 2017), which makes it difficult to provide definitive conclusion about this issue. Consequently, we would like to suggest that further development and refinement of the theoretical predictions concerning the potential interactions between individual differences and cognitive task complexity are needed.

VIII.4.3. The Role of Writing Motivation in L2 Writing: Independent Writing Motivation Effects and Interactive Effects of Writing Motivation, L2 Proficiency, and Task Complexity

Our fifth RQ asked to what extent writing motivation affects L2 written performance. We also explored whether any observed writing motivation effects on L2 written performance vary as a function of writers' L2 proficiency and the cognitive complexity of the writing task.

The exploration of the relationships of motivation with other individual differences revealed that motivation correlated positively with cognitive traits (working memory, LLAMA B component of aptitude), self-efficacy and negatively with anxiety. However, we did not observe any connections of motivation with the quality of writing performance. The observed lack of significant writing motivation effects in CAF measures of L2 written production is at odds with most previous research reporting a significant positive connection between writing motivation and written performance (e.g., Jang & Lee, 2019; Rahimi & Zhang, 2019; Tahmouresi & Papi, 2021).

A potential explanation of this finding regarding the lack of writing motivation effects could be the fact that the participants did not find the experimental task motivating enough and, because of this low level of motivation, no links with the performance were observed. The definition of motivation and the underlying psycholinguistic processes can justify this proposition. Motivation can be defined as a phenomenon that explains why learners do or do not take a certain course of action instead of others (direction), the intensity at which they pursue the action (vigour), and the length of time in which learners stay involved in that action (persistence) (Papi & Hiver, 2022). Accordingly, the motivation of learners when learning an L2 depends on how he/she perceives the value and the experience of learning an L2 (Papi & Hiver, 2022). Under the experimental conditions in this study, learners might have been induced to persist in the task and take the right course of action. In other words, the direction and persistence of the task performance action were externally imposed; however, because of the low perceived value of the task, the intensity at which learners would pursue the task (i.e., internal motivation and vigour) could have been low. As a result, the overall level of motivation might not have been high enough for the connections between motivation and performance.

VIII.5. GLOBAL INTERPRETATION OF FINDINGS

VIII.5.1. Task Complexity and L2 Writing

As mentioned in previous sections, task complexity effects were minimal as our results showed rather similar performance in the simple and complex task conditions. However, there was an indication of greater involvement of some of the individual traits targeted in our research in the simple task condition. Notably, the findings on language aptitude were mixed although the predominant effects of aptitude were more evident in the simple task. Additionally, the effects of affective variables of anxiety and self-efficacy were observed inly in the simple task. At the same time, we also observed that the L2 proficiency exerted greater effects on L2 accuracy in the complex task as compared to the simple task condition.

Globally considered, these findings point to the complex nature of the interaction of individual differences and task complexity. When findings for language aptitude and affective variables are considered, the results do not confirm the Cognition Hypothesis (2001, 2011), which predicts greater involvement of individual differences in the complex task condition. Yet, as repeatedly suggested in the L2 writing literature (e.g., Byrnes & Manchón, 2014a), original theorising on task complexity targeted primarily oral production and, as such, did not take into consideration the more extended time conditions that characterise many forms of writing, or the reprocessing and reformulation that is possible in such conditions, which Manchón (2014a) has referred to as the internal task repetition conditions of written production. Considering the idiosyncratic nature of writing, there have been various theoretical propositions related to the expansion/modification of the Cognition Hypothesis so that it can offer more refined predictions in written production. Kormos (2014), for example, suggested that modality (oral versus written) could be added as another task complexity factor. By drawing on the psycholinguistic comparison of oral and written language production, Kormos (2014) argued that, because of its time-pressed nature, speech can pose resource-dispersing demands; that is, production of oral language can pose the type of cognitive load which would disperse learners` cognitive resources over different areas of performance. On the other hand, due to its self-paced nature and visibility of output, writing can provide the conditions under which language users can pay attention simultaneously to form and meaning. Writing can thus be conceptualised as posing resource-directing demands on learners and allow for a more controlled and deliberate use of cognitive resources.

On the other hand, Manchón (2014b) suggested that, in order to better account for writing, the Cognition Hypothesis would need revision in all the groups of task factors, including task complexity (inherent cognitive load posed by the task), task condition (participant and participation factors), and task difficulty (role of individual differences). In relation to the modification of the task difficulty dimension in particular, Manchón (2014b) suggested that the Cognition Hypothesis would need to include writing-specific individual differences, such as L2 writing expertise or genre knowledge.

In their theoretical proposition, Vasylets and Marín (2021) suggested that written medium (pen-and-paper versus computer-based writing) can pose both resource-directing and resource-dispersing demands; consequently, writing medium in itself can be conceptualised as a task complexity factor. Vasylets and Marín (2021) argue that the type of cognitive load (dispersing or directing) posed by written medium would essentially depend on the learners` characteristics, such as age, L2 proficiency or typing skills, inter alia. Crucially, the cognitive load posed by the task would be, thus, a product of the interaction between writing medium (writing on paper or by using a keyboard) and learner individual characteristics. For example, for writers with little typing experience (for example, young writers) performance of a writing task on the computer would pose a resource-dispersing demands, as the as the writers` cognitive resources would have to be shared with the high- and low-order processes. On the other hand, for experienced typists, execution process with the help of the keyboard would be automatised; consequently, for this type of writers, performing a writing task using a computer would pose resource-directing demands. Conversely, writing on paper can pose resource-dispersing demands for the writers whose level of familiarity with this medium is low. This could be the case with young adults who are typically more accustomed to writing using a keyboard. For this type of writers, paper writing could pose resource-dispersing demands.

We would like to suggest that refinement of the theoretical predictions about the role of individual differences in the Cognition Hypothesis would be relevant.

VIII.5.2. Greater Role for Cognition Rather Than Affect/Motivation in L2 Writing

One relevant finding in this dissertation was that cognitive resources (language aptitude, in particular) appeared to play a greater role in L2 writing performance as compared to affective factors. Thus, LLAMA E (sign-meaning correspondence learning) positively contributed to accuracy, fluency, and lexical complexity; LLAMA B (vocabulary learning) related to lexical variety and coordination (syntactic complexity); and LLAMA F (grammar inferencing) was linked to lexical variety and fluency. On the other hand, the contribution of affective variables was less substantial, with self-efficacy contributing positively to fluency and anxiety affecting fluency negatively. These findings are in line with the recent theoretical conceptualisations of the way in which individual differences may affect L2 writing. Thus, according to Kormos (2012, 2023) both cognitive and affective factors can affect L2 writing, in particular, L2 writing processes and the manner in which L2 learners may exploit the language learning potential of writing tasks. More recently, Kormos (2023) has advanced the *Task-Mediated Cognitive Model of* L2 *Writing and Writing to Learn* (see Figure 14) which illustrates the potential role of cognitive factors in writing.

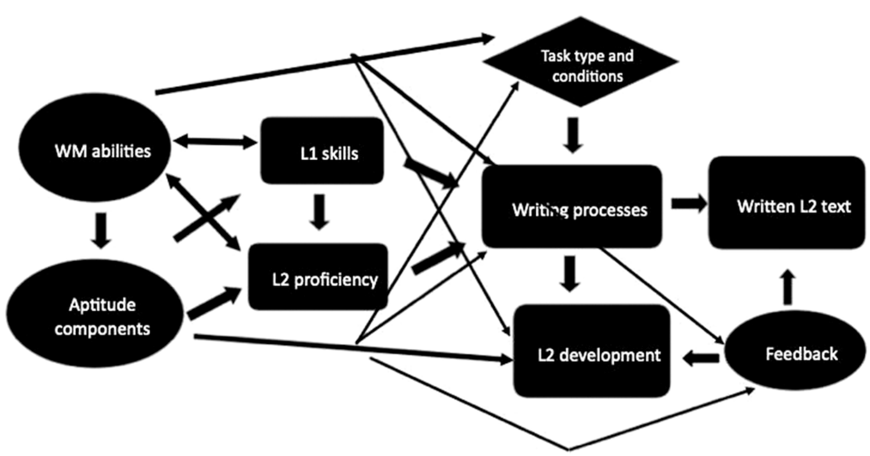

Figure 14. Task-Mediated Cognitive Model of L2 Writing and Writing to Learn. Source: Kormos (2023).

This model highlights that the role WM ability and aptitude components may vary as a function of L2 proficiency and L1 literacy skills. The model also posits that the task environment (cognitive, linguistic, and genre-based demands of the task), and the transcribing technology (handwritten vs. typed) can mediate the involvement of WM and language aptitude in L2 writing processes and outcomes. The findings in this dissertation provide some evidence in support of these theoretical suppositions. Thus, in line with Kormos (2012), we found that both cognitive and affective variables contributed to L2 writing quality. Importantly, the contribution of cognitive factors (language aptitude, in particular) was more substantial than the contribution of affective factors. This finding can lead us to a tentative conclusion about the more important role of cognition as compared to affect in writing. Future research is required to shed further insights on this issue. According to Kormos (2012), cognitive and affective factors interact in dynamic ways. Future studies are needed to factor into the comparative role of cognitive and affective factors in writing. Our findings also provide confirmation (albeit partial) to Kormos`s (2023) proposal about the factors that can mediate the involvement of cognitive variables in L2 writing. Thus, our findings of greater involvement of language aptitude in writing performance in the simple task confirms supposition that the cognitive load of the task can mediate the role of cognition in writing. Although the design of this study did not allow for the investigation of the mediating role of writing medium (paper vs. computer), our findings that language aptitude was involved greater in the simple task (which is opposed to the original prediction in the Cognition Hypothesis) may indicate that the writing medium can also mediate the role of cognitive factors. As discussed in the previous section, our participants were young adults for whom writing performance on paper is less familiar. This lack of familiarity could have influenced the way language aptitude played out in the simple versus complex task conditions. On the other hand, we did not find any differences in the role of individual differences across different proficiency levels. Future research with a wider range of proficiency levels is required to disentangle this issue.

VIII.5.3. The Role of L2 Proficiency

An important finding of our study was that L2 proficiency was the most important predictor of writing quality, mostly in terms of accuracy and fluency indices. This was especially the case in the area of accuracy, where the global measure of accuracy as errors per 100 words correlated negatively with L2 proficiency across the two task-complexity condition, hence the result of the regression analysis that L2 proficiency was a significant predictor of L2 writing accuracy: L2 proficiency accounted for 21% and 41% of variance in the simple and complex task conditions, respectively.

These findings come to reinforce previous empirical evidence of research reporting a positive relationship between L2 proficiency and writing accuracy (Kim et al., 2016; Wolfe-Quintero et al., 1998), which in the case of L2 writing can be enhanced by the affordances of the extended time conditions of writing in terms of freeing attentional resources for language-related concerns (Manchón & Williams, 2016; Vasylets et al., 2017, Williams, 2016). In our study we found positive links between L2 proficiency and accuracy of writing production in both the simple and complex tasks, which, as noted above, may be attributed to their upper-intermediate to advanced level of L2 proficiency. This high level of L2 proficiency, coupled with time-extended task implementation conditions likely allowed our participants to complete the experimental task successfully relying on the L2 linguistic resources. Additionally, as discussed in the introductory chapter of this doctoral dissertation, the physical characteristics inherent to the act of writing (in terms of its production and output, with the former being slow and self-paced, and the latter being visible and permanent) favour the allocation of attentional resources to the writing processes of planning, formulation, and monitoring. Thus, learners have more time to plan their message carefully, and they can pay attention to forms during both sub-processes of formulation and monitoring. Hence, with L2 learners devoting their attentional resources not only to the retrieval of the L2 representations, but also to the monitoring of such representations. The visibility of the written output allows the learner to perceive his/her output will be available for being carefully examined and evaluated. Hence, the learner will pay more attention to the accuracy of output in writing. Writers, therefore, have greater opportunities for enhanced focus on forms and use of their explicit and metacognitive knowledge use during the production of L2 written texts, thus leading to higher writing accuracy. In off-line/written production, L2 learners do not tend to experience difficulty in accessing forms that have been fully mastered and succeed in producing an L2 representation accurately and not resulting in errors. Also, learners' possibility to apply the learned rules may favour more target-like production in writing. Importantly, the contribution of proficiency was greater in the complex task condition, which is in line with the predictions of the Cognition Hypothesis.

Finally, another finding of our study was that L2 proficiency contributed positively to L2 writing fluency: L2 proficiency accounted for 6% of variance in both simple and complex tasks. This finding is consistent with previous empirical evidence of research reporting a positive association between L2 proficiency and fluency (Baker-Smemoe et al., 2014; de Jong et al., 2015; Larsen-Freeman, 2009; Segalowitz, 2010). In our study, we found a positive link between L2 proficiency and speed fluency of written production; the measure of words per minute was employed to assess speed writing fluency. The justification for this positive link could be attributed to the fact that learners' L2 knowledge becomes more proceduralised at higher proficiency levels (Schmidt, 1992), which facilitates faster and more effective retrieval of linguistic representations on the part of the L2 learner during written language production.

The following chapter presents global conclusions of the results obtained, accounts for the limitation of the research reported in this PhD, and makes suggestions for future research agendas.

CHAPTER IX. CONCLUSIONS, LIMITATIONS, AND IMPLICATIONS

This chapter first presents the general conclusions of our research, followed by some limitations to the study conducted in this doctoral dissertation. Finally, potential implications and suggestions for future research agendas on individual differences in SLA-oriented L2 writing research will be provided.

IX.1. GENERAL CONCLUSIONS

Our study set out to examine the independent effects of cognitive (working memory and language aptitude) and affective/motivational (writing anxiety, writing self-efficacy and writing motivation) individual differences (IDs) and the interactive effects of such IDs, L2 proficiency, and task complexity (TC) on L2 written performance.

Overall, first we can conclude that in our study, our findings showed an indication of a greater involvement of both cognitive and affective variables in the simple task. Second, we can conclude that in our study L2 proficiency played a key role in L2 writing, as the results of the correlations showed that L2 proficiency (as measured by the OPT) emerged as the main and a stronger significant predictor of L2 writing performance as compared to language aptitude (LA) (although significant effects were found), working memory (WM), writing anxiety, writing self-efficacy and writing motivation, independently of the level of complexity of the task. L2 proficiency (as measured by OPT) was the measure which correlated most with the CAF measures of L2 written production, especially in the areas of accuracy and fluency. The pattern of findings was particularly revealing for accuracy, as we consistently found significant negative correlations between the ratio of errors per 100 word and L2 proficiency (OPT) across the two task-complexity conditions. The results from the correlations were further confirmed by the regression analysis, which showed that OPT (L2 proficiency/knowledge) and LA (in particular, LLAMA B, E, and F) played an important role in the characteristics of the texts written by the participants. L2 proficiency emerged a significant predictor of L2 writing accuracy. Thus, L2 proficiency accounted for 21% and 41% of variance in the simple and complex task conditions, respectively. This finding can be interpreted as suggesting that L2 proficiency (OPT) could minimally interact with task complexity, that is, that the role of proficiency in L2 writing may vary depending on the cognitive complexity of the writing task. In addition, our findings revealed that the role of L2 proficiency may depend on the performance area, as proficiency played a different role for some measures of lexical and syntactic complexity (for example, lexical density, lexical variety, lexical sophistication, and nominal complexity) as well as for the fluency measure, i.e., the total number of words produced in the L2 learners' written texts, depending on the level of TC. Thus, higher L2 proficiency correlated positively with higher number of words and higher lexical density and lexical sophistication only in the complex task, whereas the opposite tendency was observed for nominal complexity.

Third, we can also conclude that, contrary to our expectations, WM did not appear as a significant predictor of L2 writing performance, as no significant WM effects on text characteristics (in terms of CAF measures) were observed; and no significant interaction was reported between WM and TC, as WM effects did not differ in the two TC conditions, or between WM and L2 proficiency. Nevertheless, for accuracy, lexical density, lexical variation, lexical sophistication, coordination, and total number of words, the size and nature of the correlations between these CAF measures and WM differed in the simple and complex tasks conditions.

Fourth, LA as measured via the LLAMA tests (Meara, 2005) contributed to L2 written performance less as compared to L2 proficiency (OPT), but its contribution to the quality of writing production was not negligible, and it emerged as an important cognitive ID. Our findings attested a nuanced and varied involvement of LA in written performance, principally in the LLAMA E component of LA (sound-symbol correspondence) which appeared as the most relevant predictor in writing, followed by the discrete dimensions of LLAMA B (sign-meaning correspondence) and LLAMA F (grammar inferencing ability). Concerning the interactions of LA and TC, a greater involvement of LA was found in the simple task. More specifically, LLAMA E was the predictor that significantly contributed most to writing accuracy similarly in simple and complex task conditions, as evidenced by the size of this contribution. However, there were also indications that LA contributed to the subdimensions of writing performance differently depending on the level of TC. Importantly, there was a higher number of positive significant correlations between LA components and CAF dimensions in the simple task, indicating intricate involvement of cognitive traits in performance. That is, LLAMA E, B and F contributed to lexical diversity, but only in the simple task condition. LLAMA E contributed to lexical sophistication, but only in the simple task. LLAMA E contributed to writing fluency (measured as the total number of words) to a higher degree in the simple task condition; conversely, the contribution of LLAMA F to writing fluency was more prominent in the complex task condition. In contrast, no significant correlations were observed between LLAMA D (phonetic recognition) and any of the CAF measures in simple and complex tasks. The results from the correlations were further confirmed by the regression analysis. No interaction between LA and proficiency was detected.

Finally, concerning writing anxiety, self-efficacy, and motivation, no significant correlations were observed between these affective and motivational IDs and the accuracy and both lexical and syntactic complexity measures of L2 writing production in any of the two task conditions. Writing anxiety and writing self-efficacy only significantly correlated with fluency (words per minute and total number of words, and words per minute, respectively) in the simple task. In the complex task, no significant correlations were observed between writing anxiety, writing self-efficacy, writing motivation and any of the CAF measures. Writing motivation did not correlate with L2 writing performance in any of the CAF measures in simple and complex tasks. Our findings also showed an absence of interactive effects between L2 proficiency and writing anxiety in relation to L2 writing quality, and they showed an indication (albeit tentative) that the effects of anxiety on writing performance can differ depending on the level of TC. There was an absence of interactive effects between L2 proficiency and writing self-efficacy, and an indication that the role of efficacy can change depending on TC.

Thus, the results indicated that, for our participants under study, when time-on task considerations such as when TC is operationalised in terms of reasoning demands in our study and when the IDs in our study are measured by their corresponding instruments (the *n*-back WM test, Kane et al., 2007; LLAMA LA tests, Meara, 2005; the Second Language Writing Anxiety Inventory, Cheng, 2004; the Writing Self-Efficacy Scale, Sanders-Reio, 2010; and the L2 Writing Motivation Questionnaire, Waller & Papi, 2017), L2 proficiency in terms of the amount of L2 knowledge the L2 writer has, followed by his/her cognition (language aptitude), played a stronger role in his/her L2 written production than his/her WM capacity and affect/motivation. This shows that cognition played a greater role than affect/motivation in L2 writing.

IX.2. LIMITATIONS

Despite the potential contribution of our research, the study has some limitations, particularly regarding participants. Thus, our sample size was relatively small, considering the variables that we included in our study. Furthermore, another limitation relates to the fact that our participants were all undergraduate students from a language and linguistics undergraduate degree, which limits our results to a very specific profile in regard to learners' age range and academic background, for instance (for self-wide evidence of such concerns on sampling issues, see Plonsky, 2023). Future research would benefit from expanding populations and exploring individual differences (IDs) and L2 writing effects with learners from diverse academic backgrounds; for instance, with learners from a non-linguistic background and younger students. Moreover, there are limitations in the research statistical analysis, in the sense that due to our sample size, more sophisticated statistical analyses (e.g., structural equation modelling) could not be performed. Additionally, another limitation relates to our participants' L2 proficiency level. The level of proficiency of our participants ranged from upper-intermediate to advanced; thus, they could have relied on their own linguistic resources in order to complete their task, and this might have limited the influence of cognitive, affective and motivational IDs on their L2 writing production.

Also, another general concern in the present study relates to the instrument employed to measure WM. As mentioned in the Discussion, and as Manchón et al. (2023) also noted, WM measures differ within SLA research itself and in WM L2 writing research, and also in other research fields. As Manchón et al. (2023) acknowledged, future research should further explore these WM instruments so as to provide more evidence of their validity when examining WM effects in writing. Additionally, a limitation of our study refers to the measurement of fluency. In our study, we measured fluency in terms of the total number of words and words per minute. However, as Wolfe-Quintero et a. (1998) noted, caution needs to be taken when employing this measure due to the mixed results that have been previously found (as cited in Manchón et al., 2023). Wolfe-Quintero et al. (1998) regarded the product-based measure of the length of the T-unit as one of "the best measures" of writing fluency (p. 29). Furthermore, another limitation of our study could be attributed to the fact that we did not use any process-based measure of fluency in our study, which might have shed light on the L2 writers' production/composing processes that would enable them to produce a written text more fluently. Accordingly, future investigations should consider the multidimensionality of the fluency measure and, as also noted by Manchón et al. (2023), employ product-based measures (number of words), speed measures (words/syllables per minute), and also process-based measures in conjunction.

Another important consideration concerns the fact that writing was performed under very controlled laboratory conditions, which might also change the way L2 learners perform a writing task, as compared to classroom conditions or writing in natural, extended time conditions. Therefore, for future research, it would be advisable to perform classroom-based research and research on writing in real extended time conditions. Moreover, another limitation relates to the fact that we only implemented one task type, which was the problem-solving, fire-chief task (Gilabert, 2007) previously mentioned, which is an argumentative reasoning task. Future research might consider performing research with other types of tasks such as argumentative essays, expositions and other genres. Additionally, we consider future research would benefit from WM training and its effects on L2 writing performance, which would contribute to the L2 writing literature and to the nature of WM and its malleability (Granena, 2023). Finally, our findings are relevant considering the importance of pen-and-paper writing, and it is also worth mentioning that pen-and-paper writing is still used in high stakes situations, which plays an important role in learning. However, it is relevant to be mindful that pen-and-paper writing is less relevant, as we write less and less on paper, and more using the computer. Therefore, for future research, it would be interesting to conduct this research in computer writing, as well as examine the role of cognitive and affective/motivational IDs in digital versus pen-and-paper writing (as done in Vasylets et al., 2022, for working memory and language aptitude in paper versus computer-based L2 writing). The results in Vasylets et al. (2022) indicated that the role of cognitive IDs may vary depending on the writing environment.

Despite the limitations referred to above, we would like to suggest that our study contributes to the growing body of scholarly research on cognitive, affective and motivational IDs and TC in the writing domain, as well as to the interaction between cognitive, affective and motivational IDs, TC, L2 proficiency in writing.

IX.3. IMPLICATIONS

The present study has a number of relevant implications for future IDs SLA-L2 writing research agendas, particularly from a theoretical, empirical, and methodological point of view, but it also has pedagogical implications for the field of instructed second language acquisition (SLA).

Thus, in terms of the theoretical implications of our study, from the perspective of writing itself, the obtained findings can have relevance for the language-learning potential of L2 writing theory (Manchón & Vasylets, 2019; see also Harklau, 2002; Leow & Manchón, 2021; Manchón, 2011, 2023; Manchón & Williams, 2016), and specifically for the *writing-to-learn language* (WLL) dimension of L2 writing (Manchón, 2011; Manchón & Williams, 2016; Williams, 2012), since, as stated in Manchón and Sanz (2023b), providing new knowledge about the role of IDs in writing can add new insights to refine the description of those mechanisms (mental processes) by which L2 writing advances general L2 proficiency, as well as inform about whether and how mental processes develop or change as a function of other task-related (i.e., task complexity) and learner-related (i.e., L2 proficiency level) factors. Theoretically, our findings also respond to the need in the SLA field to understand how writing may lead to language learning as well as how IDs may be implicated in the products and processes of writing, thus bringing about L2 learning through writing, as previous research in the WM-SLA literature has traditionally attracted its attention to other areas of L2 learning, such as reading comprehension (e.g., In'nami et al., 2022; Jeon & Yamashita, 2014; Shin, 2020) or L2 interaction (Li, 2017), as cited in Granena (2023). Thus, we hoped the results of our study would not only help to refine but also broaden our understanding of the role of IDs in SLA by shedding light on the similarities and differences in whether and how cognitive capacity (as well as affective/motivational dispositions) help to substantiate the development of L2 knowledge and skills (Granena, 2023) and, with respect to writing, we hope the results of our study would offer new insights into how and why IDs may be implicated in the cognitively demanding nature of the act of writing itself, and in the processing and use of the feedback received on one's writing, as noted by Vasylets and Manchón (2023).

Our results also have implications for theorising on task complexity as well as for relevant theoretical accounts of the role of IDs in L1 writing models (especially Hayes, 2012; Kellogg, 1996, 2001. See also Olive, 2022) and Kormos's (2023) task-mediated cognitive model of L2 writing and writing to learn which, as Manchón and Sanz (2023b) noted, represents a notable attempt to strengthen synergies between SLA and L2 writing research, and it constitutes the most recent and comprehensive theoretical proposal of how IDs may mediate writing processes and products as well as L2 learning through writing. Importantly, this recent theoretical model proposed by Kormos (2023) will constitute a full research program for future ID studies in L2 writing and, consequently, with future SLA-oriented L2 writing research on cognitive IDs in L2 writing heavily relying on this model. In addition, our obtained results also have implications for the theoretical dimensions of future work on the combined effects of aptitude and WM (as discussed in Kormos, 2023). Thus, from a theoretical angle, recent SLA postulations of WM as part of LA (e.g., Kormos, 2013; Linck et al., 2013; Wen, 2019, 2022; see also Miyake & Friedman, 1998; Skehan, 2002; and Wen et al., 2017) need to be put to the empirical test in the case of writing, at a minimum on account (i) of the differential demands for attention required in oral and written communication (Manchón, 2023; Manchón & Williams, 2016; Williams, 2012), the latter being characterised by its problem-solving nature and extended time conditions, and (ii) of the idiosyncratic nature of writing processes that may be linked to crucial aptitude components (i.e., language analytic ability, memory ability, and phonetic coding ability) other than WM capacity and functioning (Ahmadian & Vasylets, 2022). Furthermore, the study of aptitude in writing is also relevant in connection with the generally accepted situated nature of aptitude.

In terms of empirical implications, our findings contribute to and are relevant in TC studies as well as empirical research on IDs in SLA in general (especially regarding their implication in L2 processing and learning), and L2 writing in particular. Regarding the former, our study attempted to provide further empirical evidence on interaction between TC and learner-related factors. Additionally, we consider that our study may constitute a contribution to previous empirical work on ID effects in writing, given that the research reported in this study adds to previous work on cognitive and affective/motivational IDs in conjunction with L2 writing by not only focusing on the independent effects of IDs on L2 written production but also by combining in one and the same study an inquiry into the potential interactions between learner-related variables (WM, LA, writing anxiety, writing self-efficacy, writing motivation and L2 proficiency) and task-related variables (TC) that have hitherto been addressed separately. Thus, we hoped the expansion of the range of IDs to be investigated in our study would consistently contribute to future SLA-oriented L2 writing research, as we included cognitive IDs (language aptitude and working memory) as well as IDs that have not been a central concern in past research, such as the affective and motivational factors of writing anxiety, self-efficacy and motivation, as advocated by Li (2023b). Second, we also consider that our study may contribute to methodological considerations which are of relevance in IDs L2 writing research, particularly concerning the way in which WM is operationalised and the time-on-task conditions which are implemented.

Finally, since research on how IDs are implicated in writing is scarce, we consider that our study results in relevant pedagogical implications for the field of instructed SLA. More specifically, the relevance for pedagogy rests on the crucial and integral role of writing in the field of instructed SLA, as well as on the potential of research to shed light on the optimal writing performance and learning conditions for learners with diverse cognitive, affective and motivational ability levels/profiles, through the development of instructional strategies investigated, for instance, from an aptitude-treatment interaction (ATI) perspective (Cronbach & Snow, 1977). In addition, from a pedagogical angle and in line with Vasylets and Manchón's (2023) claims on the relevance of writing in SLA IDs research, we consider the results of our study are pedagogically relevant as they provide new insights into the importance of matching instructional interventions to learners' abilities (Robinson, 2012), and also given the presence of literacy practices in instructed SLA contexts, which is central in the language-learning potential of L2 writing theory (Harklau, 2002; Leow & Manchón, 2021; Manchón, 2011, 2023; Manchón & Williams, 2016). Finally, we consider our results on the effects of IDs would be pedagogically relevant for learning and task performance across modalities (Manchón & Vasylets, 2019; Vasylets & Gilabert, 2021; Zalbidea, 2021; Zalbidea & Sanz, 2020; for a review, see also Johnson, 2022).

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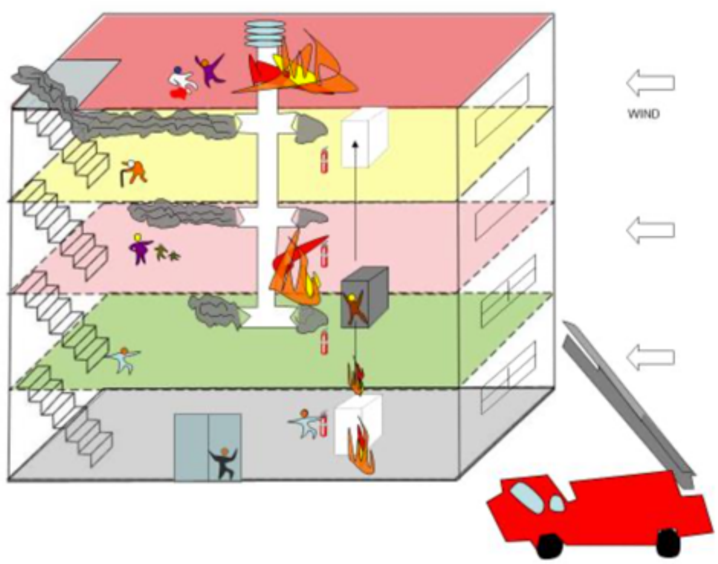
APPENDICES

Appendix 1
Complex version of "Fire-Chief" task (Gilabert, 2007)

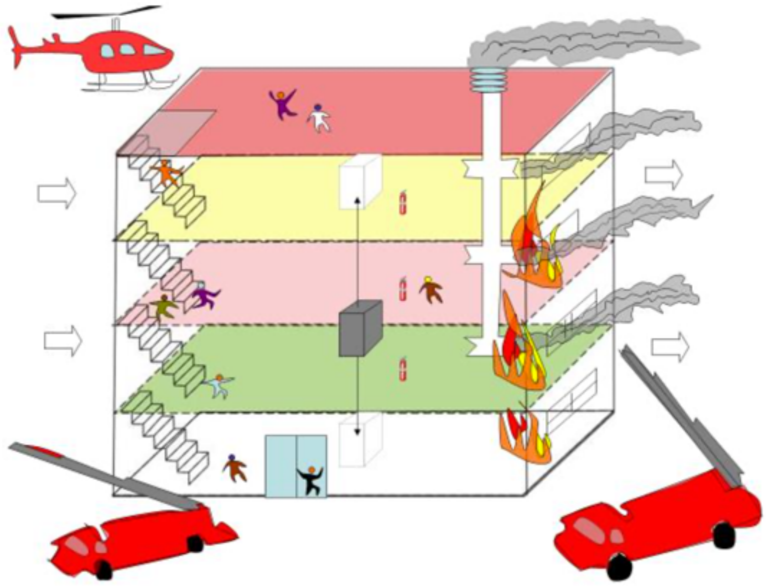


WRITING TASK

Instructions: Observe the fire chief image and **write a description**, considering all the different elements involved in the situation. More precisely, you have to explain (a) which action you would take to save as many people as possible, and (b) the sequence (i.e., order) in which you would take those actions. In both cases, you have to justify your choice of actions and their sequence. [In short, say what you would do, in which order, and why.]

Appendix 2

Simple version of "Fire-Chief" task (Gilabert, 2007)



WRITING TASK

Instructions: Observe the fire chief image and **write a description**, considering all the different elements involved in the situation. More precisely, you have to explain (a) which action you would take to save as many people as possible, and (b) the sequence (i.e., order) in which you would take those actions. In both cases, you have to justify your choice of actions and their sequence. [In short, say what you would do, in which order, and why.]