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# EFL learners' writing processes : the relationship between linguistic knowledge, composing processes and text quality

Gulay Tiryakioglu

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# Processus d'écriture en anglais langue étrangère :

*interactions entre compétences linguistiques, processus de rédaction et qualité du texte.*

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EA4162 Centre de Recherche en Terminologie et Traduction

THESE de DOCTORAT

Pour obtenir le grade de
Docteur en Lexicologie et Terminologie Multilingues Traduction
et Linguistique Appliquée

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# EFL learners' writing processes: the relationship between linguistic knowledge, composing processes and text quality

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# Resumé

L'écriture est un processus complexe à la fois dans la langue première (L1) et dans une langue étrangère ou seconde (L2). Les recherches sur les processus d'écriture en langue seconde et en langue étrangère se multiplient, grâce à l'existence d'outils de recherche qui nous permettent d'examiner de plus près ce que les apprenants font réellement dans leurs langues lorsqu'ils écrivent (Hyland, 2016; Van Waes et al., 2012; Wengelin et al., 2019) ; les recherches sur les comportements d'écriture plurilingue restent cependant rares. Cette étude examine la relation entre la connaissance de la langue, les compétences en dactylographie, les processus d'écriture (fluidité d'écriture, pauses et révisions) et la qualité des textes écrits par 30 collégiens français (14-15 ans), lors de l'écriture dans leur premier (français) et deuxième (anglais) langues. Dans la seconde étude, nous avons examiné cette relation complexe au sein d'un sous-groupe de 15 élèves bilingues turcophone (14-15 ans, résidant en France) lors de l'écriture dans leur langue d'origine (turc), langue scolaire (français) et l'anglais (une langue étrangère, également apprise à l'école). La troisième étude explore cette relation complexe entre le sous-groupe de 17 apprenants bilingues (15 apprenants turcophone et 2 apprenants arabe-français) et 13 apprenants monolingues français.

Nous avons utilisé un plan d'étude à méthode mixte: une combinaison d'enregistrement des touches tapées au clavier, de questionnaires avant et après l'écriture, de textes écrits par les élèves et d'entretiens de rappel stimulé. Nos participants ont effectué trois tâches d'écriture (une tâche de copie, une tâche descriptive et une tâche narrative) dans chaque langue à l'ordinateur à l'aide de l'outil d'enregistrement des touches tapées au clavier, *Inputlog* (Leijten & Van Waes, 2013). L'enregistrement des touches tapées au clavier (possibilité de mesurer avec précision le comportement de frappe), qui s'est développée au cours des deux dernières décennies, permet une investigation empirique des comportements de frappe lors de l'écriture à l'ordinateur. Les données relatives aux processus d'écriture ont été analysées à partir de ces données d'*Inputlog*: la fluidité d'écriture a été mesurée en caractères par minute, mots par minute et la moyenne des caractères entre deux pause en rafales de pause (de 2000 millisecondes); les hésitations ont été mesurées par le nombre de pauses, la durée des pauses et leur emplacement (à l'intérieur ou entre les mots); les révisions ont été mesurées en nombre de suppressions et d'ajouts, et en rafales de révision (le nombre moyenne d'ajouts et suppressions entre deux longues pauses de 2000 millisecondes). La vitesse de frappe a été mesurée avec une tâche de copie dans chaque langue du projet; cette tâche de copie est corrigée automatiquement par *Inputlog* ; nous avons développé cette tâche en turc pour notre étude, et elle a été normalisée et figure maintenant comme partie intégrante du logiciel, pour d'autres utilisateurs. Pour évaluer la qualité des textes écrits par nos apprenants, une équipe d'évaluateurs a utilisé une échelle d'évaluation holistique et analytique pour juger du contenu, de l'organisation et de l'utilisation de la langue dans les textes en L1, L2 et L3 ; nous avons ensuite comparé cette évaluation qualitative aux mesures quantitatives obtenus dans *Inputlog*. Nous avons également recueilli des données avec un protocole de rappel stimulé auprès d'un sous-groupe de sept scripteurs, pendant qu'ils regardaient les données enregistrées sur *Inputlog* se dérouler à l'écran (avec la fonction *Replay*); ce processus fascinant nous a permis d'obtenir des informations liées aux pensées des écrivains lors des pauses et révisions longues. Enfin, nous avons obtenu d'autres informations sur les comportements d'écriture des participants en dehors de la classe à l'aide d'un questionnaire.

Nos analyses de l'enregistrement des touches tapées au clavier révèlent des différences importantes entre la rédaction en L1 et en L2, ainsi qu'entre les processus d'écriture en L1, L2 et L3, qui semblent être liées aux antécédents linguistiques de nos sujets bilingues, et en particulier à leur contact avec le turc écrit (Akinci, 2016). Les processus d'écriture étaient plus fluides en français, avec des rafales entre pauses plus longues, et moins de pauses et de révisions que l'écriture en anglais et en turc. Des comparaisons a posteriori des processus d'écriture dans les trois langues du projet montrent que bien qu'il existe des différences significatives entre les processus d'écriture français et turc / anglais, les processus d'écriture en anglais et en turc sont similaires, avec cependant des différences de fluidité significatives. Les données relatives à la vitesse de frappe ont été analysées à partir de la tâche de copie d'*Inputlog* en français, anglais et turc, et ces analyses révèlent des différences importantes entre les comportements dactylographiques en L1, L2 et L3. Nous avons également trouvé des corrélations significatives entre la connaissance de la langue, les mesures de maîtrise de l'écriture et la qualité du texte dans les trois langues. Les relations entre les processus d'écriture et la qualité du texte dans l'écriture multilingue sont complexes, et nous discuterons des implications de nos résultats pour la pratique en classe et les recherches futures.

Mots-clés: processus d'écriture, d'enregistrement des touches tapées au clavier, *Inputlog*, écriture en anglais langue étrangère (ALE), apprentissage de langues étrangères, écriture multilingue, apprenants bilingues, bilingues français-turc, modèle d'écriture multilingue, connaissances linguistiques, compétence en dactylographie, tâche de copie, fluidité de l'écriture, qualité du texte, protocoles de rappel stimulé

# Abstract

Writing is a complex process both in the first language (L1) and in a foreign or second language (L2). Research on second- and foreign-language writing processes is increasing, thanks to the existence of research tools that enable us to look more closely at what language learners actually do as they write (Hyland, 2016; Van Waes et al., 2012; Wengelin et al., 2019); research on plurilingual writing behaviour remains, however, scarce. This study looks at the relationship between knowledge of language, typing skills, writing processes (writing fluency, pauses and revisions) and the quality of texts written by 30 middle school French students (14-15 years old), during writing in their first (French), and second (English) languages. In the second study, we looked at this complex relationship among a sub-group of 15 middle school French-Turkish bilingual students (14-15 years old, residing in France) during writing in their home language (Turkish), school language (French), and English (a foreign language, also learned at school). The third study explores this complex relationship between the subgroup of 17 bilingual learners (15 Turkish-French bilinguals and 2 Arabic-French bilinguals) and 13 French monolingual learners.

We used a mixed-method study design: a combination of keystroke loggings, pre- and post-writing questionnaires, students' written texts and stimulated recall interviews. Our participants performed three writing tasks (a copy task, a descriptive and a narrative task) in each language on the computer using the keystroke-logging tool *Inputlog* (Leijten & Van Waes, 2013). Keystroke logging (the possibility of measuring precise typing behaviour), which has developed over the past two decades, enables empirical investigation of typing behaviour during writing. Data related to writing processes were analyzed from this *Inputlog* data: writing fluency was measured as characters per minute, words per minute, and mean pause-bursts (text produced between two pauses of 2000 milliseconds); pausing was measured as numbers of pauses, pause length, and location (within and between words); and revisions were measured as numbers of deletions and additions, and revision-bursts (additions and deletions between two long pauses of 2000 milliseconds). Typing speed was measured with the *Inputlog* copy task tool in three languages; we developed the Turkish copy task for our study, and it has been standardized and added to the *Inputlog* software. To assess text quality, a team of evaluators used both a holistic and an analytical rating scale to judge content, organization and language use in the L1, L2 and L3 texts, and this qualitative assessment is compared with the quantitative *Inputlog* measures. We also collected stimulated recall protocol data from a focus group of seven writers, as they watched the keystroke logged data unfold; this fascinating process enabled us to obtain information related to the writers' thoughts during long pauses and revisions. Finally, we obtained background data on the participants' writing behaviors outside the classroom with a questionnaire.

Analyses of the keystroke logging data reveal important differences between L1 and L2 as well as between L1, L2 and L3 writing processes, which appear to be linked to our bilingual subjects' linguistic backgrounds, and especially their contact with written Turkish (Akinci, 2016). Writing processes were more fluent in French, with longer pause-bursts, fewer pauses and revisions than writing in English and Turkish. Post-hoc comparisons of writing processes in the three project languages show that although there are significant differences between French and Turkish/English writing processes, English and Turkish writing processes are similar, with, however, significant fluency differences. Data related to typing behaviour were analyzed from the *Inputlog* copy task tool in French, English and Turkish, and these analyses reveal important differences between typing in the L1, L2 and L3. We also found significant correlations between language knowledge, writing fluency measures and text quality in the three languages. The relationships between writing processes and text quality in multilingual writing are complex, and we will discuss the implications of our findings for classroom practice, and future research.

Keywords: writing processes, keystroke loggings, *Inputlog*, EFL writing, foreign language learning, multilingual writing, bilingual learners, French-Turkish bilinguals, multilingual writing model, linguistic knowledge, typing skill, copy task, writing fluency, text quality, stimulated recall protocols

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# List of abbreviations

L1: first language

L2: second language

L3: third language

FL: foreign language

EFL: English as a foreign language

ESL: English as a second language

ELCO: Enseignement de la Langue et Culture d'Origine

SCB: selected component bigrams

TB: targeted bigrams

HFB: high-frequency bigrams

CPM: characters per minute

WPM: words per minute

P-burst: Pause-burst (number of characters or words typed between two pauses)

R-burst: Revision-burst (number of characters or words typed between two revisions)

# INTRODUCTION

Writing is a complex and demanding process, which involves interacting components. Writing is difficult, because writers have to carry out cognitive, metacognitive, pragmatic, affective and linguistic activities simultaneously (Bereiter & Scardamalia, 1987; Flower & Hayes, 1980; 1981; Hayes, 1996; Hayes & Flower, 1980; Kellogg, 1996, 1999; Schoonen et al., 2011; Torrance & Galbraith, 1996). For instance, during a typical classroom writing activity, a writer must understand the task instructions, decide about the genre of the text, make global (text-level) and local (paragraph and sentence-level) plans, generate ideas, retrieve words from her long-term memory to express these ideas, arrange these words in sentences, make pragmatic decisions, revise the text – and many other operations, all of which interact, doubtless in complex ways.

Writing in a foreign language (L2[1]) is even more difficult than writing in the first language (L1), because L2 writers will be less proficient in the L2 than in their native language (Grabe & Kaplan, 1996; Schoonen et al., 2003; 2011). For beginning L2 learners whose L2 knowledge is limited and not available automatically, writing a text can be a much more effortful process, since attention will be directed at this "lower-order" knowledge such as vocabulary, spelling and grammar. Working memory capacity is not free for "higher-level" semantic and pragmatic activities such as planning, the text's content and organization, or taking the reader into account (e.g. Chenoweth & Hayes, 2001; Lindgren, 2004; McCutchen, 2000; Whalen & Ménard, 1995).

My interest in written production started with my career as an English teacher after graduating from the Teaching English as a Foreign Language (EFL) Department at Hacettepe University in Turkey in 1991. Since then, I have taught English to students at different levels from primary school to university. When I ask my learners to write a text (so that I can evaluate their writing skills for a test or exam, for example), I observe them while they build up sentences and paragraphs, and I have witnessed my EFL learners' difficulty in written production at all levels. While the more proficient EFL learners write their texts fluently and with better text quality, the less-proficient learners struggle, telling me that this is due to

[1] A second language is a language present in the learner's immediate social environment; a foreign language, as its name implies, is spoken by more distant social groups. We will use the abbreviation "L2" to refer to both, and specify the distinction when relevant.

limited vocabulary and grammatical knowledge. This often leads them to lose motivation and simply stop writing, which results in low-quality texts. Investigating the reasons for my EFL learners' ease or difficulty with L2 text production has become one of my professional objectives. Furthermore, observing their difficulty/proficiency in text production has led me to wonder whether they experience the same difficulty/efficiency when writing in their first language. What difficulties are encountered in both the L1 and L2? Are there difficulties particular to L2 writing? What do learners think about when they pause and revise their work? Why do they delete or insert a letter or a word? These questions have engaged me in a comparison of EFL learners' writing in their L1 and in English (Tiryakioglu et al., 2019).

I am also interested in bilingual learners' writing processes. When I worked as a Turkish teacher for the Turkish Consulates in Belgium and France for ten years, I had the experience of teaching Turkish heritage language[2] at primary and middle schools where there are either Turkish-Belgian or Turkish-French bilingual learners. I observed Turkish-French bilingual learners' difficulty in written production in their Turkish heritage language during my courses although they speak Turkish with a mix of French with their parents, relatives, and friends as a home language. In 2007 (the last date for which I could find reliable statistics), there were approximately 74,000 Turkish-French bilingual learners in the French education system, from nursery school to university level (Akinci, 2007). These Turkish-French bilinguals speak Turkish in their Turkish community and learn Turkish as a heritage language in some schools. French is the main school language, frequently learned from the first year of nursery school (age 3) onwards (Akinci & Decool-Mercier, 2010). These bilingual students also study English as a foreign language. With this in mind, I have always wondered whether Turkish-French bilinguals produce texts in Turkish as an oral L1, in French as a second, but dominant school language, and in their English as a foreign language in the same manner.

Although there is a large amount of research on bilinguals' written production (both in their L1 and L2) using “product” (or text) data – especially in academic writing -- there is less research comparing writing *processes* in three languages. We therefore decided for this doctoral project to look at writing processes in bilingual teenagers who are learning English as a foreign language. One of the main questions in foreign/second language writing research is *how* learners produce a written text, and how they use language structures to turn their ideas into language units. Starting with a comparison of L1 and L2 writing processes, we

[2] "A heritage language has been used broadly to refer to nonsocietal and nonmajority languages spoken by groups often known as linguistic minorities." (Valdes, 2005, p. 411).

wanted to extend our study to look at multilingual writing, comparing L1, L2 and L3 writing processes used by Turkish-French bilingual students – a sub-group in our study. We focused on three types of writing process data: writing fluency, pause and revision behaviours. To our knowledge, this study is the first to look at 14-15 year old Turkish-French bilingual students' writing processes, not only in their dominant school language (French), in their heritage language (Turkish), but also in their L3 (English as a foreign language).

These Turkish-French bilingual learners have the same learning environment as their French-speaking monolingual peers. While French monolingual learners have more language input in their first language, Turkish-French bilingual learners' native written Turkish input is largely limited to school. I have become interested in whether Turkish-French bilinguals and their French monolingual peers differ in text production. Do Turkish-French bilinguals learn to write and produce texts in French in the same way as their monolingual peers (since they all begin at the same time)? What about the quality of the texts they write (in Turkish, in French)? These two learner groups also learn English as a foreign language (L2 or L3) at school. Many questions have arisen in my mind related to bilinguals' and monolinguals' text production in L2 or L3 English: What are the similarities and differences in EFL text production between bilinguals and monolinguals? Can we collect data illustrating differing cognitive processes during text production in L1 (French or Turkish) and English?

There is a great body of research on L2 writing in academic settings, especially on the written *products* of L2 writers. In these studies, L2 texts are analyzed from different perspectives, to look at how language, content or pragmatic elements are dealt with. In the 1980s, researchers became more interested in the *processes* involved in L2 writing (Hyland, 2016), generally with university-level students in academic settings. Since there is less research on L2 text production in school settings with teenagers, I decided to study this age group (Harklau, 2007). I am particularly keen on investigating middle-school learners' text production because they are supposed to have reached a threshold level for text production in L1 and paragraph production in their first foreign language. I also wanted to collect data, particularly from 9th-grade middle-school learners, because I had access to about 70 Turkish-French bilingual students in the middle-school where I worked in France, making data collection relatively easy. These 9th-grade learners also represent the target population for the *Programme for International Student Assessment* (PISA) tests. Therefore, the information obtained from this group of learners can provide insights for educationalists and policy developers, and possibly data that can be compared with PISA results.

In this technologically developing era, we need to understand how learners process written text on computers. We need to use computer-assisted foreign language learning and writing tools in teaching and learning activities at schools. In order to develop appropriate computer-assisted writing activities for EFL courses, it is important to understand how learners write on computers, and this can be studied with computer-based research tools. Writing research uses different methods to investigate online writing processes: think-aloud protocols, stimulated recall interviews, video-recordings, and eye-tracking. An innovative writing process research tool, keystroke logging software, was introduced to me when I was studying for my Master's degree in Educational Sciences at the University of Leuven in Belgium. I was fascinated by the efficiency of the logging tool, *Inputlog,* developed by Leijten and Van Waes (2006; 2013) at the University of Antwerp in Belgium. Keystroke loggings capture time-based typing, pauses, revisions and mouse movements (editions and deletions) during writing. They record the time between pressing a key and releasing it. They register every computer keystroke, every pause, deletion, and addition to the text during the writing process (Leijten & Van Waes, 2006; 2013; Spelman Miller et al., 2008; Van Waes & Leijten, 2015). Furthermore, the *Inputlog* software provides an impressive set of data analysis programs. Due to these many useful functions, I was excited to use keystroke-logging software in my research to compare writing processes in three different languages.

A growing amount of research is being carried out using keystroke loggings to investigate L1 writing processes (Deane & Zhang, 2015; Leijten & Van Waes, 2013; Lindgren, 2004; Lindgren et al., 2008; Severinson Ekhlund & Kollberg, 1996; Wengelin et al., 2009). There are also studies which used keystroke logging tools to compare L1 and L2 writing processes (Breuer, 2014; 2019; Palviainen et al., 2012; Tillema, 2012; Tiryakioglu, Verschaffel & Sercu, 2019; Thorson, 2000; Van Waes & Leijten, 2015). Most research with keystroke loggings has been carried out with university-level students. To our knowledge, no research has been done comparing L1 and L2 writing processes and text quality with teenage French learners, or Turkish-French bilinguals writing in their first, second, and third languages.

In L1/L2 writing research, there are studies which combine keystroke loggings with other research methods such as think alouds (Stevenson et al., 2006; Tillema et al., 2013; Tiryakioglu et al., 2019), stimulated recall /retrospective interviews (Barkaoui, 2015; Choi, 2016; Rahmanpanah & Tajeddin, 2015; Révész et al., 2019) and post-writing questionnaires (Tiryakioglu et al., 2019). In this doctoral study, while our main data set will come from keystroke loggings, we will also combine this quantitative data with more qualitative

methods, like pre-post writing questionnaires and stimulated recall interviews. We hope that our analyses of the relationships between learners and their attitudes towards writing, writing process measures (fluency, pause and revision behaviour), and writing products (the texts they produce) will provide insights for developing more effective methods or tools to enhance writing performance in a learner's different languages.

Previous findings regarding the relationship between language proficiency, typing skill and writing performance vary, sometimes in contradictory fashion, and our PhD study aims to look at the differences in composing processes and text quality between L1 (French) and L2/L3 (English) among French middle school EFL learners, and between L1 (Turkish), L2 (French) and L3 (English) among French-Turkish bilingual middle school students. Thus, the aim of this research proposal is to look into the relation between typing skills, linguistic knowledge, composing processes and text quality of EFL students in L1, L2 and L3 writing.

***Overview of the study***

The main objective of this PhD project is to add to our current knowledge of foreign-language writing ability; we will therefore begin (Part I) with a review of psycholinguistic research into L1 and L2 writing. In Chapter 1 we look at the theoretical and empirical background of native-language writing. Based on the premise that L1 and L2 writing involve the same mental processes, Chapter 1 presents the writing models which will be adopted for our study. Chapter 2 is more focused on the particular characteristics of L2 writing, in particular: the role of linguistic knowledge in L2 writing ability and processes, and text quality in L1 and L2 writing. It also incorporates a description of multilingual writing processes. In Chapter 3, we will summarize previous studies on keystroke logging in L2 writing research.

Chapter 4 outlines our research questions and the structure and methods used in our doctoral study. We also present the results of a pilot study investigating the relationship between linguistic knowledge and composing processes in L2 writing, which was published as a book chapter in *the Studies in Writing* Series (Tiryakioglu, Peters & Verschaffel, 2019). Chapter 5 presents the multi-method design of our PhD project, and the profile of the 30 participants in our study. The procedures for data collection and analysis are also explained.

Part II is also composed of five chapters. Chapters 6 through 10 present and discuss our results, both quantitative and qualitative. First (Chapter 6), we present the results of study 1, which looks at the relationship between linguistic knowledge and typing skills, and writing

processes as well as text quality in the written production of thirty 14-15-year-old French middle-school students in L1/ school French and L2/L3 English. Chapter 7 provides a discussion of these results in the light of previous first and second language writing research.

Chapter 8 presents the results of study 2, which investigates the relationship between linguistic knowledge and typing skills, and writing processes and text quality in the written production of our sub-group of fifteen 14-15-year-old Turkish-French bilingual middle-school students in their L1 (Turkish), L2 (second/ school language French) and L3 (English) writing.

In Chapter 9, study 3 compares the writing processes and text quality between our monolingual (n=13) and bilingual (n=17) learners, writing in French and English as a foreign language. We will look at comparative results, and discuss the findings for possible differences between monolingual and bilingual foreign-language writing.

Chapter 10 reports the results from our qualitative data: a series of pre-/post-writing questionnaires and stimulated recall interviews. The pre-/post-writing questionnaires were designed to obtain information about the participants in the study. These instruments are our *Student Writing Profile Questionnaire*, a *Post-writing Questionnaire* in three languages, a *Student Motivation for English* questionnaire, a *Student Motivation for Turkish* questionnaire; scores from these questionnaires will be correlated with linguistic knowledge and text quality measures obtained in the previous studies. Chapter 10 also presents data from a set of stimulated recall interviews that were conducted with a small focus group of learners (taken from our original pool of 30 participants). Seven volunteer students (4 monolinguals and 3 bilinguals) volunteered to watch their *Inputlog* recorded file unfolding (in *Replay* mode), and were asked what they were thinking or doing when they paused and revised their text. These stimulated recall interviews are used to look at how our student writers describe their writing performance, in order to add to our understanding of what happens as they write in their L1, L2 and L3.

Finally, in our *General Conclusions and Pedagogical Implications,* we will briefly sketch some pedagogical implications of our research, including an earlier study on the benefits of L2 writing strategy instruction to develop writing skills in a foreign (or even first) language. I will also acknowledge the limitations of our project, and propose directions for future research on multilingual writing.

# PART 1: THEORETICAL BACKGROUND AND PROJECT METHODOLOGY

## Chapter 1: Theories and models of writing

Over the past four decades, writing research has been interested in writing as a process (e.g. Bereiter & Scardamalia, 1987; Flower & Hayes, 1980; 1981; Hayes, 1996; Hayes & Flower, 1980; Kellogg, 1996, 1999; Van den Bergh & Rijlaarsdam, 2001), and "the mental operations writers use when they are trying to generate, express and refine ideas in order to produce a text" (Roca de Larios, Murphy & Marin, 2002, p.12). Below we present the theories and models used in this writing process research.

### 1.1 Flower and Hayes' Cognitive Process Theory of Writing (1981)

Hayes and Flower (1980) and Flower and Hayes (1981) developed the first theory of cognitive processes involved in L1 text production. Their model was ground-breaking, and is considered the most influential in writing research (Archibald & Jeffery, 2000). The Cognitive Processing Model is based on five years of study: to collect process data, Hayes and Flower's team used think-aloud protocols, a method which encourages writers to attempt to express what they are thinking and doing while producing a piece of text (Flower & Hayes, 1981; Hayes, 1996; Hayes & Flower, 1980).

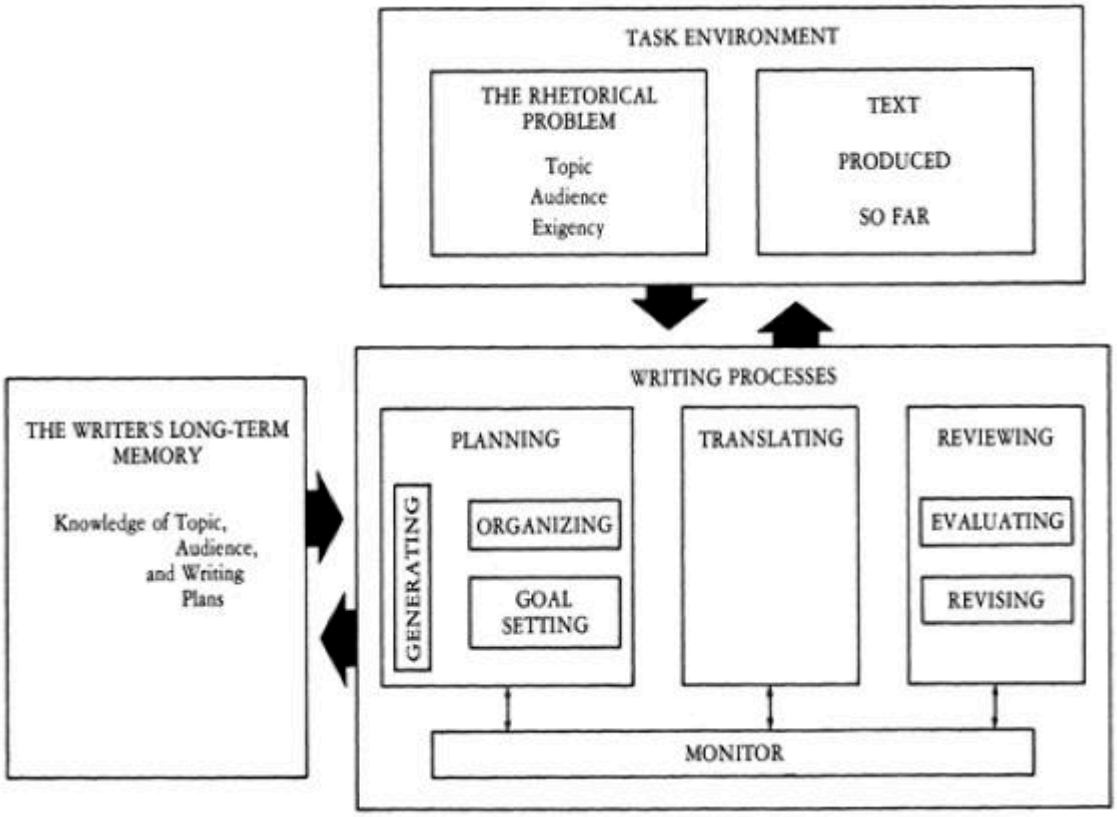
Their cognitive process theory describes the writing process as:

> a) a set of distinctive thinking processes; b) a hierarchical, highly embedded organization; c) a goal-directed thinking process; d) both high-level goals and supporting sub-goals are generated. (Flower & Hayes, 1981, p.366)

The model involves three main components; "the task environment, the writer's long term memory and the writing processes" (Flower & Hayes, 1981, p. 369; see Figure 1.1, below). In an educational context, the task environment involves the writing assignment and the growing text. The writer's long term memory includes linguistic knowledge, as well as knowledge related to the topic, the audience, and written discourse. When the writer is given a rhetorical problem (a writing assignment), s/he sets global and local goals by thinking about the topic, audience and prose. S/he generates ideas by retrieving the information related to topic knowledge from long term memory, evaluates them, turns these ideas into words and

phrases, and writes them down using previously acquired motor skills (Flower & Hayes, 1981).

Figure 1.1 Flower and Hayes' Cognitive Process Theory of writing (1981, p.370)




The third component of the Flower and Hayes 1981 model is three writing processes: planning, translating (or formulating), and reviewing. Writing is seen as a problem-solving process, in which these three mental activities are applied recursively under the control of a "writing monitor" in the construction of ideas (Figure 1.1).

Flower and Hayes suggest that composing is not a linear process, as described by certain predecessors (Gordon Rohman's "pre-write, write and re-write model," for example, summarized in Flower & Hayes 1981, p. 367). Nor are the stages of the writing process clean-cut actions that happen one after the other (p. 375). Writing, which involves planning, translating and reviewing, is instead a hierarchical and recursive process, in which these actions happen at any time during the act of composing, and may interact. For instance, a writer can revise not only after composing but also during the process when s/he wants to evaluate what has been written so far. We will start by looking at Flower and Hayes' three major writing processes (planning, formulation and revision) in more detail, since we will refer to these processes often in our analyses.

The *planning* process involves three sub-processes: generating ideas, goal-setting and organizing. When a rhetorical problem is given to the writer in a school assignment, s/he sets a goal, which involves building internal representations to communicate her ideas to the audience according to the demands of the topic. Then s/he generates ideas, which involves "retrieving information from long-term memory" (Flower & Hayes, 1981, p. 372). Before the activated ideas can be written down, they must undergo organization and structuring, which are considered sub-process; the writer must arrange her ideas coherently, grouping and categorizing them around a central topic, for example. The writer also makes pragmatic and textual decisions, “setting goals” in order to reach or influence her reader; these pragmatic goals influence the whole writing process (ibid).

The *translating* or *formulation*[3] process is described as "putting ideas into visible language" (Flower & Hayes, 1981, p. 373). The authors prefer to use *translate* rather than *transcribe* or *write* since this process involves the encoding of ideas generated during the planning process into linguistic entities: words and groups of words. The linguistic processes involved are lexical, syntactic, orthographic and grammatical; there are also the motor skills used to form letters and write (or type) out the words of the text. If these aspects are not fully automated, the formulation process becomes demanding for the limited capacity of short-term memory (Chenoweth & Hayes, 2001; Hayes & Flower, 1981; Kellogg, 1996; McCutchen, 2000). Automaticity of the motor skills involved in writing takes several years for children to develop, until they can write words and sentences without laboriously attending to the written forms.

The *reviewing-* or *revision-* process includes the two sub-processes of evaluating and revising. In reviewing, "writers choose to read what they have written either as a springboard to further translating or with an eye to systematically evaluating and/or revising the text" (Flower & Hayes, 1981, p. 374). This triggers a new cycle of planning, generating ideas and encoding. Evaluating and revising can interrupt the writing process at any time, which is why writing processes are considered to be "recursive" (Flower & Hayes, 1981).

While Flower and Hayes' (1981) model has been one of the most influential writing models in the writing research field, it has also been much criticized. It has been argued that the cognitive process model lacks descriptions of sub-processes, since it focuses on the major processes of planning, translating and reviewing (Alamargot & Chanquoy, 2001; Torrance &

[3] We prefer to use *formulation* rather than *translating,* because translating is generally confused with the act of translating from one language into another, especially in a foreign-language research context such as ours.

Jeffrey, 1999). The *formulation* process is not described in detail (Fayol, 1991), although it is one of the writing processes which takes most of the writer's active writing time (Whalen & Ménard, 1995). Later on, when Hayes (1996; 2012) revised his Writing Process Model, he described the *formulation* process in more detail by clearly delineating its sub-processes.

It has also been argued that the cognitive activities represented in Hayes' model, do not occur randomly, but that planning, formulation and revising are time-dependent (Rijlaarsdam & Van den Bergh, 1996; Van den Bergh & Rijlaarsdam, 1999). Different cognitive activities take place at different moments in writing; with some more dominant according to the demands of the task situation. The time at which certain cognitive writing activities occur may also contribute to or determine text quality (Rijlaarsdam & Van den Bergh, 1996). These Dutch findings suggest that writers who structure during the first 10 minutes of the writing process are more likely to produce a good-quality text, and writers who structure in the second phase of writing may produce a lower-quality text.

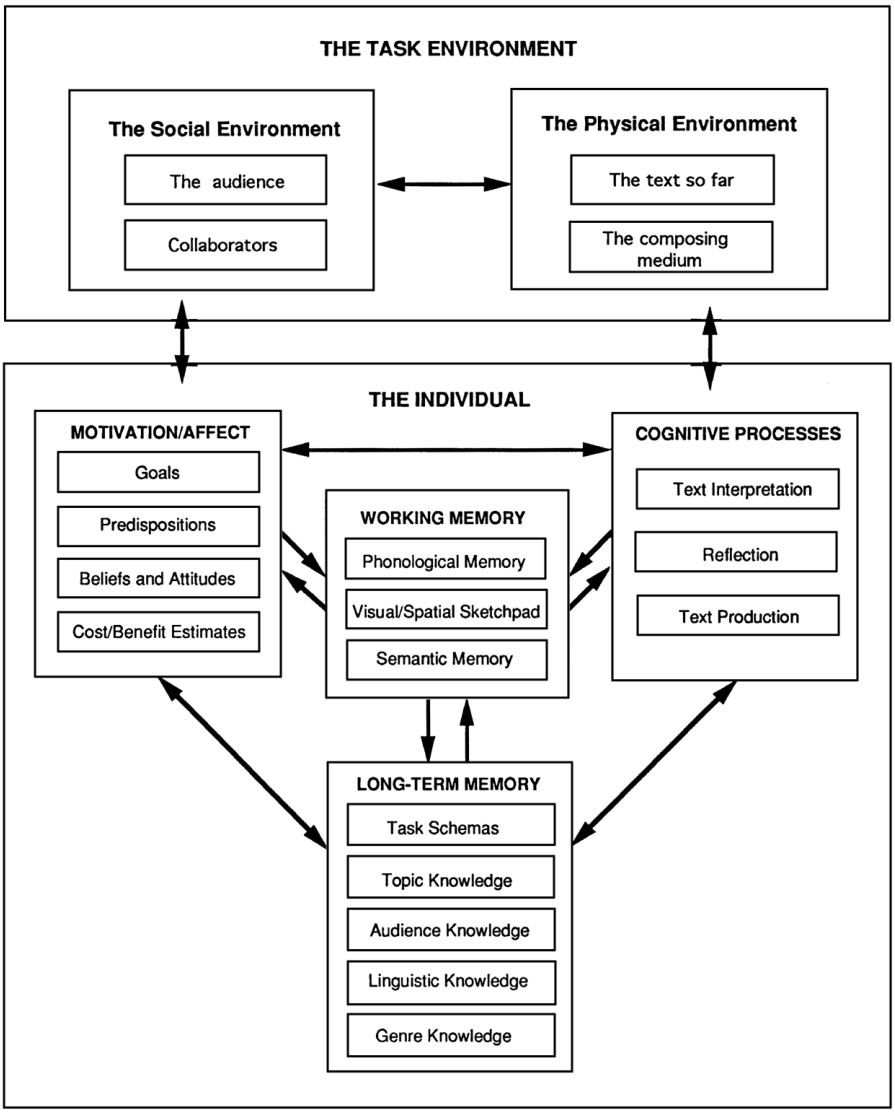
## 1.2 Hayes' Writing Model (1996)

In 1996, Hayes revised the original cognitive processing writing model by adding other components (Figure 1.2). This new framework is more comprehensive than the previous model, with greater attention to the individual, working memory, motivation, affect, and the reorganization of cognitive processes. Two major aspects of writing that are now included in the model are the task environment and the person writing with her/his working memory, cognitive capacity, and motivations and affect. How these major and sub-processes interact with each other is shown in Figure 1.2. Hayes' Writing Model posits that some tasks place more demands on working memory resources than others.

Certain aspects of any writing task require the involvement of the “central executive” of the working memory system (our conscious attention) in the act of encoding and organizing one’s ideas. When a writer aims to write a perfect first draft, this is a conscious act, engaging the attentional component of working memory. As we see in Hayes’ model, the conscious cognitive functions in writing involve "text interpretation", "reflection" and "text production." Text interpretation is defined as creating "internal representations from linguistic and graphic inputs" (Hayes, 1996, p. 13). Reflection is related to the mental activity involved in problem-solving, decision-making and inferencing. In text production, the conceptual matter activated by the writer is encoded in linguistic forms and written down. Planning is carried out using

inner speech. Hayes' (1996) revised Model of Writing has become one of the influential models in writing research.

Figure 1.2 Hayes' Written Language Production Model (1996)

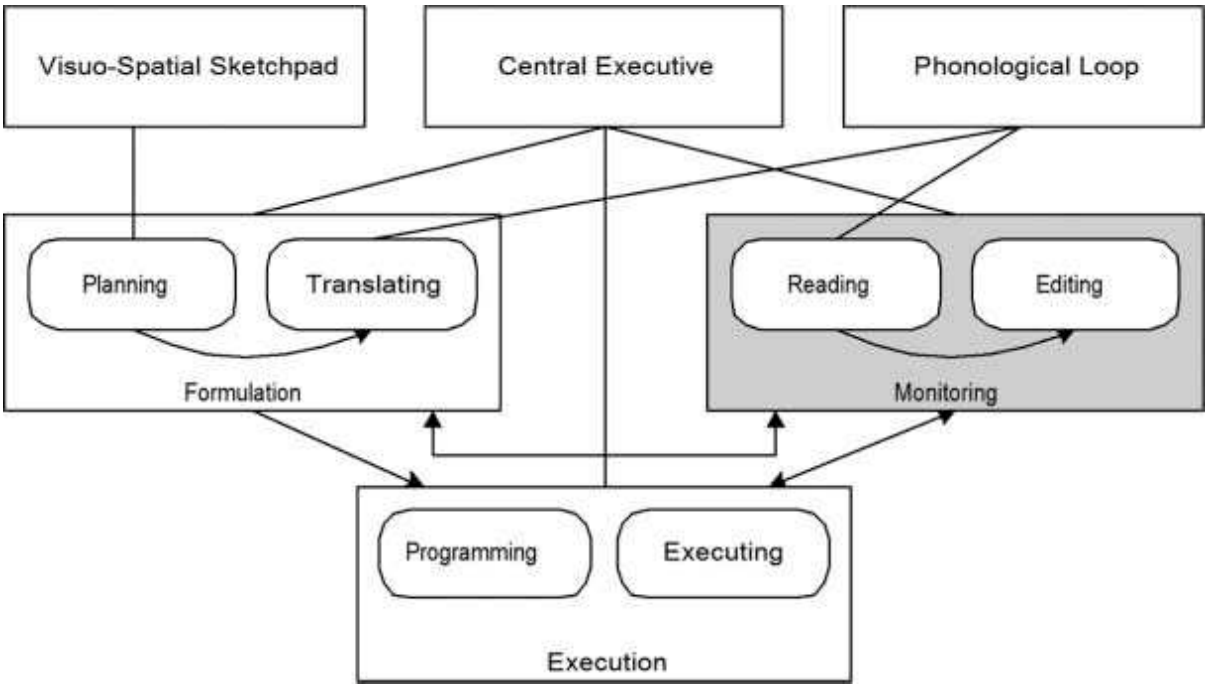



## 1.3 Kellogg's Model of Working Memory in Writing (1996; 1999)

Another influential model is Kellogg's (1996; 1999) Model of Working Memory in Writing, in which he also emphasizes the importance of working memory in the writing process. His model involves three major processes: formulation, execution and monitoring (Figure 1.3). He documented six basic processes involved in writing: planning, translating, programming, executing, reading and editing, which make demands on all the components of working memory: spatial, verbal, and attentional (the "central executive") – the boxes at the top of the model.

The cognitive cost of these six basic processes varies from task to task, depending on the writer's previous experience with each type of task. It is assumed that planning, translating, reading and editing generally put more demands on the central executive. Planning ideas is viewed as the most effortful cognitive process for the working memory in L1 writing (Kellogg, 1996).

Figure 1.3 Kellogg's Working Memory Model in Writing (1996)



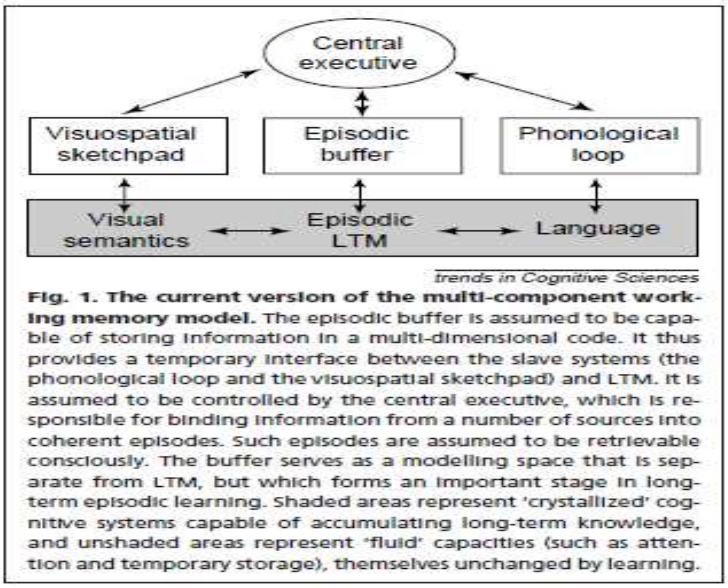

***The Role of Working Memory during Writing***

All of these process models of writing are based on theories of working memory in humans that have been developed by Alan Baddeley and his colleagues (e.g., Baddeley, 2000; Baddeley & Hitch, 1974; Gathercole & Baddeley, 1993). The earliest model of working memory (which has been widely accepted), consists of three components: *a phonological loop* which processes verbal information; the *visuo-spatial sketchpad* which processes visual information; and the *central executive* (our conscious attention) which manages the connections between automatically processed visual and phonological information, and the knowledge store in long term memory. Later, Baddeley (2000) added the *episodic buffer* as a new component to working memory model (Figure 1.4). He describes the *episodic buffer* as:

> a limited-capacity temporary storage system that is capable of integrating information from a variety of sources. It is assumed to be controlled by the central executive, which is capable of retrieving information from the store in the form of conscious awareness, of reflecting on that information and, where necessary, manipulating and modifying it. (p. 421)

Therefore, the episodic buffer acts as a temporary information storage system between working memory and long-term memory.

Figure 1.4 Alan Baddeley and colleagues' Working Memory model (Baddeley, 2000, p.421)




Both Hayes' (1996) and Kellogg's (1996; 1999) writing models are based on Baddeley and colleagues' evolving models of working memory. The differences between Hayes (1996) and Kellogg's (1996; 1999) writing models arise from differences in their conception of working memory function in writing. While Hayes (1996) suggests that writing processes make demands on all components of working memory during writing, Kellogg (1996; 1999) suggest that certain writing processes are more specifically linked to the different components of working memory. For instance, formulating and reading processes call on the attentional system, but not the spatial component; the planning process involves visuo-spatial working memory. In Kellogg's model, when working memory is overloaded, the writing processes can no longer occur simultaneously. Writers must have enough cognitive capacity in working memory at their disposal to be able to cope with the many constraints of lexical, grammatical, orthographical and discourse processes and decisions that occur simultaneously during writing.

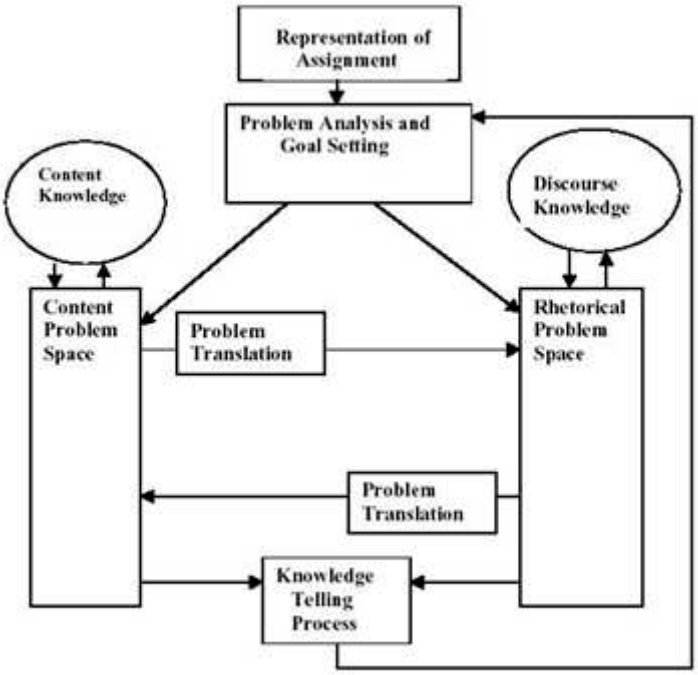
The working memory model is used to explain differences between skilled and less-skilled writers (Chenoweth & Hayes, 2001; Ellis & Yuan, 2004; Levy & Ransdell, 1996; McCutchen, 2000; Schoonen et al., 2011; Torrance & Galbraith, 2006). Unskilled or inexperienced writers may not be able to retrieve linguistic resources such as vocabulary and grammatical structures automatically from long-term memory during writing; this results in a

heavy load on the attentional system during encoding. If the writer needs to concentrate heavily on lower-level linguistic processes, it will be more difficult to engage (simultaneously) in the higher-level processes of planning, editing, and influencing the reader. In skilled writing, the automatization of linguistic processes such as lexical activation, grammatical encoding, and spelling means that little attention is necessary for these processes, leaving working memory free for pragmatic discourse management. More automatic linguistic encoding also results in greater writing fluency; which has been shown to relate to text quality.

### 1.4 Bereiter and Scardamalia's Writing Model (1987)

Bereiter and Scardamalia's writing model (1987) attempts to take developmental aspects into account. Their "knowledge-transforming" (Figure 1.5) and "knowledge-telling" models differentiate between expert and novice writers.

Figure 1.5 Bereiter and Scardamalia's Knowledge Transforming Model of Writing (1987)




Bereiter and Scardamalia hypothesize that expert and novice writers use different cognitive activities in text production. Novice writers or children use *knowledge-telling* strategies while composing, in which they just *tell* their ideas without making pragmatic decisions. They do not use complex problem-solving strategies, but rely on converting their ideas into written form without worrying about pragmatic issues. This is probably due to the fact that working memory capacity is overloaded when writers need to focus on both linguistic forms and

content simultaneously. This cognitive overload forces the writer to focus on one aspect of writing, such as checking the spelling or punctuation. Novice writers write better in a supportive environment, especially on the topics that matter to them. They are more comfortable with such particular genres as personal experience and narrative writing (Bereiter & Scardamalia, 1987).

Expert writers, on the other hand, follow Bereiter and Scardamalia's *knowledge-transforming* model while writing: they *transform* their ideas during the writing process, rather than just telling them. They engage in content organization and make pragmatic decisions, taking the reader into account: they have communicative goals, and are able to take their audience into account. Consequently, they approach the task with detailed, analytic, reflective and explicit problem-solving strategies (Bereiter & Scardamalia, 1987). This is possible largely because their attention is free to focus on these higher-level components of meaning communication, because linguistic forms can be activated automatically – i.e., without the need for conscious attention.

### 1.5 Chenoweth and Hayes' Writing Model (2003)

L2 writing research has been heavily influenced by L1 writing research, using the theories and models developed for L1 writing. Chenoweth and Hayes proposed two written production models for L1 and L2: one in 2001, the other in 2003, in which they describe how linguistic mental operations are activated while a text is written.

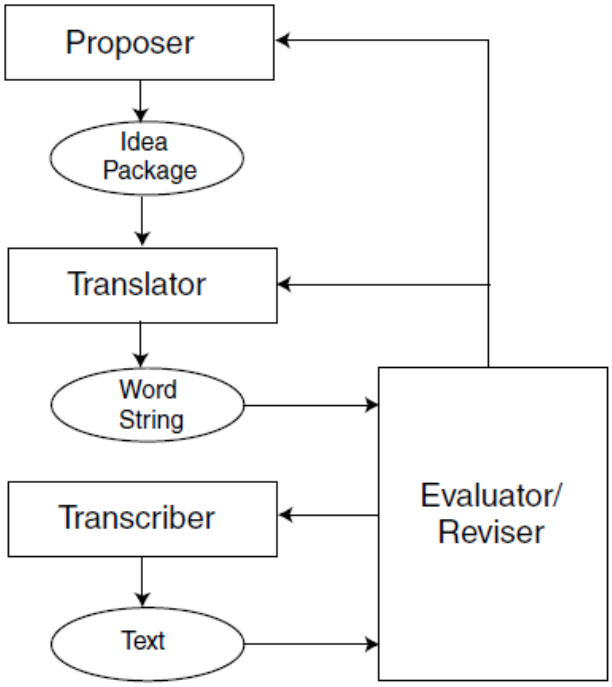
In their 2001 model, writers produce sentences not in as wholes, but in parts of sentence, or structured segments. These segments are described as 'bursts' or 'chunks' of automatically-activated language:

> [… B]ursts of proposed text were identified by pauses of two or more seconds in the verbal protocol or by a grammatical discontinuity indicating that the language prior to the discontinuity has now been revised. (Chenoweth & Hayes, 2001, p.83)

Text production between two pauses, or "burst length", is influenced by different factors. Burst lengths can vary between 6 to 12 words, depending on linguistic knowledge (Chenoweth & Hayes, 2001), and/or working memory capacity (Chenoweth & Hayes, 2003). The pauses that define these bursts indicate an interruption in the formulation process, and attended processing (of forms or ideas). Their writing process model was developed to describe both L1 and L2 writing.

Their 2003 model – presented in Figure 1.6 -- describes a typical writing process in detail from a cognitive-linguistic angle. Sentence production processes depend on the interactions between a *proposer,* a *translator*, a *reviser* and a *transcriber,* which are functional components of the writing process model (Chenoweth & Hayes, 2003, p.113). During writing, a *proposer* makes plans and prepares an idea package through reflection using information from the writing task or text produced so far. Then the *proposer* proposes this package to the *translator*. When the *translator* gets the idea package, it transforms these ideas into verbal expressions by selecting words, sentences and grammatical structures stored in long-term memory. Then the *reviser* evaluates the proposed semantic content to be accepted or rejected. If the semantic content is accepted, it is transcribed by the *transcriber* using handwriting or typewriting skills. If rejected by the *reviser*, the writer starts to search for new semantic content, and the whole process starts over from the beginning (Chenoweth & Hayes, 2003).

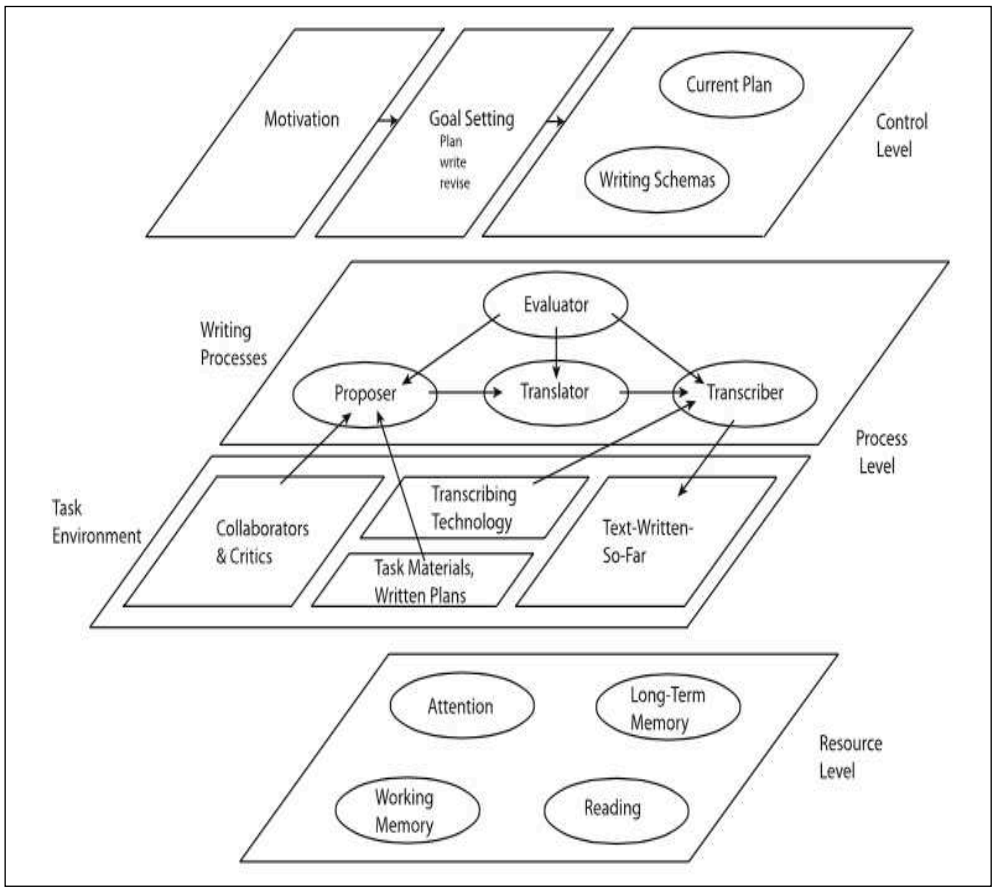
Figure 1.6 Chenoweth and Hayes' (2003) model of written language production




## 1.6 Hayes' Writing Process Model (2012)

In his latest Writing Process Model, Hayes further describes the sub-processes of the writing process (2012; Figure 1.7). This is an updated model of Chenoweth and Hayes' 2001 Writing Model. In this version, there are three levels at which the writing process takes place: the control, process, and resource levels.

Figure 1.7 Hayes' Writing Process Model (2012, p.371)




This model accounts for the roles and relationship of cognitive processes in long-term and working memory in writing. Transcription processes, which take more time in L2 than in L1, are described in functional terms as a process by which writers transform their ideas into language units. Planning is described as both a meta-cognitive and a cognitive activity, meaning that planning processes can take place both as goal-setting at the beginning of writing and as part of formulation during writing (Hayes, 2012).

All the models of writing summarized above form a theoretical background for research on first and second language writing. They provide us with a clear understanding of the processes involved in first and second language text production. However, they reflect different perspectives. Flower and Hayes' model (1980; 1981) focuses on the basic cognitive processes in writing and is one of the most influential models in writing research (Archibald & Jeffery, 2000). Bereiter and Scardamalia (1987) take into account novice and expert writers' processes in writing. Kellogg (1996; 1999) emphasizes the importance of working memory in writing processes. When using these L1 writing models for L2 writing, researchers need to consider the ways in which parts of the models must be adapted for non-

native writing. Certain modifications may need to be made, taking into account the writer's first language knowledge and second language background (Archibald & Jeffery, 2000). The emergence of L2 writing models is significant, since they attempt to shed light on the cognitive processes undertaken by language learners while composing.

We can predict that these cognitive and linguistic components illustrated in the models that we have summarized here will interact in complex ways in multilingual text production. Writing models give us a framework through which we can explore the ways in which writing processes and cognitive components interact (Torrance & Jeffrey, 1999), and they will inform the structure of our study. In the following section, we will look into the scientific literature on writing in the L2, especially the studies which compare L1 and L2 writing processes.

# Chapter 2: Writing in a second or foreign language (L2)

Early studies on second language writing were informed by L1 writing research, and have adopted the theories, models, research methods and instructional practices of this L1 research (Grabe & Kaplan, 1996; Krapels, 1990). The extensive adaptation of L1 writing research for L2 writing contexts is still prevalent today. While it is reasonable to apply the research methods used in L1 contexts to L2 writing contexts, we must not necessarily interpret the results obtained in the same ways, since the needs and expectations of L2 learners are different from L1 writers. Research on L2 writing started in the late 1960s and early 1970s in the USA and the UK, with the arrival of more foreign or bilingual students in their higher educational institutions, and increasing awareness of their needs (Grabe & Kaplan, 1996). However, there were not many studies of L2 writing *processes* before the 1980s. The early L2 writing research focused more on writing products – the texts produced by these learners -- as well as on techniques for teaching writing skills (Grabe & Kaplan, 1996). In the 1980s, L2 writing studies started to flourish, with a new focus on processes, on the writing behaviour of skilled and unskilled L2 writers, and on effective L2 text production. The development of think-aloud techniques, to investigate what writers were thinking about while writing, helped focus scientific attention on processes in both L1 and L2 writing. Writing researchers became more interested in the cognitive activities that take place during L2 writing (Grabe & Kaplan, 1996; Krapels, 1990).

## 2.1 L2 Writing vs. L1 Writing

A growing amount of second language writing research is looking at cross-linguistic similarities and differences in L1 and L2 composing processes (Akyel, 1994; Akyel & Kamisli, 1997; Beare & Bourdages, 2007; Breuer, 2019; Chenoweth & Hayes, 2001; Cumming, 1989; Grabe & Kaplan, 1996; Hirose & Sasaki, 1994; Jones & Tetroe, 1987; Manchón & Haan, 2008; Manchón et al., 2005; Pennington & So, 1993; Raimes, 1987; Roca de Larios, Manchón & Murphy, 2006; Sasaki, 2002, 2004; Sasaki & Hirose, 1996; Skibniewski, 1987; Tillema, 2012; Tiryakioglu et al., 2019; Whalen & Ménard, 1995; Zamel, 1983). Research on composing processes in L1 and L2 suggests that although writers use similar composing strategies and behaviour while writing in their first and second languages (Akyel & Kamisli, 1997; Beare & Bourdages, 2007; Zamel, 1983), there are also differences between L1 and L2 writing (Grabe & Kaplan, 1996; Raimes, 1985; 1987; Silva, 1993; Tillema, 2012). In his meta-analysis of 73 empirical studies on first and second language

writing, Silva (1993) identified the findings in terms of the features of processes and products of second language writing. According to Silva, L2 writers, compared with L1 writing, inhibit planning, set fewer goals, and experience difficulty in achieving their goals and organizing the generated ideas. He also found that the differences between composing in L1 and L2 arise from linguistic knowledge, different learning experiences, a different sense of audience, and different preferences for text organization, different writing processes, and giving different meaning and social value to text types. The characteristics of texts produced by L2 writers are also different from those of L1 writers. Texts produced in the L2 are generally shorter, involve more frequent words and less complex sentences and contain more errors (see Silva, 1993 for a review).

In another review on L2 writing, Roca de Larios and his colleagues (2002) reviewed the literature on writing processes. They selected 65 studies on L2 writing processes from the previous twenty years. These studies involve comparisons between skilled and unskilled L2 writers, comparisons between LI and L2 writing processes, relationships between writing ability and L2 proficiency, and the development of L2 writing skill. Roca de Larios and colleagues selected the studies that used the following data collection methods to capture writing activities during the L2 writing process: dual-task procedures, direct observation, think-alouds, introspective and retrospective protocols. The studies under review used different language proficiency assessment tools, ranging from standardized tests (TOEFL, IELTS etc.), institutional and locally-designed tests. In assessments of text quality, various assessment criteria were also used, with Jacobs et al.'s (1981) *ESL Composition Profile Writing Criteria* the most frequently-used scale. Other standardized writing criteria used were: the *Test of Written English* (TWE), the *Six Sub-group Quality Scale* (SSQS) etc. Several researchers used their own instruments for writing assessment criteria (Roca de Larios et al., 2002, p. 14).

While L2 writing researchers looked at cross-linguistic similarities and differences in L1 and L2 writing, they were also interested in the transfer of first language writing skills to second language writing, and how these differences and transfer might vary according to the L2 proficiency level of the writers (Jones & Tetroe, 1987; Manchón & Roca de Larios, 2007). For example, Jones and Tetroe (1987) investigated the transfer of first language writing skills to second language writing and whether language proficiency is an influential factor for this transfer of first language writing skills. Their data showed that there is a transfer of first language writing skill to second language writing. Proficiency level seems to constrain the

effectiveness of the composing process, and lessen the quantity of planning, but not the quality of planning. Second language proficiency level has little role in inhibiting the planning process. They also stated that there might be other factors affecting the planning behaviour of second language writers, in addition to a lack of language knowledge.

## 2.2 Studies on comparison of writing processes in the L1 and L2

Researchers have long been interested in comparing writing processes in different languages: the similarities and differences between writing in such languages as Dutch and English (e.g. Schoonen et al., 2003; Stevenson et al. 2006; Tillema, 2012; Van Waes & Leijten, 2015; Van Weijn, 2009), French and English (e.g. Barbier, 1998; Chenoweth & Hayes, 2001; Cumming, 1989; Whalen & Ménard, 1995), German and English (Breuer, 2014; Thorson, 2000), Chinese and English (e.g. Arndt, 1987), Japanese and English/Chinese (Hirose & Sasaki, 1994; Kobayashi & Rinnert, 2012; Pennington & So, 1993; Sasaki, 2000; 2002; 2004; Sasaki & Hirose, 1996), Polish and English (Skibniewski, 1987), Spanish and English (Beare & Bourdages, 2007; Manchón & Roca de Larios, 2007; Roca de Larios et al., 2001; Roca de Larios, Manchón & Murphy, 2006; Roca de Larios et al., 2008), Swedish and English (Sullivan & Lindgren, 2002), Turkish and English (e.g. Akyel, 1994; Akyel & Kamisli, 1997; Tiryakioglu, Peters & Verschaffel, 2019). In most of these studies, English is the second or foreign language that is compared to first language, since it is a global *lingua franc*a, taught as a second or foreign language at schools in most school systems around the world.

Arndt (1987) is one of the pioneers in comparing writing processes in L1 (Chinese) and L2 (English). He investigated six post-graduate EFL students' think-aloud protocols (while writing an article in L1 and L2), followed by open-ended interviews. The think-aloud protocols were coded using Perl's coding scheme (1979). Twenty-one composing activities were coded: planning, global planning, rehearsing, repeating, rereading, revising, editing etc. Results showed that writing behaviour in L1 and L2 were not similar, although the group of students were homogenous in writing proficiency and language proficiency. However, individual writer's approaches to composing process showed similarities between the two languages, indicating transfer of writing strategies from L1 to L2, as in Jones and Tetroe's study in 1987.

Another early example comparing writing processes is Skibniewski's (1987) study, looking at writing processes used by three advanced foreign-language writers, in Polish (L1) and English (L2) writing at three different skill levels. The results indicated that the skilled writer

in a three-subject study was more involved in planning and goal-setting activities than the average and unskilled writers. The skilled subject in this study described a hierarchically-structured use of cognitive processes in writing (Skibniewski, 1987, p. 201). The major difference between the skilled and unskilled writers was found to be the use of planning processes, in both native and foreign-language writing.

In a case study with six Singaporean university students, Pennington and So (1993) investigated writing processes and products. They used a direct observation technique, while the students were executing a narrative task in L1 (English or Chinese) and L2 (Japanese), followed by retrospective interviews. The writing behaviour of the six students was coded using Lapp's (1985) Classification of Writing Behaviours. Based on the observed writing, the subjects were categorized as skilled, semi-skilled and unskilled. The students' written "products" (texts) were assessed using Jacobs and colleagues' (1981) *Composition Profile*, which focuses on content, organization, vocabulary, language use and mechanics. Their findings show that "linguistic skill does not greatly influence writing process skill" (p. 51). However, they found that the quality of the written product in one language was related to general language proficiency in that language. The skilled writers in their study consciously controlled and directed the writing process, and were aware of its recursiveness. The unskilled writers were not able to switch back and forth between the process of generating ideas and revising their text; a lack of control and direction seemed to characterize their writing processes.

Beare and Bourdages (2007) looked at the generating strategies used by bilingual writers in L1 and L2 (Spanish and English), that is, the use of L1, re-reading the text so far, and idea generation. Eight skilled bilinguals with high language proficiency in both languages (L1 Spanish and L2 English, or L1 English and L2 Spanish) participated in the study. Results showed that the skilled bilinguals used similar writing strategies in L1 and L2. However, there were individual differences within the sample group. Re-reading was preferred by the Spanish native speakers in L1 writing and idea-generation in L2 writing; idea-generation was preferred by English native speakers in L1 and L2 writing.

Although process-oriented researchers have recently been more interested in examining ESL/EFL students' writing processes in L1 and L2, little research has been done on Turkish students' L1 and L2 (English) writing processes. In one study, Akyel and Kamisli (1997) investigated the relationship between writing processes in Turkish and English and the

possible effects of second language writing instruction on processes in L1 and L2 writing by eight Turkish university students. Think-aloud protocols and semi-structured follow-up interviews were used to examine the composing processes of these student writers. The findings indicated that there were more similarities than differences in L1 and L2 writing processes. Students used similar pre-writing and general writing strategies while composing in Turkish and English, except for their revision strategies. Student writers made more surface-level revisions (addition, deletion, punctuation, spelling, substitution, sentence structure, verb tense, word forms) in their L2 writing than in L1. Although no significant differences were found between the frequencies of students' deep-level revisions (addition, deletion, substitution, reorganization and combination) in both languages, revisions made in L2 writing tended to be at the single-word level, and in L1 writing at sentence or paragraph level. The students also used rehearsal strategies for different reasons in both languages: to search for vocabulary and grammatical structures in L2, rather than for stylistic operations to improve the content of the text in L1 writing. Akyel and Kamisli's research is important in that they identified and compared writing processes of EFL university students in Turkish and English; but they did not include L2 proficiency as a factor in their comparison of the composing processes in L1 and L2, and their participants were university-level students.

As we have seen above, process-oriented researchers have been examining foreign and second-language student writing in English, but relatively little research has been done into monolingual French writers' L1 and L2 behaviour (Barbier, 1998; Cumming, 1989; Barbier et al., 2008). For instance, Barbier (1998) focused on writing processes in L1 French and L2 English. The participants, who are more- and less-advanced university level students in France, reorganized an argumentative text on the computer under a dual task condition. Results demonstrated that the writing process in L2 requires as much cognitive effort as in L1. When reorganizing their texts in L2, the students spent more time. In L1 writing, they focused more on the organization of their ideas.

As is frequently the case for English L2 studies, these studies with L1 French writers were performed with university-level students. There is little research comparing L1 and L2 writing processes (in French and English) with middle school students, which will be the subject of our study.

## 2.3 Writing ability and language proficiency in the L2

Like L1 writers, L2 writers must also have certain knowledge and skills to compose an L2 text. These include: strategic knowledge (discourse strategies) to achieve the pragmatic and textual goals required by the writing task; metacognitive knowledge to control the writing process; and sufficient linguistic knowledge of the L2 (L2 proficiency) to encode their ideas into appropriate linguistic units (Whalen & Ménard, 1995). While strategic and metacognitive knowledge may not be language-specific, linguistic knowledge necessarily is. This involves the writer's knowledge of vocabulary, orthography (spelling), and grammar – both the morphological rules of word formation, and syntactic rules of word arrangement.

According to Canal and Swain's framework (1980, cited in Hyland; 2003, p. 32), L2 writers need to have the following skills to write effectively in L2:

- *Grammatical competence*- a knowledge of grammar, vocabulary and language systems
- *Discourse competence*- a knowledge of genre and rhetorical patterns that create them
- *Sociolinguistic competence*- the ability to use language appropriately in different contexts, understanding readers and adopting appropriate authorial attitudes
- *Strategic competence*- the ability to use a variety of communicative strategies

All these competences, whether linguistic, cognitive or sociolinguistic, influence and contribute to effective writing processes in the L2 and/or L3. Below, we will look in more detail at the research on the relationship between L2 proficiency and the different aspects of writing such as writing fluency, composing processes and text quality.

## 2.4 Writing fluency

Writing fluency is an important indicator of writing processes. It can be described as "a measure of how quickly one can access and produce linguistic structures", which "is generally measured by number of words produced in a given time" (Polio & Park, 2016, p. 287). In many studies on writing, researchers use "number of words per minute" to reflect fluency in written production in L1 (e.g. Olive et al., 2009) and L2 (e.g. Chenoweth and Hayes, 2001; Tiryakioglu et al., 2019). However, after the emergence of research on keystroke loggings in writing in the 2000s, writing fluency is now measured in characters per minute in a growing number of studies (Tiryakioglu et al., 2019; Van Waes & Leijten, 2015). There are other measures that can be predictive of writing fluency (Van Waes & Leijten, 2015), such as "mean length of production unit between pauses" (Spelman Miller, 2000, p. 137) – or what Chenoweth and Hayes (2001) described as "Pause-bursts". Van Waes and

Leijten (2015) investigated which measures of keystroke logging are most indicative of writing fluency, and found that fluency should be indicated through more than one measure: characters per minute, words per minute, pause-bursts, and other pause-related measures. Below, we will look at the relationship between various measures of fluency, and questions of proficiency and text quality.

## 2.5 The role of L2 proficiency in L2 writing

Linguistic proficiency can be defined "as the knowledge and skills needed for expressing ideas to linguistic form, including syntactic, morphologic, phonologic, and vocabulary knowledge but also the efficiency of use of that knowledge (often referred to as linguistic fluency)" (Van Gelderen, Oostdam & Van Schooten, 2011, p. 28). Jan Hulstijn describes language proficiency (LP), both in L1 and L2, as:

> the extent to which an individual possesses the linguistic cognition necessary to function in a given communicative situation, in a given modality (listening, speaking, reading, or writing). […] Linguistic cognition in the phonetic-phonological, morphonological, morphosyntactic, and lexical domains forms the centre of LP (*core components*). LP may comprise *peripheral components* of a less-linguistic or non-linguistic nature, such as strategic or metacognitive abilities related to performing listening, speaking, reading or writing tasks. (Hulstijn 2011, p. 242)

The research to date has produced conflicting evidence concerning the relationship between different L2 proficiency levels, composing processes, and products. A number of L2 studies conclude that L2 proficiency plays a major role in explaining L2 writing performance[4] (e.g., Cumming, 1989; Hirose & Sasaki, 1994; Manchón & Roca de Larios, 2007; Pennington & So, 1993; Roca de Larios, Manchón & Murphy, 2006; Roca de Larios, Manchón, Murphy & Marín, 2008; Roca de Larios, Murphy & Manchón, 1999; Sasaki, 2000, 2002, 2004; Sasaki & Hirose, 1996; Whalen & Ménard, 1995). The majority of studies found that as proficiency increases, performance in L2 writing increases (Chenoweth & Hayes, 2001; Cumming, 1989; Hirose & Sasaki, 1994; Roca de Larios et al., 1999; Sasaki, 2000; 2004; Sasaki & Hirose, 1996; Whalen & Ménard, 1995). In some older studies, it was found that L2 writing performance was not associated with L2 proficiency (Raimes, 1985, 1987; Zamel, 1982, 1983, 1984).

Cumming (1989) wanted to determine whether L2 proficiency or general writing proficiency (general writing ability) most affects L2 writing. In his research, 23 adult ESL students at three different L2 proficiency levels (measured by interview tests administered by the

[4] In writing research, writing performance has been used to refer to both the writing process and the product (writing scores or text quality). For instance, in their study which looked into L1 and L2 writing fluency, Chenoweth and Hayes (2001) used the term “writing performance” to refer to writing procesess. Cumming (1989), on the other hand, uses this term to refer to the written text.

University's ESL faculty), and three different writing proficiency levels (measured by holistic ratings of French (L1) compositions), wrote three different texts. Think-aloud protocols demonstrated that L2 proficiency did not affect thinking and decision-making processes during the writing process, but did affect text quality. Cumming concludes that L2 proficiency and writing ability are psychologically different elements that seem to contribute to different aspects of L2 writing. More importantly, higher L2 proficiency enhances the writing process. As learners develop their L2 proficiency, they are able to perform better in L2 writing, produce more effective texts and attend to the various aspects of writing.

Research suggests that L2 proficiency level is a factor that makes a significant contribution to L2 writing ability (Cumming, 1989; Pennington & So, 1993; Sasaki, 2000, 2002, 2004; Sasaki & Hirose, 1996). In a series of studies, Sasaki and Hirose (Hirose & Sasaki, 1994; Sasaki, 2000; 2002, 2004; Sasaki & Hirose, 1996) aimed to build a comprehensive L2 writing model for Japanese students by focusing on the factors that might explain the L2 writing ability. Seventy university level Japanese students aged between 18 and 21 years old participated in the study. A standardized English test, the *Comprehensive English language Test for Learners of English* (CELT) was used to determine the language level of the students. An argumentative writing task was given to the students both in L1 and L2. Strong and weak L2 writers were determined according to their score on the English compositions. A post-writing questionnaire on writing processes was also given to the students. It was found that L2 proficiency, L1 writing ability and meta-knowledge of expository L2 writing all affect L2 writing ability. It was concluded that L2 proficiency level has a major role in explaining L2 writing ability. It was also found that L2 proficiency level influences the quality of L2 writing positively. More proficient writers scored better in L2 composition. Although Cumming (1989) reported that L2 proficiency and writing expertise are distinct from each other, Sasaki and Hirose (1996) found that L2 proficiency, L1 writing ability and meta-knowledge of L2 expository writing affect L2 writing performance, and that L2 proficiency accounted for 52 % of the variance in writing performance. In another study, Sasaki (2004), who investigated the effect of writing instruction and staying abroad on EFL and ESL university students, found that when the L2 level increases, and when the students are provided with writing activities, their L2 writing expertise increases.

As part of the NELSON project in the Netherlands, Schoonen and his colleagues (2003; 2011) investigated the relationship between learners' linguistic knowledge, efficiency of linguistic processing, metacognitive knowledge and writing proficiency with 389 grade 8

students both in L1 Dutch and L2 English writing. To measure metacognitive knowledge, they used a questionnaire reflecting metacognitive knowledge of reading and writing strategies. Grammar, vocabulary and spelling tests were administered to the students in Dutch and English to measure the learners' linguistic knowledge. Two test types were used to test linguistic processing efficiency both in L1 and L2: speed of lexical retrieval and sentence building. To measure writing proficiency, three texts were written in each language. Holistic rating scores based on a set of benchmarks were used to rate the communicative quality of the texts (writing proficiency). The linguistic facets of the texts were not considered in this assessment of text quality. The results showed that L1 and EFL writing proficiency draw more on metacognitive and linguistic knowledge than on speed of access to linguistic knowledge. While linguistic knowledge was more influential in L2 writing proficiency, metacognitive knowledge was found to be more effective in L1 writing proficiency. This large-scale study is significant in L2 writing research, because it assessed the development of L1 and L2 writing proficiency longitudinally, over several years, with extensive data analyzed with structural equation modelling. However, Baba (2009) criticized the study by Schoonen and colleagues, because the correlation between metacognitive knowledge and L1 and L2 writing proficiency overshadowed the correlation between linguistic knowledge and writing proficiency in both languages. The Dutch findings contradict those of Sasaki and Hirose (1996), who found that L2 proficiency determines writing expertise in an L2. They conclude that EFL writing is harder for students than L1 writing, because L2 writers may not have fully automated their knowledge of a second language.

### 2.5.1 L2 proficiency and composing processes

Language proficiency is an important contributing factor to proficiency in writing in one's native language (Bereiter & Scardamalia, 1987; Hayes & Flower, 1980; Kellogg, 1996; McCutchen, 1986; 2000; Schoonen et al., 2003; Snellings, Van Gelderen, & De Glopper, 2004). In L2 writing, linguistic knowledge and L2 proficiency level are likely to play a major role in the writing process (as suggested by the studies summarized above), since L2 writing presents more challenges for linguistic encoding (Schoonen et al., 2003). The processes involved in formulation – transposing propositional content into verbal form – is the one which probably differs the most from L1 writing, and that writers find most challenging (Chenoweth & Hayes, 2001; Schoonen et al., 2003), since it depends heavily on linguistic knowledge. Having rich linguistic resources – "lexical, morphosyntactic and orthographic knowledge" – will ease the formulation process (Schoonen et al., 2011, p.33), and enable L2

writers to turn their attentional focus from lower-level activities like spelling, vocabulary and grammar, into higher-level activities (the pragmatics aspects of written communication; (Chenoweth & Hayes, 2001; Schoonen et al., 2003; Whalen & Ménard, 1995).

Lack of L2 proficiency may constrain L2 writing processes. Research has found that lack of L2 proficiency hinders the encoding of meaning, and also higher-level writing processes (Chenoweth & Hayes, 2001; Whalen & Ménard, 1995). Wolfersberger (2003), who investigated lower-proficiency writers' processes, reported that while some L1 writing strategies can be transferred to L2 writing, lower-proficiency writers have difficulty using a variety of writing strategies. Lower L2 proficiency writers appear to rely more heavily on their L1 during the writing process, in order to sustain the process and prevent a complete breakdown in language (Cumming, 1989; Raimes, 1985).

Chenoweth and Hayes' (2001) study on text production in L1 English and L2 French and German explored the relationship between 13 university students' writing fluency (number of words written per minute) as a composing process characteristic in L1 and L2, and their linguistic experience in L2 (number of semesters learning the L2). Think-alouds and video-recordings were used while the students composed L1 and L2 texts on four topics. Dictionaries were allowed during writing, and hesitation and revision behaviour was coded for each text. Chenoweth and Hayes found significant differences in L1 and L2 writing fluency, and concluded that increased linguistic experience in L2 (5$^{th}$-year, as compared with 3$^{rd}$-year writers) results in more fluent L2 writing, fewer revisions and more proposed words accepted in the final text. Chenoweth and Hayes (2001) looked at L1 and L2 writing fluency, but did not consider whether writing fluency affects text quality.

In a study with L2 Anglophone undergraduate students, Whalen and Ménard (1995) investigated the differences between L1 English and L2 French writing, and how linguistic processing influences the students' use of writing strategies (planning, evaluation and revision strategies) in L2 text production. They view linguistic processing as a process in which "writers retrieve, formulate and manipulate appropriate linguistic structures as defined by the morphosyntax and the lexis of the particular language system being learned" (p. 390). In think-aloud protocols, Whalen and Ménard found that limited L2 linguistic knowledge hinders the use of these strategies at more global levels in L2 writing. Compared to L1 writing, L2 writers planned and evaluated more at a linguistic level than at pragmatic or textual levels. Deep-level revisions were performed at phrase- and sentence-level more in L1

writing than in L2 writing, in which revisions operated at the morpheme or orthographical level. Although the participants were at the same level of linguistic proficiency in L2 English, they demonstrated different linguistic processing performance while writing. For instance, some participants evaluated textual efficacy by judging linguistic form, while others used meaning-focused judgments to evaluate L2 textual efficacy. Whalen and Ménard's research provides useful insights into how linguistic processing influences L2 writers' use of writing strategies.

In L2 writing research, there are studies that look into the influence of L2 proficiency on a single writing sub-process (rather than the entire writing process), such as planning (e.g. Akyel, 1994; Jones & Tetroe, 1987; Manchón & Roca de Larios, 2007), formulation (e.g. Roca de Larios et al., 2001; 2006), or revision (Stevenson, Schoonen & de Klopper, 2006, for example). Akyel (1994) looked at the relationship between L2 proficiency levels (intermediate or advanced), L2 planning and text quality scores for 78 Turkish university EFL students writing in L2 English. She found that the language (either Turkish or English) that the students used while planning did not influence planning quality for higher-proficiency students; it did have a positive effect on the lower-proficiency writers, who planned better when they used their L1 (Turkish) while planning. She concluded that L2 proficiency level influenced the quality of planning and of the L2 compositions.

In a series of studies with Spanish EFL learners, Roca de Larios and his colleagues investigated the relationship between L2 proficiency level (low, mid or high) and different aspects of L2 writing processes: planning (Manchón & Roca de Larios, 2007), formulation (Roca de Larios, Manchón & Murphy, 2001; 2006), and the distribution of cognitive activities over the whole L2 writing process (Roca de Larios et al., 2008). Roca de Larios and colleagues (1999) studied the relationship between L2 proficiency level and strategy use in L2 composing, and found that linguistic skills influence the distribution of generating activities during writing strategically. More specifically (Roca de Larios et al., 2001), formulation by Spanish EFL learners at three different proficiency levels showed that they gave equal amounts of time (70% of total composing time) to formulation processes when writing both in L1 and L2.

Roca de Larios, Manchón and Murphy (2006) investigated problem-solving formulation processes used by writers in their L1 Spanish and L2 English, at three different proficiency levels. They found that as proficiency increases, writers may have more attentional capacity

and cognitive resources to devote to idea generation. With increased proficiency, there seem to be fewer problems in lexical retrieval, and expression of more intended meaning; more proficient writers devote less time to compensating for a lack of linguistic resources.

Manchón and colleagues (2007) studied the effect of L2 proficiency level on planning processes in foreign language writing. They compared the planning behaviour of 21 writers at different stages of L1 and L2 writing. When compared to the low-proficiency students, high proficiency writers planned significantly more and did not show any performance loss in L2 writing tasks.

In another study, Roca de Larios and colleagues looked at the allocation of time for different L2 writing processes, and possible relations to L2 proficiency level (Roca de Larios et al., 2008). The time spent by L2 writers at three proficiency levels was measured at different stages in the composing process. Once again, formulation processes took up most of the writers' time at all levels. High-proficiency students allocated their time to writing activities in a balanced way; they also planned more and spent more time evaluating their texts. Lower-proficiency writers allocated more time to meta-comments. As proficiency increased, the time spent making meta-comments decreased. This was interpreted as an indication that L2 writers use their attentional resources in writing activities more strategically, as L2 proficiency level increases.

To summarize the results of these studies, we can say that high-proficiency L2 writers devoted more time to planning, and no sign of performance loss is observed (between L1 and L2 writing, by proficient L2 learners; Manchón & Roca de Larios, 2007). With increased proficiency, there might be fewer problems with lexical retrieval, and more effective expression of intended meaning; proficient L2 users devote less time to compensating for a lack of linguistic resources (Roca de Larios et al., 2006). High-proficiency writers allocated their time to different writing sub-processes in a more balanced way, with more planning and evaluation, and fewer meta-comments than low-proficiency writers (Roca de Larios et al., 2008). L2 proficiency level seems to influence the distribution of writing sub-processes (Roca de Larios et al., 1999; 2006; 2008), the quality of planning processes, and L2 composition quality (Akyel, 1994), linguistic processing performance (Whalen & Ménard, 1995), L2 writing fluency (Chenoweth & Hayes, 2001), and revision processes in L2 writing (Stevenson et al., 2016). Although the above-mentioned studies found that L2 proficiency

influences writing processes and text quality to a certain extent, other studies found different results, as we will now see.

### 2.5.2 Contradictory results on the effect of L2 proficiency level

While the above studies suggest that L2 proficiency level is an influential factor in text composition, there are other studies which suggest that L2 proficiency level does not influence the composing process (Pennington & So, 1993; Van Waes, Leijten & Van Weijn, 2009; Van Weijn, 2009; Van Weijn et al., 2008), and text quality (Raimes, 1985, 1987; Schoonen et al., 2003; Zamel, 1982, 1983, 1984). For instance, Raimes (1987) -- who examined the writing processes and products of eight ESL students at different levels of writing ability and language proficiency -- found little correspondence between language proficiency, written product, and composing strategies used in ESL writing. Think-aloud protocols were collected for eight ESL college students while composing on two different topics. The *Michigan Test of English Language Proficiency* was used to rank the students according to their language proficiency levels, as high- or low-level students. Writing course placement scores (based on holistic evaluation) were also used to correlate with language proficiency levels, by classifying the students into two groups (remedial and non-remedial). While the ESL student writers were composing aloud, six composing strategies were investigated: planning, rehearsing, rescanning, reading the assigned topic, revising, and editing. Results showed that ESL students used composing processes that are common both to L1 and L2 writing: rehearsal strategies were used a great deal while generating content, syntax and vocabulary. This showed that these L2 writers were more concerned with the giving meaning than linguistic accuracy. In general, little correspondence was found between language proficiency, evaluation of written product, and composing strategies used. Low- and high-level proficiency students used the same composing strategies. Instead of stating differences between composing strategies used by low- and high-level proficiency students, Raimes focused on the difference in students' interaction with the written text. The findings showed a different range of composing strategies depending on the amount of interaction with the written text. No correlation was found between the amount of interaction and language proficiency level but a correlation was found with writing course placement scores. It was observed that high interactors were engaged in more planning, rehearsing, rescanning, revising and editing than low interactors. Another finding of the research was that the students' scores on the *Michigan Test of English Proficiency* did not correlate with their writing proficiency as measured by holistic ratings. This was attributed to the limitations of

standardized testing for writing assessment. It was pointed out that "linguistic proficiency as evidenced on a multiple-choice test is obviously not the only factor to influence the evaluation of an L2 written product" (Raimes, 1987, p. 448). Consequently, low- and high-level proficiency students used the same composing strategies.

Likewise, Zamel (1983) observed the composing processes used by six advanced ESL students while they were writing formal expository texts. The students in Zamel's study did not experience linguistic difficulty during writing, no doubt because they were at an advanced L2 proficiency level, and were also allowed to use dictionaries while writing. In another study, Zamel (1984) found that L2 writing ability is more important than proficiency level in predicting L2 writing performance: "while ESL students must certainly deal with concerns that are linguistic-specific, it seems that it is their writing strategies and behaviour and not primarily language proficiency that determine composing skill" (Zamel, 1984, p. 198, cited in Pennington & So, 1993). She "de-emphasizes the role of language proficiency in determining writing skill" (Pennington & So, 1993, p.43).

A more recent study (Van Weijn et al., 2008) did not find a relationship between L2 proficiency level and certain cognitive activities (self-instructions, goal setting, structuring, generating ideas, meta-comments) during L2 English composing by 20 Dutch university-level students; they did find a relationship between cognitive activities and L2 text quality. Van Weijn and colleagues conclude that the occurrence of cognitive activities during L2 writing was associated more with general writing proficiency than L2 proficiency level, a result similar to Schoonen et al. (2003). This could be explained by methodological choices, since L2 proficiency level was operationalized in this study with a 64-item vocabulary test (rather than a more general L2 proficiency test). Another explanation could be that the Dutch subjects were proficient enough in L2 English to be able to produce a coherent text.

## 2.6 Measuring text quality in L2 writing research

Assessing text quality is one of the most important and difficult issues in writing research and it has received a lot of notice in the L2 field. Text quality can be defined as "an indication of the underlying writing competence" (Grabowski et al., 2014, p. 162). The difficulty of assessing text quality is related to the multi-componential nature of written texts, and the difficulty of measuring or reflecting this complexity in a reliable way.

L2 writing researchers have used different types of assessment procedures to evaluate writers' texts (Roca de Larios et al., 2001; Van Steendam et al., 2012), from analytical to

holistic. In holistic scoring, a single quality score is assigned to the text, based on a general rubric or criterion, and indicated with a number or a letter. Holistic scoring is economical, which is therefore used to deal with large-scale projects. Analytical writing scales are used to measure different aspects of writing such as content, organization, vocabulary, grammar, spelling etc. Some researchers argue that analytical scoring is more reliable and provides more diagnostic information (Park, 2006; Weigle, 2002) and more detailed information about the text (Bacha, 2001). Others contend that holistic scoring is more reliable and less-time consuming (Cumming, 2002).

Different assessment criteria have been used by writing researchers (Cho, 2003; Grabowski et al., 2014). To give a few examples, in the NELSON project, summarized above (Section 2.5), the NELSON team used holistic scoring with benchmarking scales. Due to the large number of participants in the study, the NELSON team used holistic scoring to rate their Dutch students' L1 and L2 texts. Their rating scale consisted of only one overall score, reflecting a set of benchmarks (an interval scale); scores from 70 to 85 indicate 'very poor' and 'poor' texts, respectively; scores around 100 indicate 'average' texts; and scores around 115 and 130 are 'good' and 'very good' texts, respectively. Schoonen and colleagues' (2011) results showed that 8$^{th}$ graders developed more L2 English writing than Dutch (L1) writing proficiency over a three-year period. It was also found that metacognitive knowledge, grammatical knowledge and typing fluency are the highest predictors of Dutch writing scores. Spelling knowledge (which made the largest contribution), metacognitive knowledge, grammatical knowledge, lexical speed and typing fluency are significant contributors to the development of English writing proficiency. High correlations were found between writing scores and language proficiency over time.

One of the most widely-used scales for assessing text quality in L2 writing research is Jacobs and colleagues' (1981) *ESL Composition Profile*. This is a 100-point scale which assesses five components of L2 text quality: content (30 points), organization (20 points), vocabulary (20 points), language use (25 points) and mechanics (5 points). It is considered to be both an analytic and holistic writing scale. It has been used in many studies which investigated L2 composing processes (Akyel & Kamisli, 1997; Cumming, 1989; Hirose and Sasaki, 1994; Ong, 2013; Ong & Zhang, 2013; Sasaki, 2002; 2004; Spelman Miller et al., 2008), as well as studies comparing L1 and L2 text quality (Hirose & Sasaki, 1994; Pennington & So, 1993; Uzawa, 1996). For instance, Spelman Miller, Lindgren and Sullivan (2008) compared writing process variables – such as pauses, fluency, and revision process (logged via keystroke

loggings) – in L2 English writing by 14 young Swedish writers, with text quality measured by the *ESL Composition Profile*. It was found that writing fluency influenced text quality positively.

Comparing Japanese L1 and English L2 writing processes in 22 Japanese university students, Uzawa (1996) used a four-point holistic scoring scheme based on the *ESL Composition Profile*. This adapted holistic scoring scale uses a four-point scale (max = 4, min = 1) for each of three categories: content, organization, language use. Students' texts were assessed by two judges, in the following way: (a) first, they sorted the texts into four groups (high / mid-high / mid-low / low), based on an initial quick read-through of each text; (b) next, they scored the texts in each of the three categories (content, organization, and language use) using the four-point scale. A re-evaluation was performed if there was a score discrepancy greater than one point between the two evaluators.

Tillema and colleagues (2013) looked at the differences between 160 short Dutch L1 and English L2 essays written by 20 14-15 year olds. They developed a text quality rating procedure to allow for direct comparison of text quality in both languages, by using the criteria of global quality, structure, and language. The texts were first assessed for global text quality using a benchmarking scale. Then, a jury of eight raters used benchmarking scales for the use of structure and language. This rating procedure seemed to give comparable results in both L1 and L2 text assessment. They found strong correlations between the three writing criteria measures in both languages, which appears to confirm the validity of the rating scale.

## 2.7 Text quality in L1 and L2 writing

In L2 writing research, information on the relationships between writing processes and text quality is relatively scarce. There are studies which relate a single cognitive activity to L2 writing quality, such as planning (Akyel, 1994; Jones & Tetroe, 1987), or formulation, text generation (Spelman Miller et al., 2008), and revision (Stevenson et al., 2006). Once again, the conclusions of this research are mixed. In Stevenson and colleagues' research (2006), which compares revision processes in L1 and L2 writing, text quality was assessed in two dimensions; content quality and language use. They did not find a correlation between the number of revisions the students made and text quality in either L1 or L2. However, they did find some correlation between text length and revision frequencies, in both L1 and L2 writing. The results demonstrated that the poorer-quality L2 writing scores were not a result

of more lower-level revisions, but rather of shorter text length. L2 texts have also been found to contain less lexical diversity and syntactic complexity (Crossley & McNamara, 2009).

There is less research on the relationship between multiple cognitive activities involved in writing, and L2 text quality, one exception being Van Weijn's work in the Netherlands (Van Weijn, 2009). For instance, Van Weijn et al. (2008) investigated the relationship between writing processes and the quality of texts produced by 20 university level Dutch students in L2 English, using think-aloud protocols in four different task situations. The research team was interested in whether the writing behaviour of EFL learners differs according to the time at which a cognitive process occurs, in four different situations. They compared four writing processes – planning, generating, reading the assignment and formulating – with text quality (assessed first with analytical, then holistic ratings). The assessment categories for the analytical scoring included content, argumentation, structure and conclusion. The holistic rating involved benchmarking scales in which raters decided whether L2 text quality was better or worse than one benchmarking essay with a score of 100 points. Results showed that there was a positive correlation between reading the assignment and text quality at the beginning of the writing process. Planning and text quality correlated positively when planning occurred in the middle of the writing process. A positive correlation between generating and text quality was found consistently throughout the writing process. Formulating was found to be related to text quality after the start of writing. Van Weijn's team also found that within-subject writing behaviour seemed to be stable in different task situations. This study is significant because multiple cognitive activities were compared with L2 text quality.

In another study, Van Waes and colleagues (2009) looked into the relationship between L1 use, L2 proficiency level and text quality. The process information used in the study related to planning, generating ideas, and meta-comments. They found that L2 proficiency is directly related to text quality, but not to the different conceptual activities considered. However, in another study, Akyel (1994) found that using L1 Turkish during the planning process favourably influenced the quality of texts written by lower L2 proficiency university students.

Researchers have also looked into the relationship between L2 proficiency level and L2 writing quality, with mixed results (Sasaki, 2004). While some researchers found that L2 proficiency influences text quality in L2 writing (Cumming, 1989; Jones & Tetroe, 1987; Hirose & Sasaki, 1994; Pennington & So, 1993; Sasaki, 2002, 2004; Sasaki & Hirose, 1996;

Schoonen et al., 2011; Van Weijn, 2009: Van Weijn et al., 2008, 2009; Wang & Wen, 2002; Wolfersberger, 2003), others found no relationship between L2 proficiency level and text quality (Raimes, 1985, 1987; Zamel, 1982, 1983, 1984). The first group of researchers found that higher L2 proficiency level is correlated with text quality. The latter group did not find a correlation between language test scores and text quality scores.

Pennington and So (1993) looked at the relationship between L2 proficiency level, writing processes and the quality of texts written by six Singaporean university-level L2 writers in Chinese or English L1 and L2 Japanese. L2 proficiency level was assessed with holistic scores, based on final examination results and in-class performance by the language instructor in the L2 class. The writing process skill of the students was evaluated by self-reports on the use of writing strategies and behaviour, with Lapp's *Classification Profile* (1985). Participants were classified into three groups, according to this scale: skilled, semi-skilled or unskilled. Direct observation while writing and retrospective protocols were used to collect process data for the comparison of L1 and L2 writing processes; the students completed a narrative task in both L1 and L2. Text quality was assessed (for both languages) with the *ESL Composition Profile*. The results did not show a clear relationship between writing process skill and L1 or L2 text quality. However, proficiency level in L2 Japanese was related to text quality in that language, but no relationship was found between L1 and L2 text quality. Writing processes were found to be similar in the L1 and L2, so the authors conclude that L2 proficiency level does not greatly influence writing process skills.

In a recent study with 51 adolescent writers, De Miliano and colleagues (2012) looked at the effect of writing processes on text quality, using think-aloud protocols while the writers wrote persuasive texts. They found that pre-planning and formulation have significant effects on text quality, but monitoring, evaluation and revision processes do not. In another study, Tillema (2012) investigated the relationship between writing processes and text quality in L1 Dutch and L2 English. She used the same writing criteria (global quality, structure, and language) for both L1 and L2 text quality. The results showed a correlation between text quality in the two languages; but higher text quality scores in L1 than in L2. The difference between L1 and L2 text quality scores was substantial. In another study, Palviainen and colleagues (2012) investigated writing fluency and text quality at different writing proficiency levels with university-level students in L2 English or Swedish, and found that fluency in writing is a complex phenomenon, that does always correlate with writing

proficiency. The correlation between writing fluency and proficiency was not linear in L2 writing.

## 2.8 Writing processes and bilingual learners

Studies on bilingual writers' texts in their native and second languages have also interested researchers (for example, Edelsky, 1982). In one study, 27 Spanish-English bilingual students at primary level wrote 477 texts in L1 Spanish and L2 English. The texts were coded for certain linguistic features, code-switching etc. Results showed that bilingual writers use their L1 writing strategies while writing in an L2 text. It was found that level of proficiency in the second language influences text production in the L2. Being unable to use complex structures in the L2 does not hinder the L2 writing process (Edelsky, 1982).

Although there is significant amount of research on bilingual students' writing development, there is less research on the writing development of second-language learners acquiring a majority language (Babayigit, 2014). For instance, in a study comparing bilingual and monolingual Dutch learners, Verheyden and colleagues (2010) found that Turkish-Dutch bilingual learners' texts in Dutch were weaker than their L1 Dutch peers. It was concluded that this could be related to a lower level in Dutch proficiency for the bilingual learners. In another study, Stevenson and colleagues (2006) compared monolingual and bilingual students' keystroke loggings in L1 or L2 Dutch and L2 or L3 English, and found less variability in the English texts (when compared to the Dutch texts). Monolingual's texts were found to be significantly longer than the bilinguals' in both languages. The bilinguals also had lower text quality scores than the monolinguals in both languages.

In a more recent study, Babayigit (2014) looked into the effect of word-level and verbal skills on writing quality in English (measured by vocabulary, organisation and holistic scoring), by groups of primary school children, either monolingual (n=94) or bilingual (n=74). She found that writing quality correlated well with vocabulary, working memory capacity, spelling, and reading tests. It was also found that the bilingual learners underperformed in writing quality, compared to their monolingual peers. Their vocabulary knowledge was found to be far less than that of the monolingual learners, although both groups' spelling tests were reported to be similar.

Although these studies present significant results comparing the quality of texts written by monolingual and bilingual subjects (of different language backgrounds), they did not compare text quality for bilingual learners writing in their first language, which is one of the

aims of our research. To our knowledge, there is also no research comparing writing processes used by monolingual and bilingual teenagers, writing in the L1/ majority language.

Research on language development in Turkish-French bilingual children in France is relatively scarce, although it has recently started to develop (Akinci, 2006; 2010; Akinci, Pfaff & Dollnick, 2009; Akinci & Decool-Mercier, 2010; Ertek, 2017). Akinci (2006) looked at the narrative oral development of 94 Turkish-French children (aged between 5 and 11) in L1 Turkish and L2 French. The Turkish children used fewer connectives at lower ages, and did not know the meanings of some of the words in French that are used in daily life. According to Akinci (2010), however, when compared with their French monolingual peers, Turkish-French bilinguals are not behind their peers in oral proficiency in French at the age of seven. When compared with monolingual peers in Turkey, Turkish-French bilinguals reach the same level in Turkish by the age of 14-15.

## 2.9 Writing in L1, L2 and L3

Research on the comparison of writing processes in the L1, L2 and L3 has only just started to develop recently. Plurilingualism is a hot topic in European language teaching, in our increasingly pluricultural societies (De Bot & Gorter, 2005). And multi-competence theories describe a multicompetent writer as someone whose various linguistic competences and writing skills interact with each other (Kobayashi & Rinnert, 2013; Rinnert & Kobayashi, 2016; Rinnert, Kobayashi & Katayama, 2015).

Research on text production by multilinguals found that the meaning-making process is the same among multilingual students; they use rhetorical devices in the same way while writing in three different languages (Lindgren et al., 2017). In a study on multilingual writing, Yang and Sun (2015) looked at the development of complexity, accuracy, and fluency among five undergraduate multilinguals in L1 (Chinese), L2 (English) and L3 (French) writing. They found that the development of writing is non-linear and dynamic in three languages. Similarly, in a case study, Kobayashi and Rinnert (2013) looked at the longitudinal development of a multilingual writer in three languages: L1 (Japanese), L2 (English) and L3 (Chinese) over two and half years. They focused on three aspects of writing: written texts, composing processes, individual, and social factors. They used multiple data sources, such as direct observation, stimulated recall protocols, argumentative texts and interviews. Both similarities and differences were observed between writing in three languages, with a relationship between language proficiency and writing proficiency. However, the borders

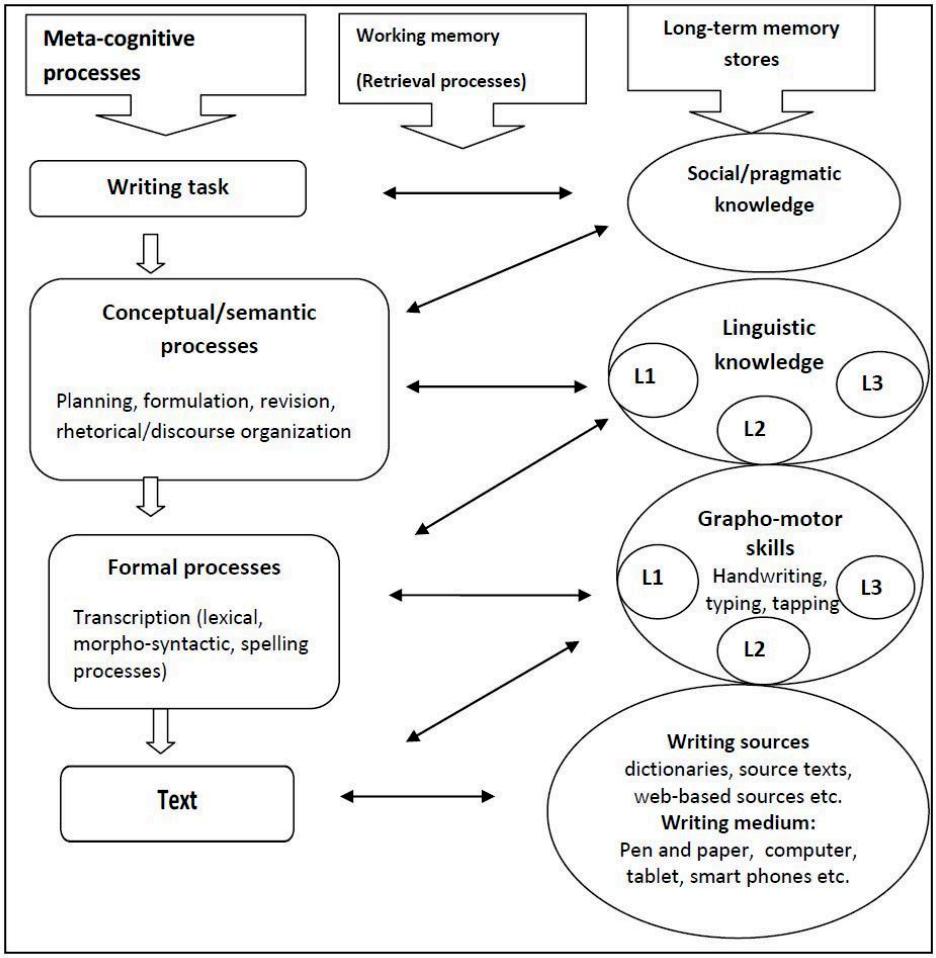
between textual and linguistic aspects in the three languages are vague and overlapping. What was found important was that the writer's cultural and individual identity influenced the writing process most (Kobayashi & Rinnert, 2013, p.6).

Previous research on multilingual writing suggests that multilingual students' languages are not isolated from each another; they are all bounded up and interact with each other during written language production, in dynamic and complex ways (Kobayashi & Rinnert, 2013; Yang & Sun, 2015). The final section of this chapter will attempt to develop a more specific model of second, foreign language and multilingual writing processes, based on the models reviewed in these first two chapters of our dissertation.

## 2.10 Proposal for a Multilingual Writing Model

To have a complete understanding of cognitive processes in L2 writing, we need to look more closely at how writers process linguistic information, and how individual and task variables influence text production.

Figure 2.1 Tiryakioglu's proposed Multilingual Writing Model



Of course, these elements interact to a certain extent. Based on the writing theories described above, we will attempt to propose a Multilingual Writing Model, which is currently lacking in writing research. This model will identify the interaction between cognitive, linguistic and grapho-motor processes in multilingual writing. We adapted it from Hilton's (2008, p. 77) Oral Production Schema that describes oral language production process based on models by Levelt (1999) and Kormos (2006). We were inspired by Levelt's Oral Production Model because it has already been used in the description of L2 oral production. Research suggests that although there are differences between oral and written language production, they are quite similar in terms of the basic cognitive architecture underlying the linguistic encoding of ideas.

In our Multilingual Writing Model (Figure 2.1), when the writer is given an L2/L3 writing task, s/he uses her social knowledge to decide about the pragmatic issues of the text s/he will write. At the conceptual level, (following Chenoweth & Hayes 2003), a new idea is generated, then evaluated by the evaluator. If it is rejected, another concept will be generated; if it is accepted, this conceptual matter (the "pre-verbal message", in Levelt's terminology) goes to the translator. The generator turns the ideas into sentences by activating lemmas and morpho-syntactic knowledge that has been previously stored in long-term memory. The working memory system activates or retrieves the vocabulary and grammar knowledge (needed to encode the ideas generated by the formulator) from long-term memory.

There are two different pathways for text generation in the L2/L3: a) direct, or b) indirect text generation. Direct text generation in the L2/L3 occurs when the writer has the necessary L2 linguistic resources to express her ideas in that language automatically: the conceptual matter can be automatically encoded into language forms, with little conscious metalinguistic effort required. Language knowledge in long-term memory can be activated without a conscious effort on the writer's part – as it is in her L1.

In indirect text generation, which occurs when linguistic knowledge in the L2/L3 is limited, the idea produced by the generator may first be "translated" with the linguistic features of the L1 (words, collocations, grammatical features). It will then have to be consciously "transformed" – that is, "translated" a second time, and probably consciously – into the L2/L3 linguistic system. At any of these stages, the conceptual or linguistic material may be evaluated – but this also requires attentional capacity in working memory. The L2 writer may also be consulting writing sources like dictionaries or digital translators, before or during

writing. When the message is accepted by the evaluator, the transcriber will mobilize grapho-motor skills (handwriting, typing or tapping), spelling knowledge and the writing medium (pen and paper, keyboard, tablet). Again, for less-experienced L2 writers, a different alphabet or writing system, and additional spelling challenges, may require attention. For these L2 writers, the discourse-production process will probably display the characteristics of Bereiter and Scardamalia's "knowledge-telling" model (Section 1.4), since working memory will be saturated with formal processes, and less available for pragmatic discourse management. While the text is being transcribed, revision processes may be operating, as the writer reads the text to evaluate it.

The most important part of our multilingual writing model is the interaction between the components – and especially between languages, or possible "language influence." According to Cummins' Interdependence Hypothesis (Cummins 1982), a person's skill in L1 writing might contribute to skill level in L2 writing:

> [It] is predicted that to the extent that instruction in $L_x$ is effective in promoting cognitive/academic proficiency in $L_x$, transfer of this proficiency to $L_y$ will occur provided there is adequate exposure to $L_y$ (either in school or environment) and adequate motivation to learn $L_y$. (Cummins 1982, p. 180)

We also hypothesize that L1 writing skill can be transferred to L2 writing, based on previous studies (Arndt, 1987; Berman, 1994; Cumming, 2001; Jones & Tetroe, 1987; Matsumoto, 1995; Woodall, 2002), and that transfer will be multidirectional between the writer's languages (Kobayashi & Rinnert, 2013). Multilingual students' languages are not isolated from each other, but are bound together, and interact during written language production, since it is a non-linear, complex and dynamic process (Yang & Sun, 2015).

### 2.11 Concluding remarks

This synthesis of a growing body of research on L2 writing shows a focus on cross-linguistic similarities and differences in writing, and how learner characteristics such as L2 proficiency level, and L1 writing proficiency might be related to writing performance. However, the results reported here are not conclusive, since the findings vary. Some studies show that L2 proficiency level has an effect on various aspects of L2 writing (L2 writing ability, planning, formulation, revision, text quality), whereas others conclude that it is not predictive of L2 writing ability, and does not influence text quality. These contradictory findings are probably due to differences in the tools and procedures used for assessing proficiency levels and text quality. Another possible reason for these different results might be the difference in L2 proficiency levels of the students in various studies, as argued by Penington and So (1993).

Manchón (2016) suggests that further research is needed to unravel the linguistic contribution to L2 writing development; in addition, there is less research on multilingual writing, which is an emerging research field. Research is needed to obtain insights into L1, L2 and L3 composing processes and text quality, and particularly into multilingual writing by language learners at the middle-school level.

In an attempt to advance research on L2 and L3 writing processes, this doctoral project attempts to provide further insights into the role played by linguistic knowledge and typing skills in L1, L2 and L3 composing processes and text quality. To our knowledge, there is no research of this type with French middle-school students. We hope to fill this gap with our research, and to gain further insights into the role of linguistic knowledge in L2 writing processes and text quality in general, and in French EFL students' writing in particular. We also hope to use the information collected to formulate suggestions for improving L2 writing by learners at this level. In the next section, we present keystroke loggings as an innovative data collection method that is currently been used in L2 writing research.

# Chapter 3: Keystroke loggings in writing research

## 3.1 Writing process research methods

Since the advent of writing process research in the 1970s and 1980s, different methods have been used to capture these processes, both synchronous and non-synchronous data collection. The synchronous methods are used for collecting data during the actual writing process, such as think-aloud, direct observation, video-recordings, keystroke loggings, eye-trackings, and dual- and triple-task methods (described below). Non-synchronous methods collect post-writing process data, through retrospective protocols (stimulated recall protocols), post-writing interviews, and questionnaires (Leijten & Van Waes, 2006; Leijten & Van Waes, 2013; Spelman Miller & Sullivan, 2006; Van Waes, Leijten & Van Weijn, 2009). Below we describe these methods briefly as they have been used in writing process data collection; they have been described in more detail by Wengelin et al. (2019), to whom we refer the interested reader.

The earliest method used to identify cognitive activities during writing was the think-aloud protocol. In this method, writers express aloud what they are thinking and doing while writing a piece of text (see Erikson & Simon, 1993, for a review of the method). The writer's verbalizations of his/her thoughts are recorded during text production, and then transcribed. These transcriptions are annotated using a coding scheme, which usually tags the different writing processes the speaker reports on - planning, formulation, and revision – in addition to sub-processes or sub-categories, such as global vs. local planning, task representation, re-reading, generating ideas, editing, etc. As all coding systems do, the typology used by the researcher depends on the objectives of each study (Flower & Hayes, 1980).

While the method has certain advantages – such as the permanent trace of the reported thought processes - it has also been criticized. The think-aloud protocol is thought actually to interrupt or interfere with normal thinking processes (Janssen, Van Waes & Van den Bergh, 1996), and it may therefore adversely increase the cognitive load of the writing activity. To compensate for these shortcomings, it is suggested that think-alouds should be combined with other online data collection methods, such as keystroke logging, which is unobtrusive (Stevenson et al., 2006; Van Weijn, 2009; Wengelin et al., 2019).

Direct observation and video recordings are used to analyse the pause and revision behaviour of writers as introspective protocol data (Matsuhashi, 1987; Zamel, 1983). Another direct

observation technique is using a secret camera inserted in a computer to record the writing session via computer. Later on this video-recording session is replayed to investigate the writer's thinking processes during writing (Levy & Ransdell, 1996).

Eye-tracking has recently been developed to capture and analyse eye movements as a data collection tool. *Eye and Pen* is writing software developed by Chesnet and Alamargot (2005), which incorporates an eye-tracking function in a digital writing tablet; it is used for analysing handwriting data. The writer uses a special pen to write on the tablet, and all movements of the pen and the eyes are registered by the software.

In dual- (or even triple-) task research techniques, writers react to stimuli such as a beeping sound at regular intervals (the secondary task), while working on a primary writing task. The reaction times to the secondary task are supposed to measure the cognitive load of the current sub-process (planning, translation, reading or revising; Olive et al., 2002; Olive, 2010).

In retrospective protocols or stimulated recall interviews, the writer is asked questions about her/ his thinking processes after the writing session. The researcher generally uses video-recordings of the writing process session to ask questions about the writer's thoughts at certain key moments in the recorded writing process. The writer's responses to the questions are transcribed, and annotated using a coding scheme according to the project objectives (Levy & Ransdell, 1996; Lindgren & Sullivan, 2003).

Since the emergence of keystroke-logging research software, replaying the logged session has been used to ask questions about what the writer was doing and thinking at a certain times during the writing process (Lindgren & Sullivan, 2003). Playing the logged session can also be used as a pedagogical tool for teaching writing. For instance, in peer-based writing instruction, the peers watch the writing session together and give feedback to each other, a method which has been shown to be effective (Lindgren, 2004; Lindgren & Sullivan, 2003).

Post-writing interviews and questionnaires are used to collect data related to writers' writing behaviour and perceptions about their writing process (Akyel & Kamisli, 1997; Hirose & Sasaki, 1994; Sasaki, 2002). The post-writing interviews are conducted just after the writing session. A wide range of questions from likert style to open-ended items can be included in the questionnaires, depending on the research goals. While the questions can be open-ended, they can also be developed to reflect the writer's perception of operations such as planning, formulation, revision, editing or linguistic processes (Akyel & Kamisli, 1997).

## 3.2 Keystroke loggings in writing process research

With the advent of the use of computers in writing research in the 1990's and 2000s, logging keystrokes has become a useful data collection technique, for both L1 and L2 writing process research (Van Waes, Leijten & Weijn, 2009). Spelman Miller and Sullivan, (2006) define keystroke logging as an approach which consists of:

> […] the computer recording of writing activity as writers compose on the computer. As an observational tool, keystroke logging offers the opportunity to capture details of the activity of writing, not only for the purposes of the linguistic, textual and cognitive study of writing, but also for broader applications concerning the development of language learning, literacy and language pedagogy. (p. 1)

Keystroke logging programmes that have been developed as an online method to reflect cognitive and linguistic activities of writers while writing on the computer are *JEdit* (Severinson Eklundh & Kollberg, 1996), *Scriptlog* (Strömqvist & Ahlsen, 1998), *Trace-it* (Severinson Eklundh & Kollberg, 1996), *Translog* (Jacobsen, 2006) and *Inputlog* (Leijten & Van Waes, 2006; 2013). While all these keystroke logging programmes share, to a certain extent, commonalities such as recording all the keystrokes, pauses, revisions and mouse movements based on a time-stamp, they also have some different functions. For instance, *Inputlog* was developed to be used in a *Windows* environment, whereas *Translog* was developed for the Macintosh environment. While *Translog* is also used for translation studies, *Inputlog* has a speech recognition function in which *Dragon Naturally Speaking* is used to capture voice recordings of subjects thinking aloud during the writing session (for a review see Van Waes et al., 2012).

Keystroke-logging is an unobtrusive method that records composition activities using the text editor of a normal *Windows* environment without disturbing the typist (Leijten & Van Waes, 2013; Spelman Miller, 2006; Van Waes et al., 2012). The tracking of key presses, pauses, additions, or deletions is also highly accurate (Deane & Zhang, 2015). The *Inputlog* log file automatically generates a rich data set: for example, the time and duration of each pause, the entire writing process time, the location of each pause (within or between words, between sentences), and various other text production, pause and revision measures; these are all shown in the log file with a precise time measure, in milliseconds and/or seconds. Recently, keystroke logging programs have been developed to track the writer's interaction with other programs and software as s/he writes. *Inputlog* can register the writer's use of tools such as *Excel*, and *Internet* browsing behaviour (such as looking up a word in a web-based dictionary etc.; Leijten & Van Waes, 2013). Overall, although keystroke loggings are indirect indicators of certain cognitive processes in writing, they are powerful tools, offering researchers a fine-

grained analysis of writing processes data (Deane & Zhang, 2015; Lindgren, Knospe & Sullivan, 2019; Spelman Miller, 2006; Van Waes et al., 2009; Wengelin et al., 2019).

For the data collection in this doctoral project, we chose the *Inputlog* program, for its interesting and varied functions: basic keystroke recording, the incorporated copy tasks, data preparation, analyses and the playback function. The "copy task" mode directs you to the *Inputlog* copy task website, where users can perform a copy task session to measure their typing skills (in the language of composition). The *Record* mode is used to record a new document, open an existing document or to continue in a previously-recorded file. The *Analyse* module currently allows for 15 different types of automatic data analysis, and hundreds of output variables. We will be reporting the *Inputlog* output variables that are related to our research questions: typing speed, writing fluency, pauses and revisions, which are generated via the Copy Task Analysis, General Analysis, Summary Analysis, Revision Analysis and Pause Analysis functions (Leijten & Van Waes, 2013). In Section 5.5.2 these types of analyses will be described in detail.

The *Pre-Process* and *Post-Process* modules are provided to manipulate and prepare data for the various "Analysis" functions. The *Pre-Process* module filters and recodes the data. For example, the filter function eliminates the silent phases at the beginning of the writing process (when writers have not yet started typing). The *Post-Process* module processes the results of various analyses, merging the logged observations into a Comma-Separated Variables (CSV) file that can be imported into statistical spreadsheets. The fascinating *Play* module enables the user to watch a logged file unfold – in fact visualizing all the concrete typing process from beginning to end: each character being typed, pauses, deletions, and revisions.

### 3.3 The copy task

The copy task module of *Inputlog* is used for measuring typing speed. It was developed recently, and is available in ten languages (Van Waes et al., 2020)[5]. Table 3.1 lists the copy task subtasks: tapping "dk" over and over for 30 seconds; copying and typing a single sentence for 60 seconds; copying and typing out three different word-sets with high frequency bigrams seven times each), typing one low-frequency word-set seven times, and finally copying and typing consonants.

[5] The Inputlog copy task website can be consulted at: http://inputlog.ua.ac.be/WebSite/copytask/tasks.html

Table 3.1 Overview of the seven components of the copy task (by Van Waes et al., 2020, p.2)

| | **Components** |
|---|---|
| Tapping task | press the ‘d’ and ‘k’ key alternatively for 15 seconds |
| Sentence | copy a sentence for 30 seconds |
| Word combination 1 | copy a combination of three words seven times |
| Word combination 2 | copy a combination of three words seven times |
| Word combination 3 | copy a combination of three words seven times |
| Word combination 4 | copy a combination of three words seven times |
| Consonant groups | copy four blocks of six consonants once |

The copy task lasts about 7-8 minutes depending on the writer’s typing speed. At the start of our research project, there was no Turkish copy task available. We wanted to use three different copy tasks in order to investigate whether our learners' typing behaviour differ in multilingual writing. I developed a Turkish version of the copy task for our project, and also for other researchers who need to measure typing speed. Comparing copy task data for the three project languages will give us important information about possible differences in typing skills in these languages. It is important to remember that English and French use the same alphabet, but Turkish does not; for the bilingual learners, Turkish is essentially a *spoken* language (at home), with only a few hours of schooling per week (some of which are dedicated to written Turkish) – the copy task becomes an important means of reflecting the impact of these differences in keyboard use.

I designed the Turkish copy task in collaboration with *Inputlog*’s developers: Luuk Van Waes, and Marielle Leijten, at the University of Antwerp, Belgium. The *Inputlog* developers consulted *Zargan*, a lexical database for Turkish created at the Bosphorus University in Turkey (2004), to construct the Turkish copy task. *Zargan* lists words according to frequency, as well as high-frequency bigrams, letters and suffixes in Turkish. The *Zargan* bigram frequency list was incorporated into an *Excel* sheet by *Inputlog* developers, to be used in the *Inputlog* system for a layout of the Turkish copy task. During the development of the word-formation sub-tasks of the copy task, the *Excel* sheet automatically calculated the characteristics of the words used, and assessed appropriateness of these three-word combinations at different levels: frequency, hand combination and adjacency. The keyboard characteristics for the Turkish copy task are based on a Turkish QWERTY keyboard and French AZERTY keyboards. In Turkey or in other countries, the QWERTY keyboard (or Turkish Q keyboard) is the most frequently used by Turkish writers. But in the school ICT

labs in France, there are AZERTY keyboards, which meant we would be using the AZERTY keyboard for our data collection.

In order to create the copy task, we needed two sub-tasks: the “Word Formation” and “Sentence” tasks. In order to design the first, I began by creating three-word combinations, totalling from 18 to 21 characters, in the top 30 % of frequency in the adjacency letter list in *Zargan*. I also avoided using seven Turkish non-ASCII letters in these word formation sets, as suggested by the *Inputlog* developers: these letters aren't available on the computer keyboards in the ICT room in France, and would therefore be difficult for the learners to produce. However, later *Inputlog* developers upgraded *Inputlog* to allow using NON-ASCII letters in the copy task.

Next, I constructed the word combinations that are the lowest 50% frequency. I made a list of more than 100 different word combinations for both high-frequency and low-frequency word combinations. I checked the words in the Turkish Bigram *Excel* file according to left/ right hand key combinations (to check whether typing on the keyboard with right- and left-hand is equally distributed) and frequencies. In the end, three high-frequency word combinations and one low-frequency word combination were chosen according to the selection criteria.

Next, I built 20 sample sentences for the “Sentence” sub-task of the copy task. I checked these sentences in the Turkish Bigram *Excel* file, for left/ right hand key combinations and frequencies. The sentence that best met the requirements of the sentence sub-task was chosen. Finally, I changed the consonant groups in the last part of the Turkish copy task. I replaced the letters "q, w, x" (which don’t occur in Turkish) with "z, c, s" (adjacent consonants). We also needed to translate some information in the user interface, such as the participant information page, and the last page of the copy task. A trial version of the Turkish copy task was made available (at first only for *Microsoft Internet Explorer,* and later for *Google Chrome*).

For online testing of the Turkish copy task, we asked fifteen adults (eight of whom are university-students) in Turkey and France to test the Turkish copy task online, save the copy task .idfx file and send it to us. We also asked their opinion about the task and whether a problem occurred during the online testing session. The resulting .idfx files were analysed in *Inputlog*. Some problems were encountered during these online trial sessions: student assumed (for the “dk” typing task) that she should type "dk" exactly as written in the instructions (ten times), instead of typing "dk" continuously for 30 seconds. We therefore

rewrote the task instructions to make it clear that testees should type the Turkish bigrams "as many times as possible". We also changed the sample illustration (in line with English and French instructions, increasing the number of occurrences, and adding dots, to indicate an unlimited number of repetitions): “dkdkdkdkdkdkdkdkdk.....”

Another problem encountered during online testing of copy task was in the sentence sub-task. One participant assumed that the sentence should be typed only once. So, we again changed the task instructions and added "as many as possible" for greater clarity:

> *30 saniye süresince, asagidaki cümleyi mümkün oldugu kadar çok sayida ve hizli tuslayiniz. Büyük harf ya da nokta kullanmayiniz: her cümleden sonra "giris" (entrée/enter) tusuna basiniz. Zamaniniz, ilk harfi tusladiginizda baslar: ciddi bir anne ile bir bebek o eve gitti.*

Finally the adapted task instructions were uploaded and the Turkish copy task was made available online.

### 3.4 Typing skills and text production

Keyboard and spelling skills are considered to be low-level skills in the writing process. If they are automated, cognitive resources in working memory are left for high-order skills (e.g. planning, translating, revising, and pragmatic concerns; Torrance & Galbraith, 2006). Previous research on the effect of typing speed on writing processes and text quality in L1 writing shows that typing skill can influence both writing processes and text quality. For instance, in a study with 34 undergraduate student writers, Alves and colleagues (2007; 2008) found that fast typists could write more words (six) in longer execution periods (12 seconds) than slow typists, who typed only 3 words in shorter execution periods (8 seconds). They also found that typing speed can be a contributing factor to better text production, since it frees attentional capacity for high-order cognitive activities. They also found that typing speed did not affect the syntactic complexity and vocabulary density in writing, but did affect writing fluency and overall text quality.

Barkaoui (2014) looked into the effects of keyboard skills at different levels, as well as the English proficiency scores of 97 graduates and undergraduates in a test-taking situation. Keyboard skills (typing skills) were identified based on two typing tests (typing speed and accuracy measures); and test-takers were categorized as having high or low keyboard skills. The test-takers performed three writing tasks (one essay and two summary tasks). The holistic rating scale for TOEFL-IBT was used to rate text quality. Barkaoui found that there is a significant but weak relationship between keyboard skills and text quality; however, keyboard skills were found to be task-dependent. When the writing task requires writers to

produce more content with effective planning, and organization (as in the case of writing an essay), keyboard skills appear to influence text quality.

### 3.5 L1/L2 writing process studies with keystroke loggings

In writing process research, only a few studies have used keystroke loggings as an online method for studying the cognitive activities involved in L2 writing. In an early study, Thorson (2000) compared the L1 English and L2 German writing processes of 18 American university students at two course levels (advanced or intermediate), while performing two tasks (writing a letter or an article) in both languages; *Trace-It* and *J-Edit* were the keystroke logging programs used in these studies. The students' revisions were compared: quantity of revisions, type of revisions, and the total number of typed characters; and it was found that these L2 students revised more in the L2.

Keystroke loggings also capture pause behaviour precisely. Pauses during text production can be considered as manifestations of cognitive processes involved in writing (Chenu et al., 2014; Olive et al., 2009; Schilperoord, 1996; Spelman Miller, 2006), and provide insights into and information about language production processes. During pauses, writers may be doing anything apart from transcribing (Latif, 2013): the writer can carry out global planning, think about the meaning of a word, retrieve the word, generate an idea, plan the next sentence, evaluate what he has written so far, organize the text, think about something else, etc. With respect to the cognitive processes in writing during pauses and text execution, Foulin (1998, cited in Olive, 2011) states that pauses between paragraphs are devoted to conceptual and global planning, and organization of ideas. Pauses between words are considered to be related to lexical processes during text production. Writers with language disorder problems – and L2 writers – produce more pauses in general, and have longer pause time at word level (Connelly et al., 2012; Wengelin et al., 2005).

Spelman Miller (2000; 2006) compared the pausing behaviour in L1 and L2 writing during academic text production via keystroke loggings. In her study with 21 university-level students, Spelman Miller (2000) asked L1 writers of English (n=10) and L2 writers of English (n=11) to write two texts in two different genres (descriptive and evaluative) on a computer, using *J-Edit*. Pause locations were identified at character level, word level, intermediate constituent level, clause level and sentence level. No differences were found related to pause behaviour between the two task situations. The L2 writers' mean pauses were larger at all pause locations than those in L1 writing. It was also found that text span between

pauses were similar between two tasks, which means that writers perform in similar ways in these two different genres. The L1 writers produced five words in chunks between two long pauses, and the L2 writers produced four words. In another study, Spelman Miller (2006) found a significant effect of language on pause duration at subject theme locations. L2 writers stopped more than L1 writers at framing device locations, used to express their message to the reader.

In one study on pause behaviour during text production in L1, Chenu and colleagues (2014) compared pauses by 5th, 7th and 9th grade students (n=40 at each level), at three levels in L1 French writing by using digitizing tablets and *Eye and Pen* software to define a pause threshold level. A pause was defined as a period when the pen was lifted from, and then replace on the tablet. They asked the students to write two texts; one narrative, and one expository. They combined the two texts in data analysis to separate the pauses that reflect cognitive processes from all others. A minimum starting pause threshold level of 15 milliseconds (for the extraction of pauses in *Eye and Pen*), was used for the data analysis, which found that pause length differs according to the level of the students. The research team concluded that a pause threshold level should be calculated for each particular writer.

In a study on pausing behaviour in EFL writing, Xu and Ding (2014) looked at differences between 24 skilled and less-skilled university level learners, using *Inputlog* 4.0. They also related pausing behaviour and writing fluency to text quality. Their results showed that skilled writers wrote more fluently with better text quality than less-skilled writers. The skilled writers' pause frequencies were lower, and pause duration was longer during the pre-writing stage. Pausing behaviour between these two groups was not found to be different during the actual composing stage.

Stevenson and colleagues (2006) compared revision behaviour in L1 Dutch and L2 English writing by 22 8$^{th}$-grade middle school students. In their study, think-aloud as well as keystroke loggings were used to analyze two argumentative tasks in each language. They chose think-aloud as a method to obtain data about the writers' *internal* revision processes (mentally rehearsed pre-textual and pre-linguistic revisions) and keystroke logging to get information related to writers' *external* visible revisions (point of inscription and previous text) in the text production. However, think-aloud and keystroke loggings were not recorded simultaneously. At first, keystrokes were logged into a simple log file, and later they were transferred into the *Trace-it* keystroke logging program. The analyses showed –

unsurprisingly – that these writers revised more in L2 English than in L1 Dutch. The writers' L2 revisions were related to language (revisions in spelling, vocabulary, and grammar). In another study, Lindgren and Sullivan (2006) compared revisions by nine junior high school students (13-year olds) in L1 Swedish and L2 English, by combining think aloud and stimulated recall interviews. They focused on whether revisions were formal or conceptual. They found that students' revisions in L2 writing are almost equally formal or conceptual.

Spelman Miller, and colleagues (2008) used keystroke loggings to examine the composing processes of 14 young Swedish writers in L2 English. They focused on keystroke logging data measuring pauses, fluency and revisions, and on text quality and "year of writing". They found that as writing experience increased, so did writing fluency; the number of pauses and time on task both decreased. The authors also concluded that keystroke loggings are less obtrusive than video recordings.

Van Weijn and colleagues (2008) compared writing processes of 20 student writers in four different tasks in L1 Dutch and L2 English, using keystroke loggings and think-alouds. Cognitive activities like planning, generating ideas and formulating were compared, showing less variance between writing behaviour in different L2 writing tasks, and hypothesized that cognitive load during L2 writing might constrain these behaviours. In another study, Tillema (2012) investigated the relationship between writing processes (planning, formulating and revising) and text quality in L1 Dutch and L2 English writing among 20 14-15-year old students, using *Inputlog* and think-alouds. Multiple tasks were used to control for task effect. Text quality seemed to be related to the presence of cognitive activity during the five stages of the writing process. Similarly, Palviainen, Kalaja and Mäntylä (2012) used keystroke loggings to look at the connection between L2 writing processes and text quality. The writing fluency of university students in L1 and L2 writing was compared, at different proficiency levels (measured according to the levels of *Common European Framework of References* as B1, B2, C1 and C2). Higher proficiency was associated with more fluent L2 writing.

In recent studies, Breuer (2014; 2019) compared the fluency, errors and revisions of ten university level German students in their L1 and L2 English writing, by using keystroke loggings in *Translog 2006*. The students composed two academic texts in German, and one simple text and two academic texts in L2 English. Results showed that they wrote their L1 texts more fluently than the L2 ones. However, no differences were found between the different task conditions. Most of the writers' linguistic errors in the L2 were explained by

the influence of their L1. However, the analysis of the errors in the final texts showed that fewer errors were made in free writing than in note-taking. There were also fewer linguistic revisions in free writing and in L1 writing.

In a more recent study, Van Waes and Leijten (2015) compared writing the fluency of 68 university student writers in L1 Dutch and L2 English, using *Inputlog*. Van Waes and Leijten's main purpose was to define fluency measures for writing process research. They proposed a new multidimensional model to measure fluency during the writing process, which focuses on four dimensions of process-related characteristics: production, process variance, revision, and pausing behaviour. Significant differences between L1 and L2 writing fluency were found in production, process variance and revision behaviour, whereas pause behaviour did not differ significantly.

In a final study, Deane and Zhang (2015) looked at whether keystroke process features influence the quality of six essays written in two different genres (argumentative or persuasive) by 94 and 204 sixth and ninth-grade middle-school students. They measured writing fluency features in terms of time on task, burst length, and within-word pauses. They found that these writing fluency features were stable across the tasks; it was also found that the students with high text quality had longer pauses and longer bursts of text (between pauses), which indicates that these students wrote more fluently than the students with lower-quality texts. However, editing and planning pauses and revisions (activities that the authors consider to be taking place during pauses between sentences, and also cut-and-paste-jump events) seemed to have a correlation with text quality scores, whereas between-word pauses and backspacing did not. A very important finding is that time on task and burst length in words contributed most to the text production skills across all tasks in both text genres.

These different studies illustrate the use of keystroke logging software both to look at text production in the L1 and to compare L1 and L2 writing processes. Lindgren and colleagues' (2017) study with 14-15 year-old bilinguals on L1, L2 and L3 writing processes is the closest to our planned study. They found that multilingual learners apply similar meaning-making process and pragmatic strategies when they write in multiple languages (Lindgren, 2008). We hope that our research will contribute to understanding the similarities and differences in writing across languages.

# Chapter 4: Basic research model

## 4.1 Significance and contributions

Writing researchers claim that theories on the teaching and learning of L2 writing have not yet been developed as much as theories of teaching and learning of L2 reading, and that writing is a neglected area in second/foreign language learning and teaching. There is still not a complete theory of L2 writing. More specifically, writing researchers have not yet developed an exact definition of L2 writing ability, since it is of a multi-componential nature, involving cognitive-linguistic, affective, metacognitive and socio-cognitive features (Kroll, 2003).

Therefore, it is important to explore what difficulties writers encounter during writing in the L1 and L2, and also how writers manipulate different writing processes and whether the resulting text quality is different in L2 and in L1 writing. As we saw in Chapters 1, 2 and 3, most studies comparing L1 and L2 writing processes involve university-level students. In our research, we specifically included EFL learners who are in earlier stages of EFL learning, because this may give better insights into the difficulties faced by L2 writers. Looking closely at a population of middle school students will enable us to consider ways in which keystroke loggings might be integrated into teaching techniques for L2 (and even L1) writing. We hope that the results of this study may be useful to curriculum designers and English teachers who want to develop instructional approaches to improve the writing skills of L2 and L3 learners.

We hope that our research will also shed light on the influence of linguistic knowledge and typing speed on composing processes and text quality in L1, L2 and L3 writing. Results may help clarify whether there are differences between writing processes in the three languages used by French-Turkish bilingual learners of English, and this, in turn, may have implications for classroom practice, especially for lower-level writers.

We hope our research will also provide insights into possible differences between monolingual and bilingual writers, and their linguistic knowledge, typing skills, writing processes and text quality. We hope that results drawn from this doctoral research project will contribute to the theories of foreign/second language acquisition, bilingualism, and especially to the improvement of L2/L3 writing instruction.

## 4.2 Research aims/objectives

This research project involves three studies. In study 1 (n=30), we looked into the relationship between linguistic knowledge, typing skill, writing processes (writing fluency, pauses and revisions) and text quality in L1/dominant French and L2/L3 English among 14 and 15-year-old students. In study 2 (n=15), we investigated the relationship between linguistic knowledge, typing skills, writing processes (writing fluency, pauses and revisions) and text quality in multilingual writing among Turkish-French bilingual 14-15-year-old students. In study 3 (n=30), we investigated the relationship between linguistic knowledge, typing skill, writing processes (writing fluency, pauses and revisions), and text quality in L1/dominant French and L2/L3 English writing between French monolingual (n=13) and bilingual (n=17) 14 and 15-year- old students.

In all three studies, we will look at different factors that may influence writing processes and text quality: specifically typing skill and linguistic knowledge, as well as difficulties in lexical encoding and sentence construction. More specifically and firstly, we will investigate whether linguistic knowledge in each language (measured with first-quarter exam scores -- oral and written -- in each language) is related to text production both at process (writing fluency, pauses and revisions) and product (text quality–measured as holistic in that language) level on the computer in different languages and. Secondly, we look at whether typing skills are different in different languages and if so, whether typing skills are related to writing processes (writing fluency, pauses and revisions) and text quality in different languages.

## 4.3 The pilot study into L1 and L2 writing processes[6]

I performed a pilot study using keystroke-loggings, to investigate whether there are differences between Turkish EFL high school students' L1 and L2 composing processes and whether L2 proficiency level affects L2 composing processes. This study was carried out with eight (six female, two male) Turkish EFL high school students in Turkey (aged 16-18), at two different L2 proficiency levels. The participants' EFL proficiency level was assessed via the *Oxford Placement Grammar Test* (Allan, 2004), which resulted in two groups of students; high-level proficiency (n = 4) and low-level proficiency (n= 4) which differed

[6] The pilot study was published as a book chapter: Tiryakioglu, G., Peters, E., & Verschaffel, L. (2019). The effect of L2 proficiency level on composing processes of EFL learners: Data from keystroke loggings, think alouds and questionnaires. In E. Lindgren & K.P.H. Sullivan (Eds.). *Observing writing: Insights from keystroke logging and handwriting* (pp. 212–235). Leiden, the Netherlands: Brill.

significantly (p<.001; low L2 proficiency mean score=48, 50, sd= 3, 41; high L2 proficiency mean score=80,50, sd=11,03). All participants participated voluntarily in that study.

Three kinds of data were collected: keystroke-loggings, think-aloud protocols and responses to the post-writing questionnaires. *Inputlog* 4.0, the writing research software developed by Leijten and Van Waes (2006), was used to collect on-line keystroke logging data. On the first day, after the language test and practicing the think-aloud, each student was given 30 minutes to compose an argumentative text on the given topic for the L2 English writing session on the computer via *Inputlog* and thinking-aloud. The L2 writing task is as follows;

> *You are a member of a website on 'presents'. On the website you have a page on which you provide some information on your choices of presents. Your friends who want to buy a present for your birthday can visit your page and learn about your preferences. So for your own page, write a text in which you argue <u>why you would rather like to receive present X for your birthday than present Y.</u> You have 30 minutes to write. Make sure your text shows a clear beginning, middle and end.*

The students were not allowed to use a dictionary while composing in L2 writing. The second day, the participants wrote an L1 text in *Inputlog*, with think-aloud and a post-writing questionnaire. After the completion of the writing tasks, a post-writing questionnaire (adapted from Akyel & Kamisli, 1997) was used to interview the students on their L2 composing process. All the sessions were audio-recorded and transcribed for further analysis.

In the data analysis we used five kinds of keystroke logging data: total composing process time, number of words and characters produced, pauses, and revisions. We conducted Revision Analysis, Pause Analysis and Text Analysis to generate these output variables for each .idf log file in *Inputlog*. Revision Analysis tabulates all the deletions and insertions of the characters in the text during the composing process; for our analyses, we did not differentiate between deletions and insertions. An example of text revisions can be seen in the linear logging file of a high L2 proficiency student in Figure 4.1. In line one, when the writer realized that she misspelt the word "*carefully*", she deleted "*er*". In lines three and four, she inserted "*ing*" to form the word *meaningful*.

Figure 4.1 The linear logging file of a high L2 proficiency student in *Inputlog*

```
so·you·must·{33057}use[BS3]{2777}use·your·money·carre[BS2]efully·[BS]. ·{104505} if·i
·must·to·say·clearly·i·dont·expect·big·{2605}presents·,i ·{2059}just·expect
·{19126}[Movement][LeftButton][Movement]but ·i[RIGHT8]meanful·presents.
{13884}[Movement][LeftButton][Movement]ing[Movement][LeftButton][Movement]{3526}[
Movement][LeftButton][Movement][RightButton][Movement][LeftButton]
```

The Pause Analysis function extracts the number of pauses included in the writing process: these are longer pauses, during which keystroke movements are suspended for more than 2000 milliseconds. We chose 2000 milliseconds as a pause threshold level because this duration is considered as reflecting high-level cognitive processes such as planning, formulation, or re-reding during the composing process; it is also the most frequently-used threshold level for pauses in writing process research (Van Waes & Leijten, 2015), making our study comparable with previous work (Kowal, 2014; Palviainen, Kalaja & Mäntylä, 2012; Spelman Miller, Lindgren & Sullivan, 2008). Text Analysis calculates "composing process time" and "number of words produced", which were used to reflect writing fluency in both languages. Total composing process time is the time from when *Inputlog* program starts to record keystrokes until the recording stops. Number of words produced refers to the total number of words typed (including deleted ones) during the composing process (see Leijten & Van Waes, 2006; Van Waes & Leijten, 2015 for more detailed information). Writing fluency was also measured by words and characters written per minute. These figures are calculated manually by dividing the total number of words and characters by the composing process time. All descriptive statistical tests for the writing process data obtained through *Inputlog* were carried out using the SPSS software package. We also generated graphical representations of students' online composing processes to reflect their writing fluency. These are graphs automatically generated by *Inputlog*, based on the LS graph program by Lindgren and Sullivan (2002) and the *Geographical Information System* (GIS) (Lindgren, Sullivan, Lindgren & Spelman Miller, 2007); these graphs help visualize the online composing processes of low and high L2 proficiency students in L1 and L2 writing.

The data obtained through our think-aloud protocol were transcribed and analysed based on the coding scheme developed by Roca de Larios and colleagues (2008); transcriptions were typed into *Word*, and the analysis was carried out by hand, with no dedicated transcription software. The transcriptions are divided into the following segments: 1. *Reading the prompt,* 2. *Task conceptualization,* 3. *Planning,* 4. *Formulation*, 5. *Evaluation,* 6. *Revision,* and 7. *Metacomments.* I also added an eighth category, 8. *Lexical search*, since comments concerning vocabulary issues was frequent in my data. Two raters coded transcribed protocols; the intercoder reliability was very high (Cronbach's alpha= .96).

In the analysis of our think-aloud and keystroke logging data, we did not apply significance testing, since the number of participants was too small (n=8). Lastly, the students' responses

to the questionnaire were analysed and used as qualitative data to help us interpret and cross-validate the findings from think-aloud protocols and the keystroke logging data.

### 4.3.1 Results of the pilot study

The results of the pilot study seem to suggest that there are differences between Turkish EFL high school students' L1 and L2 composing processes in writing an argumentative text. Firstly, as the keystroke logging data showed, the composing process time, number of words produced, writing fluency, number of pauses and revisions were found to be different in L1 and L2 writing (Table 4.1).

Table 4.1 Mean occurrences of L1 and L2 composing processes (*Inputlog* data)

| | L1 (Turkish) *Mean (SD)* | L2 (English) *Mean (SD)* |
|---|---|---|
| Composing process time (in min) | 7.67 (2) | 15.30 (8.60) |
| Number of total words | 109 (35) | 164 (50) |
| Number of words per minute | 13.88 (3.03) | 10.03 (4.8) |
| Number of characters per minute | 94.80 (25) | 48.42 (14.96) |
| Number of pauses | 29 (10) | 68 (44) |
| Number of revisions | 17 (21) | 49 (55) |

Standard deviations are in brackets (*SD*)

We also found that there are important differences in those process variables between high and low L2 proficiency writers in L2 writing. Low L2 proficiency students spent more time on composing the L2 text than high proficiency students (Table 4.2). However, as seen Table 4.2, high L2 proficiency students produced more numbers of words than low L2 proficiency students. High L2 proficiency students tended to compose their L2 texts in a shorter period of time than low L2 proficiency students.

Table 4.2 Mean occurrences of L2 composing processes by high and low L2 proficiency students (*Inputlog* data)

| | Low L2 Prof *Mean (SD)* | High L2 Prof *Mean (SD)* |
|---|---|---|
| Composing process time (in min) | 18.16 (8.60) | 13.86 (2.5) |
| Number of total words | 137 (40) | 192 (47) |
| Number of words per minute | 6.45 (1.53) | 13.61 (4.30) |
| Number of characters per minute | 38.03 (5.47) | 57.28 (14.31) |
| Number of pauses | 85 (44) | 60 (10) |
| Number of revisions | 71 (55) | 38 (21) |

Standard deviations are in brackets (*SD*)

We found that high proficiency students (mean=13.61 words per minute) wrote twice as fluently as compared to the low proficiency students (mean=6.45 words per minute). Low proficiency students paused more than high proficiency students. Finally, low proficiency students' revisions (deletions and editions) were more frequent than high proficiency students in L2 task.

The *Inputlog* graphs in figures 4.2, 4.3, 4.4 and 4.5 show the visual representations of online L1 and L2 writing processes of high and low L2 proficiency students (Leijten & Van Waes, 2006; 2013; Lindgren & Sullivan, 2002). As can be seen in the figures, there were variations between and within writers (Kowal, 2014). The graphs show the number of characters produced and deleted each time, the cursor position and pauses longer than our predefined threshold value of 2000 milliseconds. The x axis represents the process time (in seconds) and the y axis represents the number of characters formulated and left in the final text. The zone in between them shows the distance between the ideas proposed (upper-line) and accepted (below the zone) in the final text. When the zone is wider, it means that more characters and words are deleted during writing. The circles just below this zone represent the pauses. The bigger the circle is, the longer the writer pauses. When there is a sudden drop in the line, this means that a number of characters was deleted in the text. Along the x axis, the grey dashed lines show all the points in time where the writer pauses and red band at the bottom of the graph shows the location of each revision (Leijten & Van Waes, 2006; Van Waes, Leijten & Van Weijen, 2009).

As can be seen in these figures, in L1 writing, the writers did not pause and revise as frequently as in L2 writing. *Inputlog* graphics 4.2 and 4.3 show that high and low L2 proficiency students' composing processes do not differ much in L1 writing. They wrote their L1 texts in a linear way and more fluently with a regular distribution of pauses throughout the writing process.

Figure 4.2 A graphical representation of a high L2 proficiency writer's L1 composing process

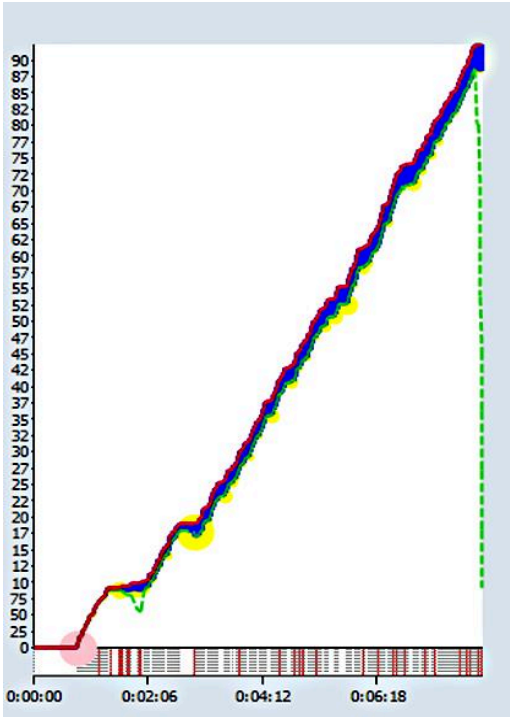
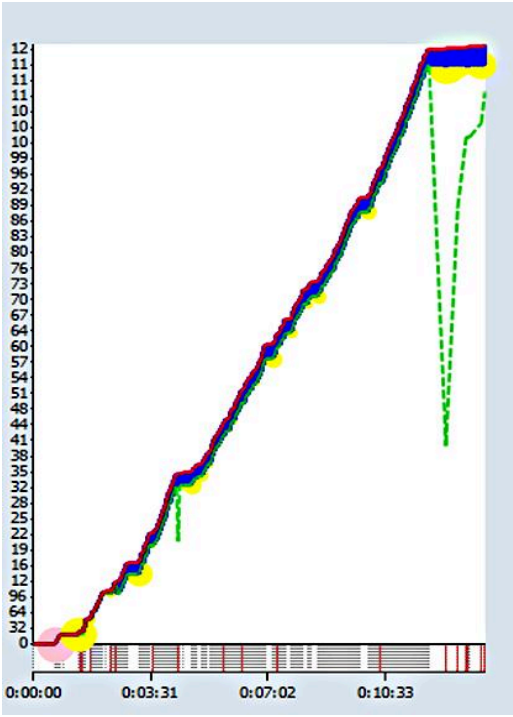



Figure 4.3 A graphical representation of a low L2 proficiency writer's L1 composing process




Figures 4.4 and 4.5 summarize the writing behavior for the two writers, writing in their L2. Figure 4.4 shows that the high proficiency student wrote her L1 text and L2 text in as similar way. Figure 4.5 shows that the lower-proficiency L2 writer works less fluently in L2 than in L1. Writing fluency is reflected by the narrowness of the zone in the middle, because proposed written ideas were not deleted and showing that there is less revising and pausing – more ideas seem to be translated into linguistic units in the text. However, this was not true for the low-level student, who exhibits a less fluent writing process (Figure 4.5). The regular distribution of circles in the high proficiency student's writing graph shows that she paused at regular intervals throughout the process. She planned, generated ideas and the text, evaluated and revised systematically and recursively. Figures 4.2, 4.3, and 4.4 show that the pauses occurred throughout the whole composing process. However, the lower-level L2 writer's pauses intensified in the middle of the composing process (Figure 4.5), which indicates that she was probably struggling with text formulation, possibly due to formulation challenges at the word and sentence levels.

Figure 4.4 A graphical representation of a high L2 proficiency writer's L2 composing processes

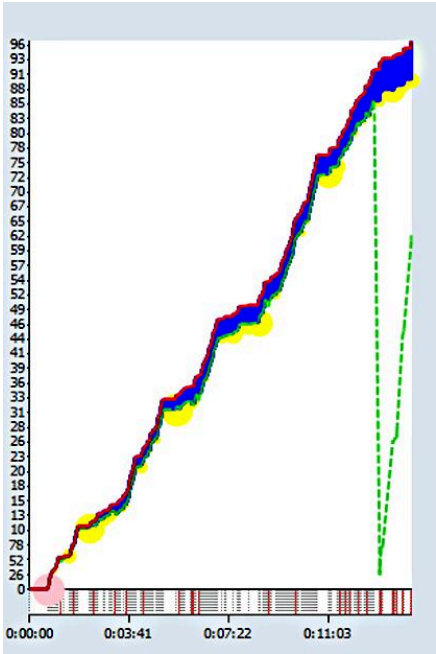
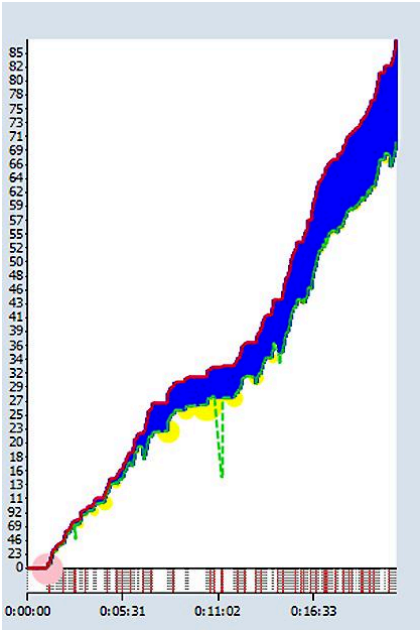



Figure 4.5 A graphical representation of a low L2 proficiency writer's L2 composing processes




The graphical representations generated automatically by *Inputlog* are particularly useful for visualizing fluency behavior in writing (Leijten & Van Waes, 2006; Lindgren & Sullivan, 2002; Lindgren et al., 2007; Van Waes & Leijten, 2011).

### 4.3.2 Discussion and conclusion of the pilot study

Our pilot study findings seem to corroborate the research illustrating significant differences between EFL students' L1 and L2 composing processes, and notably important

fluency differences: fewer words per minute, in particular (Breuer, 2019; Chenoweth & Hayes, 2001; Lindgren, Sullivan, & Spelman Miller, 2008; Sasaki & Hirose, 1996; Schoonen et al., 2009; Silva, 1993; Van Waes & Leijten, 2015). L2 writers pause more frequently, probably facing greater difficulty "translating" their ideas into linguistic units and "transcribing" them into written words and phrases. Revisions (deletions and insertions) also take place more often in L2 writing than in L1 (Stevenson, Schoonen & De Glopper, 2006; Thorson, 2000). Akyel and Kamisli's (1997) also found that EFL students tend to be concerned with searching for vocabulary and/or checking for grammar while composing their L2 texts (see also Cumming (1989) and Schoonen et al. (2003)).

Our findings also support the relatively obvious conclusion that there is a relationship between L2 proficiency level and composing processes in L2: increased experience with the language brings increased fluency in writing (Chenoweth & Hayes, 2001; Lindgren, Sullivan, & Spelman Miller, 2008; Palviainen, Kalaja & Mäntylä, 2012; Spelman Miller et al., 2008). In terms of our model (Figure 2.1), greater linguistic proficiency enhances formulation processes in L2 writing. Accesibility to linguistic resources enables higher-proficiency writers to plan more, generate text more fluently and pay attention to pragmatic concerns in L2 writing.

The lower L2 proficiency writers in our pilot study write less fluently, formulating fewer words in a longer period of time than their high proficiency peers. Findings related to word-search operations among low-level students show that they devote a lot of attentional resources to linguistic concerns and compensatory problems (Manchón & Larios, 2007). Lack of linguistic knowledge seems to constrain these L2 students' expression of meaning and interfere with high-level processes (Chenoweth & Hayes, 2001; Whalen & Ménard, 1995). Our pilot think-aloud data showed that L2 writers devoted more thought to reading the prompt, task conceptualization, planning, formulation, evaluation, revision, metacomments and lexical search. Our high L2 proficiency students reported engaging in more composing processes than the lower L2 proficiency writers, who reported more time spent reading the prompt and searching for words. The think-aloud protocols of the high L2 proficiency sub-group showed more attention devoted to pragmatic aspects of their texts; the low L2 proficiency students' protocols lacked this pragmatic concern for their reader.

Our post-writing questionnaire showed that our student writers were faced with three major difficulties while composing their L2 texts: 1) difficulties related to the retrieval of words to express intended meaning, 2) spelling, 3) the grammatical accuracy of the sentences produced. Again, the high L2 proficiency students expressed more concerned with pragmatic and stylistic aspects of their texts: for example, varying words and sentence structure to communicate their ideas.

A limitation to this pilot study is, of course, the very small number of learners involved (only 8). For this reason, we could not carry out statistical analysis of the data set (comparing our quantitative and qualitative data, for example). A larger-scale study would be needed for more structured data analysis.

### 4.4 Research hypothesis

Our doctoral project built on this exploratory study. With this project, we expect to find differences between French, Turkish, and English composing processes and text quality. We will also look at the effect of typing skill and linguistic knowledge on the fluency, pause, and revision behaviour in L1, L2 and L3 writing, and on text quality in the three project languages. Our expectations for our research results are based on the assumptions drawn from previous research on writing processes and our pilot study. The hypotheses informing our research project and its design were the following:

Hypothesis 1: There will be differences between the L1 and L2 composing processes of our 9$^{th}$ grade learners. The differences might be explained by the fact that L2 writers have less developed linguistic knowledge in the L2 than in the L1 (McCutchen, 2000; Schoonen et al., 2003, 2011). We also expect that limited L2 linguistic knowledge may interfere with typing, fluency, formulation, pause and revision processes in L2 written discourse. The effect of linguistic knowledge may be particularly strong in L2 writing, and may result in decreased writing fluency (numbers of words typed per minute; Chenoweth & Hayes, 2001; Whalen & Ménard, 1995).

Hypothesis 2: Our middle school learners' difficulties may primarily be related to the use of linguistic knowledge in L2/L3 writing; finding relevant vocabulary, spelling and grammatical structures to express their intended meaning, although we may discover other difficulties when analysing our corpus (Breuer, 2014; Tiryakioglu et al., 2019).

Hypothesis 3: Linguistic level should influence the formulation process in L1/L2/L3 writing. We predict that writing in French might be challenging for our Turkish-French

bilingual learners since this is a second language for them, and one with particular formal challenges because of its complex orthographical system. We also expect to find that L2/L3 formal knowledge will have an effect on the allocation of our writers' attentional resources during the writing process. As in Raimes' (1985) study (and much of the research summarize in Chapter 2), EFL students might pay more attention to low-level processes while composing an English text, than to higher-level pragmatic aspects.

Hypothesis 4: Typing skill might differ in L1, L2 and L3, which is an important issue and has not attracted as much attention as it deserves. Typing speed must certainly be related to writing fluency and may even affect text quality in L1/L2/L3 writing. We assume the faster the writer can type, the more fluently s/he will be able to compose a text, which may result in better text quality.

We do not make strong claims concerning the revision behaviour of our teenage writers, because, as we have seen, the results so far are inconclusive and even conflicting in this area. However, we tentatively predict that Revision-burst length could be longer during text production in L1 writing compared to L2/L3 writing. Similarly, more revision behaviour (deletions and additions) might be observed in L2/L3 text production than in L1 text production.

### 4.5 Research questions

Our overall research questions are, therefore: What differences in text production (composing processes and text quality) will we find across tasks (descriptive and narrative writing) and languages (L1, L2 and L3)?

More specifically:

1. Are there differences between composing processes (as measured by writing fluency, pauses and revisions) in L1/dominant French and L2/L3 English?
2. Are there differences between descriptive and narrative writing in L1/dominant French and L2/L3 English?
3. Are there differences between text quality scores in L1/dominant French and L2/L3 English?
4. Are there differences in the typing skill of these French middle school learners in their L1/dominant French and L2/L3 English?
5. What relationship can be found between learner characteristics, composing processes and text quality in L1/dominant French and L2/L3 English?

For each of our three studies, the list of research questions can be detailed as follows:

**Study 1:** n= 30 French middle-school EFL learners

1. Are there differences in the typing skill of these French middle school learners in their L1/dominant French and L2/L3 English?
2. Are there differences between descriptive and narrative writing tasks in L1/dominant French?
3. Are there differences between descriptive and narrative writing tasks in L2/L3 English?
4. Are there differences between L1/dominant French and L2/L3 English composing processes (as measured by writing fluency, pauses and revisions)?
5. Are there differences between L1/dominant French and L2/L3 English text quality scores in this learner group?
6. What relationships can be found between typing skill, first-quarter school averages, composing processes (writing fluency, pauses and revisions) and text quality scores of EFL students in their L1/dominant French and L2/L3?
7. What relationships can be found between our learners' writing profile scores, post-writing perceptions and text quality in L1/dominant French writing? (Qualitative data)
8. What relationships can be found between our learners' writing profile scores, motivation towards learning for L2/L3, post-writing perceptions and text quality in L2/L3 English writing? (Qualitative data)
9. What are the middle-school EFL students' attitudes towards writing in L1/dominant French and in L2/L3 English? (Stimulated recall interviews)

We have essentially the same questions for our second study, focused on our Turkish-French bilingual learner sub-group.

**Study 2**: n=15 Turkish-French bilingual students

1. Are there differences in the typing skill of these 9th grade middle-school French-Turkish bilingual students in their L1 (Turkish home language), L2 (French dominant school language) and L3 (English as a foreign language learnt at school)?
2. Are there differences between L1 Turkish, L2 French and L3 English composing processes (as measured by writing fluency, pauses and revisions)?
3. Are there differences between L1 Turkish, L2 French and L3 English text quality scores in this learner group?
4. What relationships can be found between typing skill, first-quarter school averages, composing processes (writing fluency, pauses and revisions) and text quality scores in Turkish, French and English?
5. What relationships can be found between our bilingual learners' writing profile scores, post-writing perceptions and text quality in French writing? (Qualitative data)

6. What relationships can be found between our bilingual learners' writing profile scores, motivation towards learning Turkish as a heritage language, post-writing perceptions and text quality in Turkish writing? (Qualitative data)
7. What relationships can be found between our bilingual learners' writing profile scores, motivation towards learning English as a foreign language, post-writing perceptions and text quality in English writing? (Qualitative data)
8. What are the middle-school French-Turkish bilingual students' attitudes towards writing in Turkish, in French; and in English? (Stimulated recall interviews)

**Study 3**: comparison between French monolingual (13) and bilingual students (n= 17)

The same research questions apply to the overall analysis comparing the monolingual and bilingual subgroups; certain questions may not be relevant, depending on the findings for study 1. So for the comparison between these two groups, we can just present the results related to differences between tasks, languages and text quality scores.

1. Are there differences between bilingual and monolingual middle-school students' L2/L3 English composing processes (as measured by writing fluency, pauses and revisions)?
2. Are there differences between L1/dominant French and L2/L3 English first-quarter school averages in these learner groups?
3. Are there differences between L1/dominant French and L2/L3 English text quality scores in these learner groups?

In the next chapter, we present the methodology used to collect the data that we need to answer these research questions.

# Chapter 5: Context and Methodology

As our research questions (Chapter 4) show, there are three aims of this PhD project. One is to look at the relationships between certain learner characteristics (typing skill and linguistic knowledge), writing processes (writing fluency, pauses and revisions), and text quality (overall text scores) in French (the first or dominant language for our subjects), and in English (a foreign language for all of the subjects) in writing assignments carried out by middle-school teenagers in France. The second aim is to look at these relationships in multilingual writing (L1-Turkish, L2-French and L3-English) by a sub-group of Turkish-French bilingual middle-school students. The third aim is to compare the writing behaviour of our monolingual and bilingual teenagers, writing in both French and English. We will look at as many different factors as we can that may influence writing processes and text quality.

## 5.1 Sampling

We chose to collect our data in two middle schools in the small French city of Mâcon (35,000 habitants), since the researcher was already working in this school system, and therefore had relatively easy access to the numbers of classrooms needed. More importantly, in these schools there are Turkish language courses attended by Turkish-French bilingual students, an important sub-group for our study. The last grade of middle school (French "troisième" classes, or "Third Year", equivalent to American ninth grade) were chosen, because at this point, after four years (at least) studying English as a foreign language, we expected the learners would be comfortable with the L2 writing exercises that we wanted to ask them to complete. We contacted the principals of the schools six months before the data collection period, by sending them the description of the research project by email. Both middle schools gave us permission to collect the data in their schools, according to the availability of the students and their teachers. Although Lyon 2 University did not, at the time of data collection, require approval of the project by a Board of Ethics, we attempted to adhere scrupulously to the guidelines established by the French *Agence National de la Recherche*.

## 5.2 Participants

The participants in our first study (study 1) were 30 9$^{th}$-grade French middle-school students (aged from 14 to 15 years old) who are all learning English as a foreign language.

In this total subject pool (n=30), we have three sub-groups: 13 monolingual French learners of English as a first foreign language (L2), 15 bilingual Turkish-French learners of English as a first foreign language (L3), and two other (Arabic-French) bilingual learners. The language profile of the 15 Turkish-French bilingual subjects is as follows: their L1 is Turkish (used at home, mostly orally), their *second language* is French (and probably their dominant language, since they have learned to read and write it and use it all day at school). Their L3 is English as a foreign language taught at school. The participants were chosen according to the procedure outlined below.

We contacted the vice-principals and English teachers in the two participating middle schools to organize data collection. They informed the 9$^{th}$ grade students about the project and asked whether there were volunteers to participate. The volunteer students registered into the project: 12 students in school A; nine monolingual students in school B, along with 18 Turkish-French bilingual students who were following the Turkish heritage course, which we will describe below.

After the volunteer students registered as participating students, their parents were asked for their authorisation to allow their children to take part in the data collection. Parental consent forms were sent to the parents through vice-principals or their English teachers. Two of the volunteer students did not return their authorisation forms, so they could not participate in the data collection. Two of them did not appear at any of the data collection sessions. Four learners started the data collection process, but were absent from school on one day of data collection. As a result, eight students were dropped from the participation list. Another subject participated in all sessions, as well as the stimulated recall interview. But since his native language is English, he was dropped from the data analyses presented here.

The resulting number of participating students (Table 5.1) is therefore 30: 13 French monolingual learners, 15 Turkish-French bilingual learners and two other bilingual (French-Arabic) learners. Table 5.1 gives an overview of our middle-school project participants, with a brief summary of the language profiles of our sub-groups (columns 6-8). This information was obtained through our linguistic profile questionnaire, which was completed by the parents of our participants.

We selected fifteen-year-olds as subjects for our project, since they represent the age group targeted in the *Programme for International Student Assessment* (PISA), implemented by

the Organisation for Economic Co-operation and Development (OECD) to measure 15-year-olds' scholastic aptitude internationally. Inclusion of 15-year old students will enable cross-national comparability of teenage writing skill, as stated in Tillema and colleagues's (2013, p. 14) study: "Should a PISA assessment of writing literacy be set up, then tools for cross-national comparisons of writing become relevant, too".

Table 5.1 Participants' characteristics and language background

| Learner type | *N* | gender | age | school year | Language learning background | | |
|---|---|---|---|---|---|---|---|
| | | | | | L1 | L2 | L3 |
| Monolingual French students | 13 | 6 girls, 7 boys | 14 - 15 | 9th grade (3ème) middle school | French: native language and language used at school | English: foreign language at school: 3 hours a week | n/a |
| French-Turkish bilingual students | 15 | 8 girls, 7 boys | 14 - 15 | 9th grade (3ème) middle school | Turkish: native language (oral communication); taught one hour a week; Turkish literacy skills | French: language used at school (dominant language) | English: foreign language at school; 3 hours a week |
| Other bilingual students | 2 | 1 girl, 1 boy | 14 - 15 | 9th grade (3ème) middle school | French: language used at school | Other native languages: not taught as a school subject | English: Foreign Language at school; 3 hours a week |
| Total: EFL learners | 30 | 15 girls, 15 boys | 14 - 15 | 9th grade (3ème) middle school | French: language used at school (26 hours of attendance per week, all subgroups) | English: foreign language at school; 3 hours a week, with a skills-focused curriculum | |

*Note.* n/a: non-applicable

***Language education at school***

For all of our learners, French is the language of instruction for all school courses. For the teaching of French as a subject matter, the National Curriculum identifies three target knowledge and skill areas:

- the development of receptive and productive oral and written language skills;
- the deepening of linguistic skills that allow a synthetic understanding of the language system, including orthographic, grammatical and lexical systems as well as elements of language history (in connection with foreign languages and regional languages);
- the constitution of a common literary and artistic culture, bringing together literary works of national heritage, contemporary productions, French-language literature and literature of ancient languages and foreign or regional languages, and other artistic productions, in particular still and moving images. (Ministre de l'Education Nationale, 2018)

According to the National Curriculum, 9th grade students are supposed to have learnt discourse aspects of narrative writing when they were in the 3rd year of Primary school (Olive et al., 2009). One of the raters in our project (a middle-school French teacher) reported that she asks students to write articles with 60 lines, on certain topics, as argumentative writing. They also carry out text-completion activities (write a paragraph or two to conclude a text or narrative.

All the participants in this study have been learning EFL since the fourth year[7] of primary school (CM1, for "Cours moyen 1") with one and half hours a week as stipulated by the foreign language curriculum (Ministre de l'Education Nationale, 2018). In the middle schools, the first foreign language, which is generally English, is taught for three and half hours a week. A second foreign language is also introduced to the students in the 7th grade (5ème) with two and half hours a week. It is generally either Spanish or German, among other possible options. The aim, knowledge and skills to be developed in the foreign language courses are described in the French *Programmes*. Communication situations adapted to age, cognitive abilities and student interests are used as a means of constructing language knowledge, making it possible to reach the A1 level of the *Common European Framework of Reference for Languages* (CEFR) in the five language skill areas by the end of primary school: speaking, listening, reading, writing, and interacting. In the foreign-language middle-school programme, the writing curriculum is not described in detail. Based on my experience and interviews with English teachers in the middle school where I worked, I can provide a brief description of the writing activities done in English classes with 9th grade students. These consist of the production of descriptive paragraphs, based on pictures in the learners' course books, (in this case, *Join the team*, Adrian et al., 2013). Learners are also asked to write letters, notes, messages, and paragraphs based on pictures, tasks and samples in the textbooks. In an interview with an English teacher from school B, for example, she asked her students to write a letter from a soldier during World War I. She also asks them to write posters about pollution or charities, or newspaper articles. They also write narrative paragraphs, practising the use of the simple past. Another English colleague, in answer to our questionnaire, responded with a brief description of her 9th-grade's levels and writing activities:

[7] Foreign language education is supposed to start in the first year of primary schools, according to a 2010 decree. Before this date, English was taught from third grade onwards (but only as an introduction to the language by class teachers). Schools are currently to provide from one to two hours of foreign language per week.

> It depends on the skills. I would say they are generally better at reading comprehension than writing skill and speaking. We would like them to be close to B1 but they are mostly A2+. I think most of them started in CE1 (even CP) but the primary teachers' level in English is not always very good and, since there are so many things to teach, some teachers sometimes "forget" about English. So the levels are very different when children get to 6th grade. I think the best thing would be to have secondary education teachers to go to primary schools to teach languages (that is what I could do in the primary school, and school directors liked it because then, English is compulsory and taught by a specialist).

For the fifteen children in the Turkish-French bilingual sub-group, we will describe their context: language background and heritage language learning at school in more detail below.

***The context of Turkish-French bilingual students in France***

The context of Turkish-French bilingual learners can be described as follows based on the researcher's more than five-year observation of the Turkish community, not only at French primary and middle schools but also in their social lives in France. The first generation of Turkish immigrants immigrated to France in the 1965s to work in mines or factories. Their native language was Turkish, and they did not learn French in a structured, institutionalized context. The children of this first generation attended French primary or secondary schools. However, their first language remained Turkish. The third generation started in French nursery school at the age of three, like all French children. They therefore speak both languages in their daily lives. For some of them, Turkish remains their dominant language, perhaps due to continued close socio-cultural ties with Turkey, marrying a native Turkish speaker (from Turkey), for example (Akinci, 2010). The fourth generation of Turkish immigrants are the current school-age children in France. Either French or Turkish may be their dominant language, depending on variations in their social environment. The dominant language of families that live in a large Turkish community is either Turkish, or a mixture of Turkish and French. Family members may literally combine the languages as they speak, code-switching from one to the other. Parents whose dominant language is Turkish often insert French words into Turkish utterances while speaking, or vice versa. Although there are exceptional cases, there is also a common trend among Turkish parents – especially in larger Turkish communities – to bring up their children by speaking only Turkish with them at home, until the children start school. The parents have the idea that the children are exposed to French and continue learning it when they start schooling. Based on my own observations of teaching and living in Turkish community in France for five years, younger parents, especially who live farther from Turkish communities, have more of a tendency to speak French at home, since French

appears to be their dominant language, and Turkish words are inserted while speaking. They speak Turkish much more rarely, so that the children hear and learn Turkish when they visit their Turkish relatives. Akinci and Decool-Mercier's study (2010) found that Turkish-French bilingual children have limited structural and lexical capacity in narrative development compared to the monolingual children in Turkey. As they are exposed to Turkish in their daily lives less than their monolingual counterparts in Turkey, they are less proficient in Turkish, both in written and spoken production.

In our Turkish-French bilingual subject pool, Turkish is the home language for eleven subjects; and mixed Turkish and French for four. They have been attending Turkish courses, organized as part of the ELCO (*Enseignement de la Langue et Culture d'Origine*) heritage-language teaching project since primary grade 2 (*Cours élémentaire 1*) for seven years on, as stipulated in the Turkish Ministry of Education curriculum. In France, the national ELCO Project is designed to enable bilingual children to learn their heritage language, within the public school system. The ELCO Project is implemented according to bilateral agreements based on a European directive of 25 July 1977, legislating the schooling of migrant workers' children. These agreements involve nine countries: Algeria, Croatia, Italy, Morocco, Portugal, Serbia, Spain, Tunisia and Turkey. The aim of the project is to teach the heritage language and culture to immigrant children. The principle behind this, originally, is that mastery of the mother tongue is a prerequisite for success in a second language (Akinci, 2016). The project objectives are complementary: a) to structure the language spoken in the family environment; b) to foster the personal growth of young people from other cultures; c) to promote the diversification of languages at school.

These ELCO courses are taught by native-speaker teachers from the countries concerned. They are made available by their respective governments, and are usually organized by consular authorities. In France, each regional *Académie* is responsible for the organization of ELCO courses, in cooperation with the consulates of the countries (Ministre de l'Education Nationale en France, 2018). From 2016 onwards, the ELCO project was scheduled to develop into another project called *Enseignements internationaux de langues étrangères* (EILE; International foreign language teaching) with the aim of standardizing the teaching of heritage languages, based on the knowledge and skill levels defined in the *European Framework* for languages. The EILE project was put into place and the schools

and the teachers have attempted to adapt the new practices and applications according to availability of school facilities.

In primary schools, ELCO courses are taught from the 2nd grade on an optional basis, from 1 hour 30 minutes to 3 hours per week. Most of these courses are organized after school. Although this project is implemented mostly with primary schools based on parents' demands, ELCO courses are also taught in middle schools, high schools and vocational high schools. However, there are fewer courses in middle than in primary schools. Teaching activities are organized in two different groups at 2nd-3rd (CE1-CE2) and 4th-5th (CM1-CM2) grade levels in primary schools, although in many schools all four grades are mixed. There are also a few schools in which ELCO courses are taught homogeneously for example in classes where there are only CE1 students and so on. In middle schools, the curriculum is organized in two groups, if the number of participating learners is sufficient: 6th-7th grades (6ème-5ème in the French education system) in one class and 8th-9th grades (4ème-3ème) in another. Frequently, however, student numbers are insufficient, and the classes become mixed-grade classes with students from all four middle school grades. Therefore, in one class, there can be students from 6th, 7th, 8th and 9th grades. This was the case in school A. However, in school B, the students coming from 6th and 7th grades were in one class; the students from 8th and 9th grades were in another.

Our fifteen bilingual learners attended these ELCO Turkish courses one and half hours a week in primary school, in which they learnt Turkish literacy skills along with basic grammar. In secondary school, they have been studying Turkish one hour a week. In these courses, they improve their knowledge of Turkish vocabulary and grammatical structures, and read Turkish literature, with the objective of improving their knowledge of Turkish history, geography and culture. As part of writing development, they write descriptive, narrative and argumentative texts. Examples of writing exercises in Turkish include writing a paragraph or short text describing a person (best friend/ family members), explaining a proverb/expression, narrating a story, describing a past holiday, arguing about a school activity, and so on.

Measures of our participants' linguistic knowledge – in L1, L2 and L3 – were obtained using their first-quarter school average for French, English and Turkish courses. These quarterly grades are based on quizzes, homework assignments, written, and oral exams. The number of grades averaged together may differ between French, English and Turkish.

## 5.3 Instruments

In our research, both quantitative and qualitative research methods will be used to gain a better understanding of writing processes (Hyland, 2003; Matsuda & Silva, 2005) in the three languages of the study. We used the following data collection instruments: keystroke loggings, stimulated recall interviews and pre-/post-writing questionnaires to collect data. Table 5.2 summarizes the types of data collected, and our objectives.

Table 5.2 Data collection instruments

| type of data | objective |
|---|---|
| Keystroke loggings | to measure typing speed (the copy task), fluency, pauses and revisions |
| Stimulated Recall protocols | to investigate (qualitatively and quantitatively) students' reasons for hesitation during pauses and revisions in narrative writing |
| *Linguistic Profile Questionnaire* | to obtain information related to the languages spoken at home. It consists of ten multiple, closed- and open-ended questions. |
| *Student Writing Profile Questionnaire* | to evaluate students' perceived writing behaviour. It consists of nine multiple, closed- and open-ended questions. |
| *Student Motivation for English* Questionnaire | to evaluate students' motivation for learning English as a foreign language. It consists of sixteen 3-likert style questions. |
| *Student Motivation for Turkish* Questionnaire | to evaluate students' motivation for learning Turkish heritage language. It consists of sixteen 3-likert style questions. |
| The *Post-writing Questionnaire* | to obtain information related to our students' post-writing perceptions in narrative writing in French, Turkish and English. It consists of nine 3-likert scale questions. |

Research suggests that it is advisable to combine keystroke loggings with other data collection methods such as think-aloud protocols, introspective or retrospective stimulated recall protocols or videos to get information concerning the reasons for the writer's behaviour, especially to interpret the fluency, pause and revision processes (Lindgren, 2005). In the following sub-sections, we give a more detailed description of each of the instruments used to collect the data that will be analysed in Chapters 6 to 10.

### 5.3.1 Writing tasks

In our data collection process, we asked the subjects to complete two writing tasks in each language. Assessing the writing ability of a learner based on a single-task condition is less reliable and does enable the researcher to formulate generalisations about each subject's writing ability; the difference between L1 and L2/ L3 writing cannot be appropriately studied by using a single task for each language (Tillema, 2012). So we asked the project participants to complete two writing tasks in each project language: a descriptive task, and a narrative task. The descriptive task resembles the sorts of tasks that learners are asked to complete in the *Brevet* and the *Baccalauréat* oral exam in France; one English teacher at the school where the data collection took place, confirmed that the students frequently

describe pictures in their English classes. Narrative tasks are the ones most frequently used in native- and second-language acquisition research, and therefore make our data comparable to that obtained in other writing acquisition studies. For both tasks, the students composed a piece of text by looking at pictures, and our analyses will of course control for possible task effects.

***Designing the writing tasks***

In order to produce comparable types of texts in three languages, it is important to maintain, as far as possible, the same writing conditions. In choosing the pictures used in our tasks, we therefore considered the following criteria: number of pictures, the content of the story or description, the lexical and grammatical knowledge needed to encode this content in a written text.

One-page static pictures were chosen for the descriptive task in each language; we searched for open-source pictures, suitable to our learners' age group, probable language knowledge, and interests. We found three different pictures, triggering comparable types of language output. The pictures illustrate scenes from everyday life, with teenagers talking, playing with their tablets or mobile phones, etc. The descriptive task instructions ask the learners to describe one picture in four minutes with at least four sentences. The materials used for the descriptive tasks in three languages are provided in Appendix K.

The *Edmonton Narrative Norms Instrument* (ENNI), developed by Schneider and colleagues (2003), was chosen as a trigger for the narrative writing task. The ENNI tasks are story-telling tasks, based on a series of pictures, specially designed to assess the story-telling ability of school-age children, from pre-school to secondary school. Ability to narrate a story is an important developmental language skill, since narration requires speakers to combine words and sentences with a particular aim. The ENNI tasks have been shown to be reliable, valid and comparable (Schneider et al., 2003); they were developed and tested according to the "Story Grammar model" of children's story-telling ability, which reflects "how individuals organize story information in order to encode, understand and retrieve stories" (Schneider et al., 2003, p.5). A scoring scale is provided, which takes into account the goal-directedness of the narrative activity. In all of the ENNI picture stories, there is a main character who attempts to solve a problem with goal-directedness. He or she tries different possibilities, until a positive solution is found. The story revolves around that character, and the final solution creates a happy ending. The story-teller needs

to mention a set of necessary elements, in order for the story to be comprehensible. There are three units in the assessment criteria, all of which need to be mentioned: the initiating event, the attempt(s) at a solution, and the outcome. Each of these units is given 2 points, other units mentioned (setting, internal plan, internal response, reaction) add 1 point each. All of these units are clearly defined by the researchers, so that they can be efficiently tabulated while scoring each narrative produced. According to the authors, assessment of the story-telling can also be done using other language evaluation criteria (Schneider et al., 2003, p. 6). We did not evaluate the narrative tasks according to these criteria, preferring a text quality scale to enable us to compare the descriptive and narrative task scores; Jacobs, and colleagues' *ESL Composition Profile* was adapted for our scale (Jacobs et al., 1981).

We examined the ENNI picture story battery, and reached the following conclusions. There are two sets of ENNI tasks (A and B). Each set of tasks has a different number of pictures; the A-1 and B-1 tasks have 5 pictures; the A-2 and B-2 tasks have 8 pictures; and the A-3 and B-3 tasks have 13 pictures. Among the three different ENNI tasks, we decided it would be better to choose those involving fewer pictures, to make the writing task clearer for the students. In order to identify the picture series best adapted to our project, we asked a teenager to pre-test various ENNI support materials. Certain lexical items (in ENNI tasks A3, B1, and B2) proved too challenging. The final selection used for our data collection is provided in Appendix K. For French (L1 and dominant language), we chose ENNI A2, which involves five pictures showing an elephant and a giraffe playing next to a swimming pool and having an accident. We reduced the number of pictures from eight to five. For Turkish (oral L1), we chose ENNI B3, in which a rabbit and a dog fly a balloon in the park. We also reduced the number of pictures from 13 to 5, to make the story comparable to the English and French narratives. For English (everyone's foreign language), we chose ENNI A1, which involves five pictures with an elephant and a giraffe playing ball next to a swimming pool; the words for the description seemed appropriate for this early L2/L3 level. In all three languages, the students were given eight minutes to write a narrative based on the five-picture story.

### 5.3.2 Inputlog keystroke logging software

Our main research question is to compare L1 and L2/L3 writing processes, so we used keystroke logging as our primary data collection method, since – as we saw in Chapter 3 – it is the current most effective method for capturing writing process data. All keystroke loggings and mouse movements produced by the students were recorded using *Inputlog*

7.1 (Leijten & Van Waes, 2006; 2013). As reported in Chapter 3, the *Inputlog* copy task was used to measure typing skill (Van Waes et al., 2020). This standardized typing speed measurement is performed in the copy task website online[8]. First, participants must fill in a questionnaire with personal information, and accept the terms and conditions. Then, they perform a series of sub-tasks.

For our data collection, technicians from both schools installed *Inputlog* and other necessary software on the ICT room computers. At both schools, installation of the software took more than a month, since the computers were not previously equipped with *Microsoft Office*, which is necessary for *Inputlog* to run properly; we were very fortunate that the school administrators financed and accepted the installation of the *Office*. After these installations, every computer was checked to make sure that *Inputlog* was working properly at both schools. Problems were solved with the help of the ICT technicians, to whom we are extremely grateful.

### 5.3.3 Questionnaires

A series of pre- and post-writing questionnaires (Appendices B through H) were used to obtain information relating to our students' linguistic profiles, writing profiles, language motivation and L1, L2 and L3 post-writing behaviour. All the questionnaires were written in French so that all of the learners could understand and respond to the questions.

Information related to the languages spoken at home was obtained through the *Linguistic Profile Questionnaire* (Appendix B). It was adapted from the Seine & Marne Primary project (Hilton et al., 2016), and consists of ten questions to be completed by the learners' parents. It was delivered to parents via the school along with the parental authorisation forms (Appendix A). We found that 17 students out of 30 are bilingual; 15 French-Turkish bilinguals, and two French-Arabic bilinguals. They are all true bilinguals, who have been using both languages since they were born, and speak both fluently.

The *Student Writing Profile Questionnaire* was adapted from Bosredon (2014) and Hilton's Seine & Marne Primary project (Hilton et al., 2016) to obtain information related to students' perceptions of their writing behaviour (Appendix C). The students' writing profile concerns general writing activities in French only, in and out of school. The questionnaire consists of nine questions reflecting writing habits, approaches to writing, types of texts written, preferred tools. To evaluate the students' perceived writing

[8] http://inputlog.ua.ac.be/WebSite/copytask/tasks.html

behaviour, answers were scored between -1 to 3; we gave the score -1 to negative answers; we gave the scores 1 to 3 to positive answers. And then we calculated the sum of these scores. We obtained an overall score for our students' perceptions of their perceived writing behaviour ranging from 4 to 23, with a median of 12.25.

The *Student Motivation for English* questionnaire was adapted from the VILLA project (Rast et al., 2014; adapted from Gardner, 1982), and used to reflect students' motivation for learning English as a foreign language (see Appendix D). Since our students are 14-15 year-olds, the original questionnaire was reduced to 16 items, so that these teenagers could understand and respond to the questions in optimal fashion. It is a 3-point likert scale questionnaire. Answers were scored between 1 to 3 points[9] to the responses from "I don't agree" to "I totally agree". Then we summed all the points for each response into one overall score representing each learner's level of motivation for learning English. The higher the score, the more motivated the learner is considered to be for learning English.

The *Student Motivation for Turkish* questionnaire is essentially the same instrument, adapted for L2 Turkish as a heritage language (Appendix E). It was used to probe the bilingual students' motivation to learn more about their home language, Turkish. The scoring of this questionnaire is the same as for *Motivation for English*. The overall score is interpreted in the same way: the higher the score, the more motivated the learner is for learning Turkish as a heritage language.

The *Post-writing Questionnaire* consists of nine questions related to our students' post-writing perceptions in narrative writing in French, English and Turkish (see Appendix F, G, and H respectively). It was given to them just after they wrote the narrative text based on the *Edmonton Narrative Norms Instrument* in each language. The questionnaires consist of nine items, with responses on a three-point likert scale, ranging from "I don't agree" to "I totally agree." The questions aim to collect the learners' perceptions of their writing performance, with a different questionnaire for each project language. The answers were tabulated into one overall score for each learner: the higher the score, the better the individual learner perceives and appreciates writing as a process. We will use the results from the post-writing questionnaires in correlations with writing process measures in the three project languages.

[9] 1-3 points likert style questions are given scores between 1 to 3.

### 5.3.4 Stimulated recall interviews

Stimulated recall is a retrospective think-aloud analysis. The learners are asked what they think during their pauses and revisions, just after the writing process finishes (Barkaoui, 2015; Lindgren, 2004; Révész et al., 2019; Sasaki, 2000; 2002). For this study, the participants were asked whether they wanted to participate in a stimulated recall interview session voluntarily. Seven students volunteered to participate in this qualitative sub-group. They were asked questions designed to help them recall what they did and thought during longer pauses and revisions in the writing process (DeSilva & Graham, 2015; Sasaki, 2000; 2002). We asked them these questions in front of a computer screen, where we showed them their typing behaviour using the replay function in *Inputlog*. At each pause longer than 2000 ms, we stopped the *Inputlog* file, and asked them why they hesitated at that point. The two-second pause threshold was chosen because other stimulated recall research on pause analysis uses this threshold. As we have seen (Chapter 3), Van Waes (2016) suggests that 2000 millisecond-pauses are related to meta-cognitive processes.

The stimulated recall protocol was reserved for the narrative writing task only. Our questions were chosen and adapted from those used in previous stimulated recall interviews (DeSilva & Graham, 2015; Sasaki, 2000; 2002), and questions in Akyel and Kamisli's post-writing questionnaire (1997; Appendix L in English and in French). The interviews were carried out in the language the students were most at ease with, which in most cases is French (in Appendix M we have provided the samples of French and English transcriptions of a monolingual learner's stimulated recall interview sessions and the Turkish transcriptions of a Turkish-French bilingual learner). With two of the bilingual learners, we spoke both in Turkish and in French during the interviews; they spoke French when they describing their writing behaviour, probably because they are more familiar with metalinguistic terms from French classes at school.

### 5.3.5 Pilot-testing the instruments and writing tasks

We pilot-tested the instruments and writing tasks with one Turkish-French bilingual student (16 years old). We chose a bilingual student in order to test all three writing tasks (in the three languages). We chose a 16-year old student to pilot the tests, because we already had a small subject pool, and did not want to use one of our 14-15-year-old learners for pilot testing. All phases of data collection were piloted in an individual session in the computer room with that pilot learner. *Inputlog* and the *copy tasks* in three languages worked well, without any problems. We gave the pilot writer ten minutes for writing on

the computer for both tasks for both languages. However, we found that this was too long for describing a static picture in L1/dominant French. So, we adapted the time for the descriptive and narrative tasks in the data collection according to this observation, allotting 4-5 minutes for the descriptive task, and 8 minutes for the narrative task. We also found that the pictures initially chosen for the writing tasks were not very stimulating, so we changed them, as described in the previous sections.

## 5.4 General data collection procedure

Data collection for this research project was carried out between November 2016 and March 2017. After the volunteer students applied to the project (in November 2016), via their school's principal, the parental authorisation form, completed by the volunteers' parents at home, and returned to the children's homeroom teacher.

Table 5.3 Data collection protocol

| ***session language*** | ***type of learners*** | ***task*** | ***allotted time*** |
|---|---|---|---|
| French | all learners (n=30) | *writing profile questionnaire* | 5 minutes |
| | | copy task in French | 7-8 minutes; *Inputlog* website |
| | | writing task 1 in French | 4 minutes; descriptive |
| | | writing task 2 in French | 8 minutes; narrative |
| | | *post-writing questionnaire* in French | 5 minutes |
| | | stimulated recall interviews for seven sub-group learners | 10 minutes for each sub-group learner |
| Turkish | Turkish-French bilingual learners (n=15) | *student motivation questionnaire* for Turkish learning | 5 minutes |
| | | Turkish copy task | 7-8 minutes; *Inputlog* website |
| | | writing task 1 in Turkish | 4 minutes; descriptive |
| | | writing task 2 in Turkish | 8 minutes; narrative |
| | | *post-writing questionnaire* in Turkish | 5 minutes |
| | | stimulated recall interviews for two sub-group learners | 10 minutes for each sub-group learner |
| English | all learners (n=30) | *student motivation questionnaire* on English learning | 5 minutes |
| | | copy task in English | 7-8 minutes; *Inputlog* website |
| | | writing task 1 in English | 4 minutes; descriptive |
| | | writing task 2 in English | 8 minutes; narrative |
| | | *post-writing questionnaire* in English | 5 minutes |
| | | stimulated recall interviews for seven sub-group learners | 10 minutes for each sub-group learner |

Keystroke logging data and retrospective recall data were collected in the ICT labs in our two participating schools. Table 5.3 gives an overview of the data collection procedure. We organized one session for each language (see Table 5.3). The first session was the French session. The participants were first given instruction about how to perform the typing and writing tasks (see Appendix I) and about how to use *Inputlog*, since it was a new software program for them (see Appendix J). Next, the students filled in (with pen and paper) a *Student Writing Profile Questionnaire* to assess their attitudes towards writing in general; this took about 5 minutes. They then performed the copy task in French on *Inputlog* (7-8 minutes) on the computer. After that, they performed the French descriptive task on *Inputlog* (4 minutes) followed by the French narrative task on *Inputlog* (8 minutes). After completing these L1/ school language writing tasks, they filled in the *Post-writing Questionnaire* (5 minutes, pen and paper) designed to collect their reactions to the narrative task.

As seen in Table 5.3, the Turkish and English sessions followed the same overall structure as the French session without the *Student Writing Profile Questionnaire* (completed only once). The students performed the Turkish copy task for the Turkish session and English copy task for the English session. The *Student Motivation Questionnaire* for Turkish was completed in the Turkish session, and the *Student Motivation Questionnaire* for English was filled in for the English session (5 minutes). Then the students performed the two writing tasks (descriptive, narrative) in each language, on individual computers.

Data collection with the students took one class 'hour' (50 minutes) per language, for a total of two lessons devoted to the process for the monolingual sub-group, and three lessons for the Turkish-French bilingual subjects. During each fifty-minute time period, the students completed the battery of tasks for one language. The volunteer students participating in the focus group spent 10 more minutes for each retrospective interview sessions. In order to limit fatigue or boredom, we spaced these sessions out over three weeks (or days). We organised the data collection sessions according to the availability of the students: the English and French sessions were four days apart in the same week, five days later the French-Turkish bilinguals completed the Turkish session. Instructions were given in French in the French and English sessions, since the students reported that they felt more comfortable with French when they were asked about their preferences for the language of the sessions. The instructions were given with a mix of French and Turkish in

the Turkish session with our Turkish-French bilingual learners, since they reported that either language could be used.

## 5.5 Projected data analyses

The aim of this doctoral project is to compare writing processes and text quality in L1, L2 and L3 text production in general, and look at whether typing skills and linguistic knowledge influence writing processes and text quality in particular. We will therefore use both quantitative and qualitative data analysis methods.

### 5.5.1 Pre-processing the keystroke-logging data

Before performing analyses on the *Inputlog* data, we tidied up the logged data using various filters in the *Pre-Process* module of *Inputlog*. First we applied time-filtering, to remove unnecessary pauses at the beginning and end of the logged data (those where the participants spent time after opening the software, before they start typing, or after they finish writing but haven't yet closed the software). These pauses do not reflect on-line writing processes, and they were removed by applying first-key and last-key automatic filtering in all tasks and languages. As a result, all the resulting filtered files started with the first letter typed and ended with the last letter typed by the student.

Next, we applied ID (Identification) filtering. After the *Inputlog* analyses, the data needs to be in a format that can be read correctly by our statistics software, SPSS. In preparing the data, we realized that some of the variable means (provided in *Inputlog*) were much higher than the others. Looking back at the *General Analysis* logged file for these learners, we found that three of them had logged their two writing task files into one file. This remains a bit of a mystery, since the students were instructed to stop *Inputlog* at the end of the first (descriptive) task; but apparently these students missed or didn't understand this instruction, and did not stop their *Inputlog* file between the two writing tasks. So, in these three cases, we segmented the two logged files by entering their start ID and end ID, which enabled us to separate the descriptive and narrative task files. After this manual segmentation process, we were able to carry out the automatic *Inputlog* analyses (General, Summary, Pause and Revision Analyses) on the ID filtered files.

### 5.5.2 Inputlog data analyses

As we saw in Chapter 4, it is easy to analyse five kinds of keystroke logging data with *Inputlog*; total composing time, numbers of words and characters per minute, number and location of pauses, and numbers and types of revisions. This information is obtained

automatically (or semi-automatically), with the General Analysis, Summary Analysis, Pause Analysis, Revision Analysis and Copy Task Analysis in *Inputlog*, which are run directly on the .idfx log file. All the analyses are logged in a separate XML file for each learner.

***General analysis***

The *General Analysis* output file is the logged file of the writing process which shows every character's logging time (the start and end time), pause time, pause location, deletions and insertions (see Figure 5.1). It also provides information on mouse movements and the source information if used. We used this output file to view the overall writing process i.e. whether a problem occurred during the logging of the whole writing process. We also used it to get information on pause time for the stimulated recall interviews. After processing the *General Analysis*, we noted down location of pause time over 2000 milliseconds to ask questions why a sub-group participant stopped there.

Figure 5.1 A sample of an *Inputlog* General Analysis output file in L3 (English) writing

| #Id | Event Type | Output | Position | DocLength | Character Production | StartTime | StartClock | EndTime | EndClock | ActionTime | PauseTime | PauseLocation | Int |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | focus | WordLog_ 10EN02_20170210132101 - Microsoft Word | | | 1373 | 11535 | 00:00:11 | 11535 | 00:00:11 | 0 | 0 | CHANGE | |
| 11 | keyboard | t | 0 | 1 | 1373 | 11535 | 00:00:11 | 11583 | 00:00:11 | 48 | 0 | BEFORE SENTENCES | |
| 12 | keyboard | h | 1 | 2 | 1374 | 11767 | 00:00:11 | 11807 | 00:00:11 | 40 | 232 | WITHIN WORDS | |
| 13 | keyboard | i | 2 | 3 | 1375 | 12423 | 00:00:12 | 12551 | 00:00:12 | 128 | 656 | WITHIN WORDS | |
| 14 | keyboard | s | 3 | 4 | 1376 | 12663 | 00:00:12 | 12823 | 00:00:12 | 160 | 240 | WITHIN WORDS | |
| 15 | keyboard | SPACE | 4 | 5 | 1377 | 12839 | 00:00:12 | 12887 | 00:00:12 | 48 | 176 | AFTER WORDS | |
| 16 | keyboard | i | 5 | 6 | 1378 | 13271 | 00:00:13 | 13343 | 00:00:13 | 72 | 432 | BEFORE WORDS | |
| 17 | keyboard | s | 6 | 7 | 1379 | 13431 | 00:00:13 | 13559 | 00:00:13 | 128 | 160 | WITHIN WORDS | |
| 18 | keyboard | SPACE | 7 | 8 | 1380 | 13719 | 00:00:13 | 13887 | 00:00:13 | 168 | 288 | AFTER WORDS | |
| 19 | keyboard | a | 8 | 9 | 1381 | 16047 | 00:00:16 | 16215 | 00:00:16 | 168 | 2328 | BEFORE WORDS | |
| 20 | keyboard | SPACE | 9 | 10 | 1382 | 16335 | 00:00:16 | 16487 | 00:00:16 | 152 | 288 | AFTER WORDS | |
| 21 | keyboard | p | 10 | 11 | 1383 | 30150 | 00:00:30 | 30238 | 00:00:30 | 88 | 13815 | BEFORE WORDS | |
| 22 | keyboard | i | 11 | 12 | 1384 | 30422 | 00:00:30 | 30534 | 00:00:30 | 112 | 272 | WITHIN WORDS | |
| 23 | keyboard | c | 12 | 13 | 1385 | 30846 | 00:00:30 | 30942 | 00:00:30 | 96 | 424 | WITHIN WORDS | |
| 24 | keyboard | t | 13 | 14 | 1386 | 31118 | 00:00:31 | 31159 | 00:00:31 | 41 | 272 | WITHIN WORDS | |
| 25 | keyboard | u | 14 | 15 | 1387 | 31486 | 00:00:31 | 31574 | 00:00:31 | 88 | 368 | WITHIN WORDS | |
| 26 | keyboard | r | 15 | 16 | 1388 | 31686 | 00:00:31 | 31710 | 00:00:31 | 24 | 200 | WITHIN WORDS | |
| 27 | keyboard | e | 16 | 17 | 1389 | 31870 | 00:00:31 | 32022 | 00:00:32 | 152 | 184 | WITHIN WORDS | |
| 28 | keyboard | , | 17 | 18 | 1390 | 32310 | 00:00:32 | 32390 | 00:00:32 | 80 | 440 | AFTER WORDS | |
| 29 | keyboard | BACK | 18 | 19 | 1391 | 33270 | 00:00:33 | 33366 | 00:00:33 | 96 | 960 | REVISION | |
| 30 | keyboard | SPACE | 17 | 18 | 1391 | 33614 | 00:00:33 | 33718 | 00:00:33 | 104 | 344 | AFTER WORDS | |
| 31 | keyboard | w | 18 | 19 | 1392 | 34318 | 00:00:34 | 34510 | 00:00:34 | 192 | 704 | BEFORE WORDS | |
| 32 | keyboard | i | 19 | 20 | 1393 | 34534 | 00:00:34 | 34631 | 00:00:34 | 97 | 216 | WITHIN WORDS | |

*Summary Analysis* gives process and product information related to the characters, words and sentences each writer produces; Figure 5.2 gives an example of a “Summary Analysis” output. “Process information” summarizes typing activities including spaces; “product information” excludes spaces. As Figure 5.2 shows, the *Summary Analysis* provides means, total numbers, standard deviations and medians.

*Summary Analysis* can also be used to extract “composing time”, "total words in main document" and “number of words and characters per minute”. “Total words in main document" refers to the total number of words produced (including deleted ones) during the composing process time (see Leijten & Van Waes, 2006; Van Waes & Leijten, 2015 for more detailed information). The *product/process ratio* refers to the "total number of characters in the final text divided by the total number of characters produced during the writing process". If the ratio is 1, this means that no revision took place during writing (Leijten & Van Waes, 2013, p. 364). We also used the *Summary Analysis* output file to get information on writing fluency measures, which I describe in the next section.

Figure 5.2 A sample of *Inputlog* Summary Analysis file

| **Process Information** | |
|---|---|
| **Keystrokes Produced in This Session** | |
| Total Keystrokes incl. Inserted and Replaced Characters in Main Document | 407 |
| - Total Non-Character Keys | 0 |
| - Characters Inserted | 0 |
| - Characters Replaced | 8 |
| - Total Typed (incl.spaces) | 399 |
| - Per Minute (incl. spaces) | 54.666 |
| - Total Typed (excl.spaces) | 321 |
| - Per Minute (excl.spaces) | 43.980 |
| **Words** | |
| Total Words in Main Document | 75 |
| Per Minute | 10.276 |
| Mean Word Length | 4.107 |
| Median Word Length | 4 |
| Standard Deviation Word Length | 2.318 |
| **Sentences** | |
| Total Sentences in Main Document | 1 |
| Mean Characters/Sentence | 399 |
| Median Characters/Sentence | 311 |
| Standard Deviation Characters/Sentence | |
| Mean Words/Sentence | 75 |
| Median Words/Sentence | 75 |
| Standard Deviation Words/Sentence | |
| **Paragraphs** | |

***Writing fluency analysis***

Writing fluency is determined by many variables, in interaction (see Van Waes & Leijten, 2015, for more detailed information). For our analyses, we choose the following fluency measures from *Inputlog* to reflect our students' writing fluency: *characters per minute, words per minute, pause-burst length.* All of these measures are calculated automatically

by *Inputlog*. *Characters per minute,* (including spaces) will be the main fluency indicator in our research. *Words per minute* is also an indicator of writing fluency, which has been used by many researchers, especially before the emergence of keystroke logging programs; we will include *words per minute*, in order to compare our results with these previous studies.

*Pause-bursts* are also important indicators of writing fluency. Writers produce text not in isolated words, or "complete sentences", but in chunks or bursts of text. As we saw in Chapter 1, "pause-bursts" (or "P-bursts") are defined as the segments of text produced between two long pauses (Chenoweth & Hayes, 2001). These can be measured in characters, or in words; in this study, we will use characters produced between two pauses of 2000ms or more.

***Pause Analysis***

Figure 5.3 presents some output variables from *Pause Analysis* for one writing sample in *Inputlog*. We choose to use four measures in *Inputlog* related to our learners' pause behaviour: pause time, and number of pauses, as well as two basic locations: between and within words.

Figure 5.3 A sample of *Inputlog* Pause Analysis output file

| | |
|---|---|
| **General Information** | |
| **Overview** | |
| Total Process Time | 00:07:17 |
| Total Pause Time | 00:06:11 |
| Total Pause Time (s) | 371.377 |
| Total Number of Pauses | 395 |
| Arithmetic Mean of Pauses (s) | 0.940 |
| Median Pause Time (s) | 0.416 |
| Geometric Mean of Pauses (s) | 0.522 |
| 95% CI Log-Transformed - Low Boundary (s) | 0.479 |
| 95% CI Log-Transformed - High Boundary (s) | 0.570 |
| Coefficient of Variation | 107.368 % |
| Standard Deviation (s) | 1.887 |
| Id of the First Key Event | 11 |
| Start Time of the First Key Event (ms) | 11535 |
| **Pause Location** | |
| **Within Words** | |
| Number of Pauses | 176 |
| Arithmetic Mean of Pauses (s) | 0.452 |
| Median Pause Time (s) | 0.328 |
| Geometric Mean of Pauses (s) | 0.368 |
| 95% CI Log-Transformed - Low Boundary (s) | 0.340 |

*Pause Time* refers to the time latency between pressing the previous and current keys; these are not generally normally distributed at the micro level (Van Waes, 2016). "Number of pauses" counts the number of times that a writer stopped writing. We chose 2000 milliseconds as a pause threshold for the number of pauses. We chose 200 milliseconds as a pause threshold level for the analysis of word-related pauses: within- and between-word,

assuming that we can get information on language differences in the lexical retrieval processes (Leijten et al., 2019).

***Revision analysis***

In *Revision Analysis*, the number of revisions, average number of revisions, and standard deviations are recorded in a separate XML file for each learner (Figure 5.4). We choose to analyse three measures in *Inputlog* related to our learners' revision behaviour: numbers of revisions, revision-burst (R-burst) length, and ratio. The number of revisions refers to the number of times a writer deleted or inserted a character in the text (see Van Waes & Leijten, 2015, p. 86 for more detailed information). R-bursts are identified as the numbers of additions and deletions (measured in characters) produced between two revisions (idem); we assume that the longer the R-burst length, the more productive the learner is at text production.

Figure 5.4 A sample of *Inputlog* Revision Analysis

| Type | #Revisions | Edits | Duration | Length | Chars | Chars without space | Words |
|---|---|---|---|---|---|---|---|
| All | 40 | 601 | 06:09.408 | 445 | 344 | 261 | 92 |
| Normal Production | 14 | 441 | 05:55.848 | 392 | 302 | 225 | 80 |
| Delete | 17 | 140 | 00:11.008 | 41 | 34 | 29 | 11 |
| Insert | 9 | 20 | 00:02.552 | 12 | 8 | 7 | 1 |
| **R-Bursts** | | | | | | | |
| Number Of R-Bursts | 14 | | | | | | |
| Mean RBurst Time (s) | 25.357 | | | | | | |
| Median R-Burst Time (s) | 21.955 | | | | | | |
| StDev R-Burst Time (s) | 19.333 | | | | | | |
| Mean R-Burst Chars | 21.571 | | | | | | |
| Median R-Burst Chars | 18.000 | | | | | | |
| StDev R-Burst Chars | 18.082 | | | | | | |

**Revisions**

| #Revision | Type | Content | Edits | Start | End | Duration | BeginPos | EndPos | Length | Chars | Chars without space | Words |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Normal Production | this·is·a·picture, | 19 | 3053 | 3073 | 00:20.855 | 0 | 18 | 18 | 14 | 11 | 4 |
| 1 | Delete | , | 1 | 3074 | 3074 | 00:00.096 | 18 | 17 | 1 | 0 | 0 | 0 |
| 0 | Normal Production | ·wich·da | 8 | 3075 | 3077 | 00:02.752 | 17 | 25 | 8 | 6 | 4 | 2 |
| 2 | Delete | a | 1 | 3078 | 3078 | 00:00.088 | 25 | 24 | 1 | 1 | 1 | 0 |

A sample of an *S-notation* file [10] can be viewed in Figure 5.5. In the *S-notation* file, '.' indicates a pause, square brackets [ ] indicate deletion; curly brackets { } indicate character addition/ insertion. The numbers after the characters or words show the number of revisions carried out, in chronological order. An example of character deletion and insertion is illustrated in the linear *S-notation* file of a bilingual student in Figure 5.5. For

[10] "For convenience, we use the word 'S-notation' both for the notation (representation) of the revisions made to a text, and/or the method for generating this representation fom a keystroke record. The name 'S-notation' was originally chosen because of the first letter S of the Swedish word for 'write' (skriva). An alternative and simpler term might be just 'revision trace'." (Kollberg & Severinson-Eklundh, 2002, p. 90)

instance, when she recognized that she misspelt the word *deals* – "*daels*" in the first line (underlined section), she deleted the "a" and inserted "e".

Figure 5.5 The *S-notation* file of a bilingual student in *Inputlog* (L2/L3-English writing session)

S-notation

this·is·a·picture[,]1|1·wich·d[a]2|2eals·with·pool.·[yhe]4|5{The·}6{·}5|6·scene·takes·place·[in]3|3|4in·the·swimming·pool.·we·can·see·two·carac[tér]7e|7eres:·a·girafe·and·a·elephante.·They·are·frands·.·they·are·plaing·with·bal[lo]13|14{.}14n.·But·elephant·[w]8s|8as·fall·the·bal[lo]11|12{,}12|13n,·a[n]9|10{d}10|11g·a·girafe·is·ga·ball.[·s]17|18{S}19{o}18|19o·girafe·[[dive·]15|15is·diving]16|16dive·on·the·swimming·pool·|17.[·[·]21|22]23|24{H}24{e}22|23he·is[·]20b|20we·And·[th]25|25a·elephant··is·smilin[·in·]26|26g·on·the·corner.·elephant·us·super·happy.·t.|21et·|9

We used these *S-notation* files to look at students' deletions and insertions in detail. In our analyses, we did not differentiate between deletions and insertions since *Inputlog* calculates them automatically together as revisions.

***Copy Task Analysis***

We performed *Copy Task Analysis* in *Inputlog* for the copy task logged files. As explained in Chapter 3, the *Copy Task Analysis* gives results related to typing speed measures, because this is the only analysis that should be carried out for copy task data (Van Waes et al., 2020). *Targeted Bigrams* calculates the typist's speed for high- and low-frequency bigrams (two-letter groups) in the *Inputlog* copy task sub-tasks (Section 5.3.2): the number of times the typist manages to type the "dk" bigram in 15 seconds; bigram speed and accuracy over 30 seconds for a sentence with short words; typing speed and accuracy for three sets of word-formation tasks with high-frequency bigrams (each set typed seven times); typing speed and accuracy for a word formation task with low-frequency bigrams, typed seven times; speed and accuracy for four consonant groups, typed once. The *Selected Component Bigrams* copy task analysis counts both high- and low-frequency bigrams in the sentence and word formation tasks. *High Frequency Bigrams* are the bigrams that are 30% most frequent in adjacency letter list based on lexical databases. *High Frequency Bigrams* that are found in the sentence and word formation tasks are evaluated in data analysis. All these output variables are measured as characters per minute and generated automatically by *Inputlog*. Although, as we see in Figure 5.6, there are some

other types of descriptive measures reported for the copy task (count reports of numbers of characters typed, mean interkey intervals, logmean trimmed; see Van Waes et al., 2020, p.5, for more detail), in our data analyses we take into account only the numbers of "characters per minute" for our three copy tasks, because these can be compared to the "characters per minute" reflected in the other keystroke logging measures we will use (writing fluency, revisions, revision-bursts and pause-bursts).

Figure 5.6 A sample output of *Inputlog* Copy Task Analysis

**Overall Synthesis of the InterKey Intervals (IKI)**

| | Count (targeted) | Count (not targeted) | Mean IKI | StdDev | Median | LogMean (trimmed) | Coef. of Variation | CPM |
|---|---|---|---|---|---|---|---|---|
| Targeted Bigrams | 722 | 47 | 322.9 | 364.7 | 237 | 243.7 | 80.4 % | 186 |
| High Frequency Bigrams | 504 | 20 | 333.7 | 347.7 | 248 | 282.1 | 50.8 % | 180 |
| Selected Components' Bigrams | 419 | 24 | 329.5 | 348.6 | 256 | 283.1 | 47.0 % | 182 |

**Components**

**Overall**

| | Count (targeted) | Count (not targeted) | Mean IKI | StdDev | Median | LogMean (trimmed) | Coef. of Variation | CPM | Absolute CPM |
|---|---|---|---|---|---|---|---|---|---|
| Typing speed | 136 | 4 | 104.5 | 46.0 | 100 | 93.5 | 53.1 % | 574 | 547 |
| Sentence | 47 | 6 | 259.1 | 166.3 | 208 | 227.7 | 49.5 % | 232 | 94 |
| Words 1 | 142 | 9 | 312.1 | 284.5 | 232 | 269.5 | 47.7 % | 192 | 86 |
| Words 2 | 140 | 9 | 337.3 | 494.6 | 252 | 277.2 | 46.8 % | 178 | 109 |
| Words 3 | 137 | 6 | 339.5 | 193.2 | 288 | 304.5 | 45.8 % | 177 | 93 |
| Words 4 | 102 | 11 | 516.2 | 443.5 | 352 | 406.4 | 72.0 % | 116 | 58 |
| Consonants | 18 | 2 | 888.8 | 632.5 | 677 | 679.3 | 89.7 % | 68 | 43 |

After we run all these *Inputlog* analyses for each learner, we get thousands of results reflecting writing processes at the micro level; however the measures retained for our research project will reflect typing speed, fluency, and pause and revision behaviour during writing. The keystroke logging data will be transferred to and analysed in SPSS, providing statistical analysis of differences and possible correlations between writing process measures across tasks and languages.

## 5.6 Our qualitative data

### 5.6.1 Analysis of stimulated recall interviews

The students' responses to the stimulated recall questions were transcribed and used as qualitative data to help us interpret the findings from the pre- and post-writing questionnaires, and the keystroke logging data. All the interview recall protocols obtained from seven volunteer subjects (16 interview protocols in total) were transcribed on the computer, using a non-dedicated word-processing program. Two of these 16 interview protocols from the same subject (a monolingual) and a sample from a Turkish-French bilingual learner are included in the Appendix M.

After transcription of the interviews, each transcription was segmented, according to our annotation scheme. Our annotation codes were developed through a bottom-up approach:

first we read through the transcriptions, to identify recurring themes as the learners talk about their reasons for pausing and revising, and the problems they encountered during their narrative text writing. Then, we made an overall list in which we identified five categories of reasons given by the learners, which then became codes for annotating the transcription files. After successive testing phases, our final coding scheme includes: vocabulary, spelling, grammar, pragmatics and referential reasons for hesitating and revising. Table 5.4 presents the codes, and the types of comments they refer to.

Table 5.4 Coding categories for the stimulated recall interviews

| **coding category** | **reasons given for hesitating** | **example from our recall corpus** |
|---|---|---|
| vocabulary | finding a correct word, trying to remember a word, lexical processing | *j'ai cherché comment dire 'jeter'* |
| spelling & punctuation | fixing typing mistakes, correcting spelling, punctuation, capitalization, etc. | *j'ai interverti les lettres* |
| grammar | comments concerning corrections or decisions involving inflectional morphology, syntax | *J'ai rajouté un 'e' à l'éléphant* |
| pragmatics | discourse organization, concern for reader or truth value of discourse | *Je suis en train de regarder comment formuler les phrases pour que ça fasse un beau recit.* |
| referential | the learner is commenting on the pictures, the story they tell, the task | *pour regarder bien à l'image ce qui s'est passé* |

The vocabulary category refers to hesitations that the learners relate to lexical encoding problems or improvements. The spelling and punctuation code is used for comments relating to typing mistakes, punctuation and correcting spelling mistakes. The grammar category refers to comments on correcting inflectional morphology or syntactic structures (word order, etc.). The pragmatics category refers to discourse organization and concern for the reader or the truth value of the text. And finally, the referential category is used to label comments that refer to what the pictures illustrate, or how the task was interpreted.

I transcribed and coded the stimulated recall interviews myself, as conscientiously as possible. With my supervisor, we decided on the best way of categorizing the reasons given by the learners, after a careful study of the corpus: for example, we wanted to separate “referential” remarks (where the learner is commenting on the pictures, the story they tell, etc.), from “pragmatic” remarks (where the learner is commenting on how to manage her discourse, what the reader needs to know, the structure of the text, etc.). If a reason is given, and then the learner repeats or reformulates the reason (for the same pause

or revision event), this was only coded once. We discussed any ambiguous items and decided on one code for each.

### 5.6.2 Assessment of text quality

In order to compare text quality in L1, L2 and L3 writing, we needed text assessment criteria that would be valid for all three languages in our study (Tillema, 2012). We used the *ESL Composition Profile* to reflect text quality in all three languages, since it has been one of the most widely-used text evaluation instruments for L2 writing; it has also been used to evaluate both L1 and L2 texts (Hirose & Sasaki, 1994). As explained in Section 2.6, the original *ESL Composition Profile* (Appendix N) is a 100-point grid assessing five components of L2 writing both analytically and holistically: content (30 points), organization (20 points), vocabulary (20 points), language use (25 points), and mechanics (5 points). We used the adapted version of the *Profile* (Uzawa, 1996), which reduces the 100-point scale to four points (Appendix O). We wanted to implement the two-step procedure, which rates text quality holistically, and then more analytically. Our text quality rating process involved one grid reflecting a holistic assessment of each text, and a second grid for the more detailed assessment; this procedure was used in all three project languages (with a different rating team for each language). The grid developed for our project is presented in Figure 5.7.

Figure 5.7 Our four-point-holistic and analytical Adapted Composition Profile Scale (adapted from Jacobs *et al.,* 1981)

| | **4** | **3** | **2** | **1** |
|---|---|---|---|---|
| **text quality: general category** (put a tick) | high | mid-high | mid-low | low |
| | | | | |

***more precisely***

| | **4** | **3** | **2** | **1** |
|---|---|---|---|---|
| **content** | very good | adequate | limited | not enough |
| **organisation of ideas** | clear | adequate | limited | not enough |
| **use of grammar, vocabulary and spelling** | very effective | adequate | limited | dominated by errors |

The first, "holistic" scale provides a general benchmark for overall text quality: high (4 points), mid-high (3 points), mid-low (2 points) and low (1 point). In this initial step, the raters were instructed to read through each learner text relatively quickly, and sort it into one of these four overall text quality categories, ticking the category in the first grid once all the texts are sorted (Uzawa, 1996). They were then instructed to move on to the second scale for each text, performing a more precise analysis of three more specific writing

criteria: content, organization of ideas, and language use (which includes grammar, vocabulary and spelling). For our purposes, we combined the original *ESL Composition Profile*'s three writing criteria (vocabulary, language use and mechanics) into one "language use" category.

### 5.6.3 Text quality assessment procedure

For our text quality assessments, we recruited two French, two English and two Turkish judges to rate each student's texts. For optimal coherence with the scope of our project, we wanted middle-school teachers to fulfil these roles; however, finding six raters was more difficult than initially anticipated. We asked two Turkish teachers who work for the ELCO Project to evaluate the bilingual students' texts in Turkish; they are both teachers with more than ten years of teaching experience, currently teaching Turkish in primary and middle schools in two cities near Lyon (both also taught English in high schools in Turkey before coming to France to work for ELCO). We contacted five middle schools in Lyon and Mâcon in October 2017, to look for French and English teachers who would be willing to evaluate the students' texts in French and English. From these five schools, we received only three responses: from one French and two English teachers. We therefore had to use a networking technique to find one more French teacher, with the help of one of the English raters (from a high school in Dijon).

A booklet was used (Appendix P) to present the evaluation procedure to the raters, with versions in French and English (for the Turkish teachers). We also attached the two sets of task pictures (the descriptive and narrative support material) to the booklet. The students' texts were presented individually in one booklet for each project language, with the *Adapted Composition Profile Scale* following each text. These booklets were printed on different colour paper for each rater (to facilitate processing), and in A5 format (for easier handling; one text per page). The booklets were mailed to the raters (due to their geographical dispersion) by regular post.

After the raters evaluated the texts, we performed a reliability test on the two raters' global text quality scores for each language. Table 5.5 presents Cronbach's Alpha, as a measure of the reliability of the global text quality scores given by both raters in each language. As the table shows, reliability was high in all three languages, ranging from in all the three languages was high, ranging from a low of .83 for the Turkish descriptive task, to .96 for the English descriptive task.

Table 5.5 Reliability of global text quality scores of both tasks in the three languages

| | French | | Turkish | | L3 English | |
|---|---|---|---|---|---|---|
| | descriptive | narrative | descriptive | narrative | descriptive | narrative |
| Cronbach's Alpha | .93 | .85 | .83 | .88 | .96 | .95 |

As the *alpha* values in Table 5.5 show, the English raters seemed to function in particularly similar fashion (.96 and .95 for the two tasks); the Turkish ratings were a little more divergent (.83 and .88); and the French results appear reliable for the descriptive task (Alpha of .93) but less so for the narrative task (.85). Although these values for the French raters fall into what is usually considered reliable for Cronbach's Alpha (Park, 2006), a more qualitative look at the French ratings showed that almost half of the French compositions (29 out of 60 texts) were sorted into a different text quality category by the two French raters. Since statistical analysis of this difference showed it to be significant ($t$=4.474, $df$=29, p<.000), we thought we needed a third opinion on the texts that were rated differently, according to Belanger's warning of the "potential inaccuracy of an individual opinion" in text quality ratings (1985, p. 88; cited in Uzawa, 1996, p.280).

We therefore set out to find a third French teacher, to evaluate those 29 texts which had been differently. We again sent emails to schools, and, despite a few setbacks (due to school holidays), we finally managed to find a French teacher who agreed to evaluate all 29 texts. In this step, we asked the third French rater to decide between the two scores that had been attributed by raters 1 and 2. We accepted the third rater's evaluation and used his ratings as the second rater's score. Overall, the text quality evaluation procedure took five months, proving to be far more complicated to organize than we had initially imagined. In fact, this took almost as long as setting up and implementing data collection with students at the schools.

Once we finally had reliable text quality scores for each text, we could proceed with our analyses. The two raters' global quality scores were summed into one overall text quality score for each task (8 points maximum). For the French text quality scores, we used the third rater's score in the sum. We also calculated the sum of both the descriptive and narrative global text quality scores, for an *overall text quality score* in each language, with a possible range of 4 to 16 points. We also tabulated the sub-scale analytical writing scores for each category -- content, organization and language use -- using the same procedure for

summing up the scores. All the data were imported into SPSS for statistical analyses, the results of which will be presented in Chapter 6.

# PART 2: RESULTS AND DISCUSSION

## Chapter 6: Results of study 1

This chapter presents the results of data collected from our 30 French middle-school students to compare their L1 and L2/L3 writing processes. As previously reported in the *Methodology* Section (5.1), the language profile of our 30 learners varies. Our monolingual sub-group has French as a first language (n=13); our bilingual subgroup has Turkish (n=15) or Arabic (n=2) as a first language, French as a second language, dominant in this educational context (since it's the language in which all of the students learned to read and write), and English as a foreign L3. In this chapter, we will be comparing the data from the bilingual and monolingual participants, contrasting writing in French (each child's first or second dominant school language), and writing in English as a foreign language (L2 or L3, respectively).

In this section, we report the results of analyses of the three kinds of data that we collected from these 30 middle-school students to answer our research questions: (1) keystroke logging data, (2) text quality scores, and (3) first term school averages in French and English. All quantitative data (keystroke loggings, first term school averages, and the text quality scores) were transferred to SPSS and analyzed statistically. We performed descriptive statistics, nonparametric comparative statistics, and two-tailed Spearman's rho correlation analyses.

First, we will look at the descriptive statistics for this data set, with tables presenting the medians, range, minimum and maximum values as well as means and standard deviations. Although much of our data is not normally distributed, we wanted to include the means to enable the comparability of our descriptive results with other keystroke logging studies that present parametric analyses.

In Section 6.1, we present typing speed results in L1/dominant French and L2/L3 English. In 6.2, we will compare the two writing tasks (descriptive and narrative tasks) in French, and in Section 6.3, in foreign-language English. In Section 6.4, we compare writing component variables in the two languages of production considered here, French, and English. We used the nonparametric Wilcoxon Signed Rank Test and Chi-square tests to make these comparisons, since our sample is too small (n=30) to perform ANOVAs, and

because much of the data is not normally distributed. We also calculated the pause and revision percentage rates per 100 words, in relation to each learner's text.

Finally, in Section 6.5, we present text quality results in French and English. Then in Section 6.6, we will look at correlations between the different measures obtained in the production tasks. Two-tailed Spearman's rho correlations were used, again due to low participant numbers, and the fact that most of the pause measures in the keystroke loggings are not normally distributed (see below).

## 6.1 Descriptive statistics for copy task (typing speed) results in the L1 and L2/L3

The copy task is designed as an individualized measure of typing speed, and this figure serves as a baseline for interpreting the keystroke logging data. Typing fluency may vary depending on task type (descriptive or narrative), so the copy task provides a more standardised typing fluency variable to measure the typing skill in each language.

Here we present the results of three types of copy task measures (see Chapter 3.3 for more complete descriptions of the tasks). The "Targeted Bigram" measure indicates the typist's speed and accuracy for specific high- and low-frequency bigrams (that are typed in isolation). "Selected Component Bigrams" indicates typing speed and accuracy for high- and low-frequency bigrams in the word formation and sentence typing subtasks; and "High Frequency Bigrams" indicates typing speed and accuracy for all high-frequency bigrams in all subtasks of the copy task. These copy task measures are expressed in characters per minute.

Table 6.1 Tests of normality for the copy task measures

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| L1/dominant French | | | | | | |
| Targeted Bigrams | .121 | 30 | .200*[11] | .968 | 30 | .497 |
| High Frequency Bigrams | .123 | 30 | .200* | .953 | 30 | .201 |
| Selected Component Bigrams | .101 | 30 | .200* | .964 | 30 | .386 |
| L2/L3 English | | | | | | |
| Targeted Bigrams | .082 | 30 | .200* | .980 | 30 | .835 |
| Selected Component Bigrams | .100 | 30 | .200* | .968 | 30 | .489 |
| High Frequency Bigrams | .094 | 30 | .200* | .966 | 30 | .429 |

[11] Significant values for the Kalmogorov-Smirnov test statistical begin at .200.

We ran normality tests to see whether the copy task results are normally distributed or not. Kolmogorov-Smirnov and Saphiro-Wilk's Tests, presented in Table 6.1, show that the copy task measures can be considered as normally distributed; the distributions of these variables can also be consulted in histogram format in Appendix Q.

Since the distribution for these measures can be considered normal, we ran a Paired Samples *t*-test to compare the two languages. Table 6.2 presents the copy task results for typing in French, and typing in L2/L3 English, as well as the *t*-test comparisons between the subjects' performance in the two languages. The means of all three typing speed measures (Targeted Bigrams, High Frequency Bigrams and Selected Component Bigrams) from the copy task are significantly higher in L1/dominant French than in L2/L3 English.

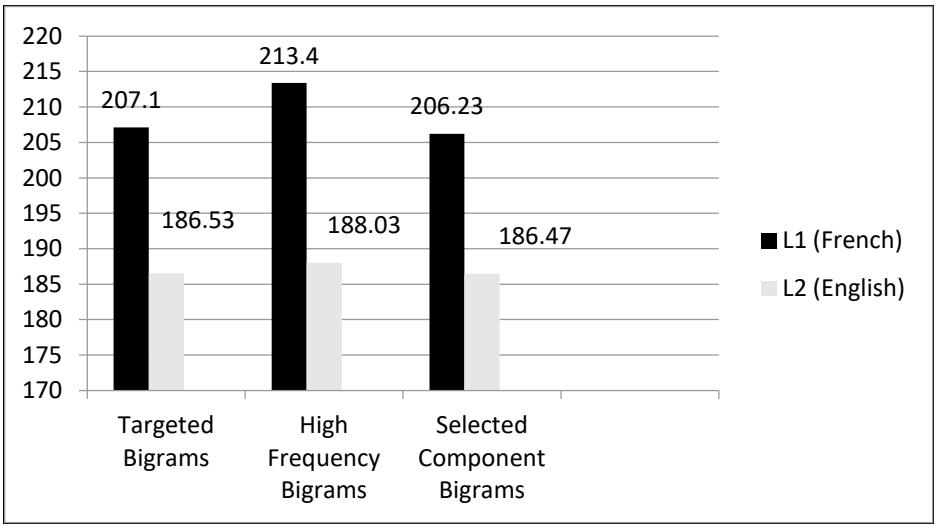
Table 6.2 Descriptive statistics for typing speed variables for the French and English copy tasks, in characters per minute (CPM); with Paired Samples t-test comparisons

| | **Mean** | **Range** | **Min** | **Max** | **Median** | **SD** | ***t*** | **p value** |
|---|---|---|---|---|---|---|---|---|
| Targeted bigrams (CPM) | | | | | | | | |
| French | 207.10 | 195 | 125 | 320 | 211.50 | 39.88 | 6.459 | .000** |
| L2/L3 English | 186.53 | 169 | 114 | 283 | 186.00 | 36.09 | | |
| High-frequency bigrams ( CPM) | | | | | | | | |
| French | 213.40 | 185 | 143 | 328 | 220.00 | 40.72 | 7.899 | .000** |
| L2/L3 English | 188.03 | 194 | 105 | 299 | 184.00 | 37.34 | | |
| Selected component bigrams (CPM) | | | | | | | | |
| French | 206.23 | 177 | 135 | 312 | 209.00 | 40.14 | 5.430 | .000** |
| L2/L3 English | 186.47 | 189 | 102 | 291 | 186.00 | 36.26 | | |

*Note.* N=30. SD= Standard deviation. *** p<.000

The *t*-test comparisons reported in columns 8-9 show that these differences are significant, with much faster typing of contextualized high-frequency bigrams in French (an average group rate of just over 213 characters per minute), compared with 188 in L2/L3 English. Targeted and Selected Component bigrams show a similar discrepancy, with about 207 CMP on average in French, and 186 in L2/L3 English for these measures of typing speed. It is interesting to note that the minimum and maximum values vary widely, with performance dropping to just over 100 characters per minute for the slowest typists in L2/L3 English. Figure 6.1 presents the same data in histogram form.

Figure 6.1 Mean characters per minute for the copy task measures in French and L2/L3




Although typing speed measures were found to be different in L1/dominant French and L2/L3 English, Spearman correlations show that these measures are all highly correlated within and between the two languages (Table 6.3). We found that within-language correlations (highlighted in light grey, ranging from $r = .89^{***}$ to $r = .99^{***}$) are higher than between-language correlations (highlighted in dark grey, ranging from $r = .78^{***}$ to $r = .88^{***}$). The correlations within the L2/L3 (ranging from $r = .89^{***}$ to $r = .98^{***}$) are very high, and similar to the correlations within the L1/dominant French (ranging from $r = .91^{***}$ to $r = .99^{***}$). This indicates that the same individual level of typing skill underlies both L1/dominant language and L2/L3 keyboard production, despite slower overall performance by our learners in L2/L3 English.

Table 6.3 Correlations between copy task measures (in CPM) in L1/dominant French and L2/L3 English

| | L1- SCB | L1-HFB | L1-TB | L2/L3-SCB | L2/L3-HFB |
|---|---|---|---|---|---|
| L1/dominant French | | | | | |
| High Frequency Bigrams | .986*** | | | | |
| Targeted Bigrams | .908*** | .913*** | | | |
| L2/L3 English | | | | | |
| Selected Component Bigrams | .809** | .806** | .882*** | | |
| High Frequency Bigrams | .806*** | .794*** | .858*** | .976*** | |
| Targeted Bigrams | .779*** | .788*** | .872*** | .931*** | .892*** |

*Note*. N=30. TB: Targeted Bigrams. SCB: Selected Component Bigrams. HFB: High Frequency Bigrams. CPM: Characters per minute. ** Correlation is significant at the .001 level. *** Correlation is significant at the .000 level. (2-tailed).

We will use the Selected Component Bigrams measure to represent the copy task in the remainder of this study. Firstly, because this measure reflects the subject's typing rate for both high- and low-frequency bigrams in the sentence and word-formation copy task

subtasks. It is also significantly correlated with the other copy task measures, as shown in Table 6.3: *r* =.99*** with High Frequency Bigrams, and *r* =.90*** with Targeted Bigrams. Finally, since we are comparing language production in writing in two or three languages, sentence and word-formation typing subtasks constitute a good comparison measure, reflecting both motor and linguistic aspects of writing in these languages.

## 6.2 Task differences in French writing

Table 6.4 presents the results for our writing process and productivity measures for the descriptive and narrative writing tasks in L1 French, as well as Wilcoxon-Signed Rank

Table 6.4 Descriptive statistics for the two writing tasks (descriptive and narrative) in L1/dominant language (French) writing and Wilcoxon-Signed Rank Tests, comparing the two tasks

| Line | Writing process and productivity measures | Task type | Median | Range | Min | Max | Mean | SD | *Z* | *p* value |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Process time | Descriptive | 4.58 | 4.11 | 2.41 | 6.12 | 5.08 | .810 | -4.78 | **.000*** ** |
| | | Narrative | 8.22 | 5.02 | 4.56 | 9.58 | 8.29 | 1.20 | | |
| 2 | Number of words | Descriptive | 88.50 | 77 | 47 | 124 | 87.13 | 24.04 | -4.32 | **.000*** ** |
| | | Narrative | 108.50 | 166 | 63 | 229 | 120.97 | 36.47 | | |
| 3 | Characters per minute | Descriptive | 95.71 | 105.61 | 35.43 | 141.04 | 94.98 | 26.85 | -3.30 | **.001** ** |
| | | Narrative | 78.31 | 73.36 | 56.45 | 129.81 | 82.077 | 19.58 | | |
| 4 | Words per minute | Descriptive | 17.81 | 21.78 | 5.85 | 27.63 | 17.63 | 4.67 | -3.50 | **.000*** ** |
| | | Narrative | 14.14 | 16.31 | 10.71 | 27.02 | 14.87 | 3.74 | | |
| 5 | P-Burst length | Descriptive | 25.75 | 48.78 | 8.92 | 57.70 | 29.73 | 13.30 | -2.42 | **.015* ** |
| | | Narrative | 23.36 | 38.12 | 12.97 | 51.09 | 25.29 | 9.23 | | |
| 6 | Pause time in minutes | Descriptive | 1.26 | 1.85 | .36 | 2.21 | 1.16 | .527 | -4.70 | **.000*** ** |
| | | Narrative | 2.06 | 3.38 | 1.12 | 4.10 | 2.14 | .794 | | |
| 7 | Number of pauses | Descriptive | 17.50 | 18 | 10 | 28 | 17.33 | 5.47 | - | **-** |
| | | Narrative | 26.00 | 23 | 18 | 41 | 27.53 | 6.02 | | |
| 8 | Number of within-word pauses | Descriptive | 187.50 | 235 | 78 | 313 | 190.20 | 61.10 | - | **-** |
| | | Narrative | 259.00 | 301 | 140 | 441 | 272.43 | 75.23 | | |
| 9 | Number of between-word pauses | Descriptive | 87.50 | 81 | 48 | 129 | 89.17 | 23.86 | - | **-** |
| | | Narrative | 120.50 | 171 | 63 | 234 | 126.13 | 36.82 | | |
| 10 | Number of revisions | Descriptive | 45.00 | 55 | 19 | 74 | 44.53 | 14.99 | - | **-** |
| | | Narrative | 78.00 | 120 | 18 | 138 | 77.33 | 27.45 | | |
| 11 | Product/ process Ratio | Descriptive | .892 | .396 | .578 | .974 | .883 | .081 | -1.99 | .052 |
| | | Narrative | .875 | .496 | .469 | .965 | .851 | .098 | | |
| 12 | R-Burst length | Descriptive | 16.13 | 31.13 | 6.50 | 37.63 | 17.89 | 7.72 | -668 | .504 |
| | | Narrative | 13.89 | 32.82 | 8.26 | 41.08 | 17.14 | 8.83 | | |

(m) p<.05; * p<.01; *** p<.000

Test comparisons between the two tasks with their statistical significance (last two columns). Analyses of the normality of distribution for each of these measures[12] reveal that about half of them are not normally distributed; we will therefore focus on median values in our presentation.

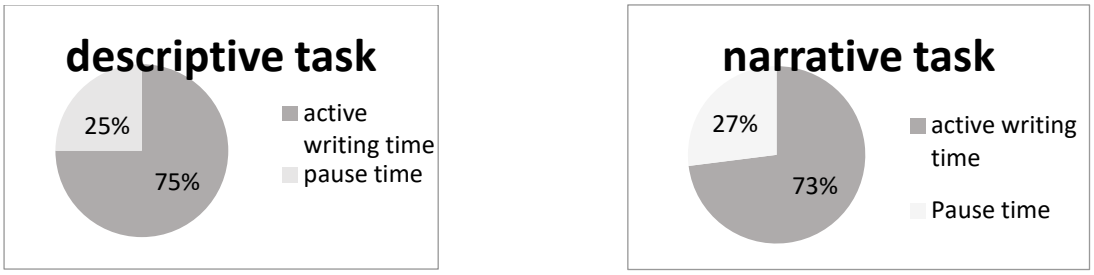
As we can see in this table (right-hand column), all of the writing process measures differ significantly between the two tasks, apart from the length of revision bursts and process/product ratio. Total process time is the time of writing (in minutes) starting with typing the first key and ending with typing the last key. Line 1 in Table 6.4 shows that the time spent on the two tasks was different. Since there was a difference in the time allotted for the two writing tasks (4 minutes for the descriptive task, and 8 for the narrative task), it is not surprising to discover a significant difference in total process time (line 1): the learners spent just over 4 minutes and 58 seconds on average on the descriptive task and 8 minutes 22 seconds on the narrative task. Line 2 shows that the learners wrote about 88 words in the shorter descriptive task (ranging from a minimum of 49 to a maximum of 124 words), and only about 30-40 words more (medium 108.5, mean 121) for the more complicated narrative task (which suggests that perhaps a certain amount of their writing time was devoted to sequencing their story). The cognitively challenging nature of the narrative task would also appear to be illustrated by the slower typing rate in the narrative task (line 3): with only 78.3 characters per minute (average 82), compared to 95 in the descriptive task. This difference in productivity is also reflected in Words per Minute (WPM, line 4): more than 17.5 WPM in the descriptive task, compared with just over 14 in the narrative task. The subjects also typed significantly more characters in their "pause bursts" (P-burst, between two pauses of 2000 ms or more) during the descriptive task (*Mdn* = 25.75) than the narrative task (*Mdn* = 23.36).

With the big time difference presented in line 1 – and the significant difference in numbers of words produced - it is obvious that the values in lines 6-10 (which are all linked to text length) will also be different. It is therefore important to look at the whole picture, including the percentage of pause time, when we compare the two tasks: we see slightly higher pausing time (27%) in the narrative task, compared with 25% in the descriptive task (Figure 6.2). Our results show that our young writers pause more in the narrative task, which requires the writer to narrate the story from the strip-story pictures. While the

[12] Complete tables for the Normality Tests can be consulted in Appendix R.

descriptive task enabled the learners to describe one-page static picture more quickly, the picture story required more reflection and discursive planning during writing.

Figure 6.2 Proportion of L1/dominant French writing time spent pausing, comparing tasks




We analysed different types of revision variables in our keystroke logging data, numbers of revision, R-burst length, and product/process ratio. Table 6.4 shows that our learners revised significantly more during the narrative task (*Mdn* = 78) than the descriptive task (*Mdn* = 45), in French. There is no difference in R-burst length between the two tasks (line 12). This means that our learners produced the same amount of text between revisions (deletions, additions) in both tasks. It is interesting to observe that revision behaviour in L1 text production does not exhibit the same task effects as pausing behaviour. Another interesting measure of revision behaviour - the product/process ratio, which is calculated automatically by *Inputlog* - divides the total number of characters in the final text by the total number of characters produced during the writing process; a ratio of 1 means that no revision took place during writing (as we saw in Section 5.5.2). Table 6.5 (line 11) shows that the slightly higher process/product ratio observed for the descriptive task is a marginal effect, with very slightly less revision in the narrative task – a relatively surprising (though only marginal) finding.

***Pause and revision rate results***

Since the raw numbers presented in Table 6.4 may not be particularly interesting for the measures related to text length (such as numbers of pauses, etc.). Table 6.5 shows rates of pause and revision behaviour (per 100 words) in the two tasks in L1 French writing. We calculated the pause and revision percentage rates per 100 words, in relation to each learner's text. In line 1, we found that the long pause rate (for pauses at our pause threshold of 2000 ms or more) was slightly higher in the narrative task (25 %) than in the descriptive task (21 %), as above. We also found that revision rate was significantly higher in the narrative task (65 %) than in the descriptive task (53 %) (see line 2 in Table 6.5).

Table 6.5 Mean pause and revision rates in the two tasks in French writing

| line | writing process measures | task type | rate (%) | *t* | p value |
|---|---|---|---|---|---|
| 1 | long pause rate | descriptive | 21 | -2.194 | **.036*** |
| | | narrative | 25 | | |
| 2 | revision rate | descriptive | 53 | -2.781 | **.009**** |
| | | narrative | 65 | | |

*Note.* Significant results are presented in bold type

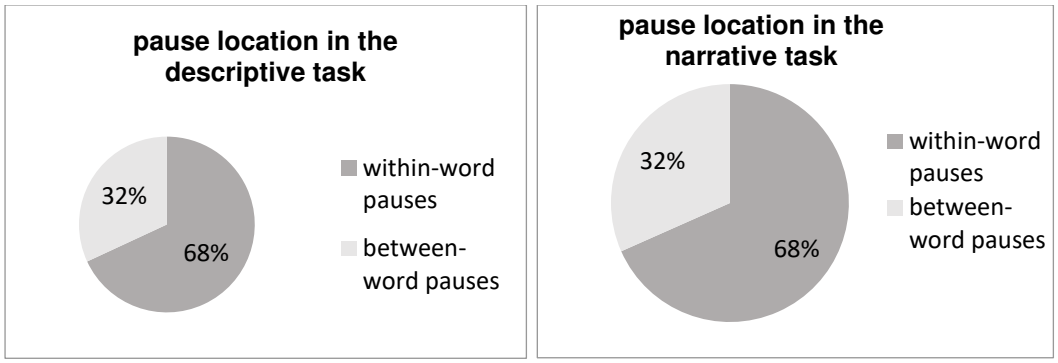
We ran a Chi-square test on the pause location observations reported in Table 6.6: within-word and between word pauses for both the descriptive and narrative tasks in French writing; these are the shorter, 200ms or more pauses. The test results do not show a difference between proportions of pauses at the two pause locations in descriptive and narrative writing in French: $\chi^2$ (20338, 1) = 0.15, p< .698.

Table 6.6 Location for short pauses in both French tasks

| | numbers of within-word pauses | numbers of between-word pauses |
|---|---|---|
| descriptive task | 5706 | 2675 |
| narrative task | 8173 | 3784 |

Figure 6.3 shows that the proportions of these two different types of hesitations are identical for both tasks. We also see in Figure 6.3 that our learners' within-word pauses (68 %) are more than double the number of between-word pauses (32 %).

Figure 6.3 Proportion of pause location in French writing, comparing tasks




## 6.3 Task differences in L2/L3 (English) writing

Table 6.7 presents the results for our writing process and productivity measures for the two descriptive and narrative writing tasks in L2/L3 English. Analyses of the normality of distribution for each of these measures (see the tables of Normality Tests in Appendix S) reveal that about half of them are non-normally distributed; we therefore focused on

median values in our summary, and used the non-parametric Related Samples Wilcoxon Signed Rank Test to compare the different writing process measures obtained in our two different tasks in L2/L3 English writing. The results of these tests are presented in the last two columns of Table 6.7.

Table 6.7 Descriptive statistics for the descriptive and narrative tasks in L2/L3 English writing, and comparisons (column 10, Wilcoxon)

| line | Writing process and productivity measures | Task type | Median | Range | Min | Max | Mean | SD | *Z* value | sig. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Process time | Descriptive | 5.43 | 5.26 | 3.35 | 8.21 | 5.52 | 1.10 | **-2.79** | **.005*** |
| | | Narrative | 7.27 | 10.22 | 3.50 | 13.32 | 7.12 | 2.51 | | |
| 2 | Number of words | Descriptive | 54.50 | 85 | 8 | 93 | 56.63 | 22.24 | **-2.942** | **.003*** |
| | | Narrative | 65.50 | 97 | 26 | 123 | 70.10 | 26.26 | | |
| 3 | Characters per minute | Descriptive | 47.64 | 83.70 | 9.88 | 93.58 | 49.65 | 17.97 | -.278 | .781 |
| | | Narrative | 50.08 | 61.99 | 25.25 | 87.24 | 49.74 | 14.09 | | |
| 4 | Words per minute | Descriptive | 9.59 | 17.40 | 1.72 | 19.12 | 9.93 | 3.54 | -.175 | .861 |
| | | Narrative | 10.01 | 12.77 | 4.85 | 17.62 | 9.75 | 2.81 | | |
| 5 | P-Burst length | Descriptive | 12.35 | 19.01 | 5.16 | 24.17 | 12.33 | 5.24 | -.319 | .750 |
| | | Narrative | 11.46 | 18.56 | 4.71 | 23.27 | 12.24 | 4.22 | | |
| 6 | Pause time in minutes | Descriptive | 2.31 | 4.15 | 1.13 | 5.28 | 2.53 | 1.02 | -1.957 | .050m |
| | | Narrative | 3.17 | 5.17 | 1.13 | 6.30 | 3.18 | 1.27 | | |
| 7 | Number of long pauses | Descriptive | 25.00 | 30 | 6 | 36 | 24.80 | 6.55 | - | - |
| | | Narrative | 30.00 | 47 | 11 | 58 | 31.20 | 11.52 | | |
| 8 | Number of within-word pauses | Descriptive | 107.50 | 217 | 24 | 241 | 124.27 | 52.39 | - | - |
| | | Narrative | 136.50 | 234 | 55 | 289 | 154.33 | 65.37 | | |
| 9 | Number of between-word pauses | Descriptive | 59.00 | 86 | 7 | 93 | 61.03 | 22.33 | - | - |
| | | Narrative | 65.00 | 111 | 11 | 122 | 70.13 | 27.81 | | |
| 10 | Number of revisions | Descriptive | 39.50 | 78 | 3 | 81 | 41.80 | 19.61 | - | - |
| | | Narrative | 43.50 | 96 | 19 | 115 | 51.50 | 28.25 | | |
| 11 | R-Burst length | Descriptive | 10.14 | 17.00 | 6.40 | 23.40 | 11.56 | 4.38 | -1.296 | .195 |
| | | Narrative | 11.62 | 19.50 | 4.50 | 24.00 | 12.91 | 5.14 | | |
| 12 | Product-process ratio | Descriptive | .821 | .419 | .559 | .978 | .812 | .103 | -1.481 | .139 |
| | | Narrative | .857 | .298 | .644 | .942 | .836 | .078 | | |

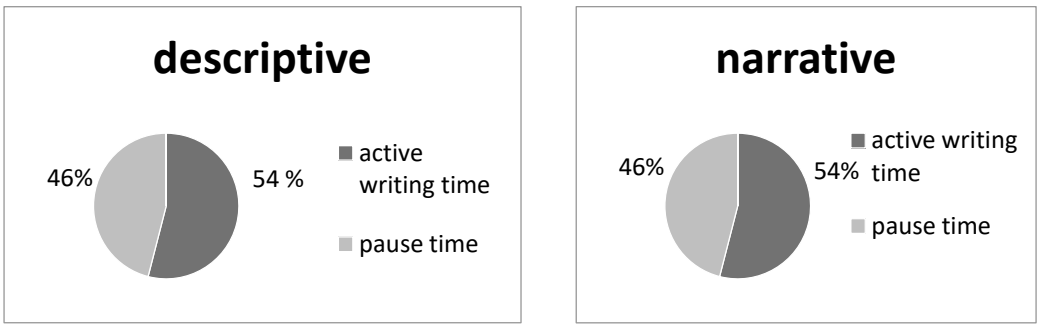
*The significance level is .01. Significant results are in bold type.

As we can see in this table (right-hand column), not all but some of the measures of writing process and productivity differ significantly between the two English tasks. In line 1, we see that on average our students spent more total process time on composing the narrrative text than the descriptive text in L2/L3 English (Table 6.7). The difference in total process time between the two tasks is statistically significant ($p<.005$).

Second, our students wrote more words in the narrative (*Mdn* = 65.50) than the descriptive task (*Mdn* = 54.50), since they were given more time (line 2, Table 6.7). The difference in total words produced betwen the two tasks is significant (p<.003). Lines 3-5 in Table 6.7 show the descriptive statistics for the L2/L3 English writing fluency measures, with no fluency differences in characters per minute, words per minute, or P-bursts between the two tasks.

Table 6.7 (lines 6-9) shows descriptive statistics of pause behaviour in L2/L3 English writing. Our participants' pause behaviour varies according to two tasks in L2/L3 writing. First, our learners paused an average of 2 minutes 31 seconds in their total process time (*Mdn* = 5'43") in the descriptive task. In the narrative task, our learners paused an average of 3'17" in their total process time (*Mdn* = 7'27"). The proportion of pause time to the total process time is the same in both the descriptive and narrative tasks (just under half of total composing time), as illustrated in Figure 6.4.

Figure 6.4 Proportion of pause time to process time in the two writing tasks in L2/L3 English




In Table 6.7, lines 10-12 show descriptive statistics of our participants' revision behaviour in the narrative and the descriptive task in English. There is no significant difference in Revision-burst length between the two writing tasks, and the product/process ratio appears to be higher in the narrative task (*Mdn* = .857) than the descriptive task (*Mdn* = .821), but this difference is not significant (line 11 in Table 6.6).

***Pause and revision rates***

Table 6.8 shows the rates of pause and revision behaviour in the two tasks in L2/L3 English writing. Pause and revision rates are expressed as the numbers of long pauses or revisions per 100 words; and Paired Samples t-tests were used to compare these rates. Contrary to the results of L1/dominant French task comparisons (which showed more pausing during the

narrative task, Table 6.5), we found that pause and revision rates were not different between the descriptive and the narrative tasks in L2/L3 English.

Table 6.8 Mean pause and revision rates in the two tasks in L2/L3 writing

| writing process measures | task type | rate (%) | *t* | sig. |
|---|---|---|---|---|
| long pause rate | descriptive | 50 | .797 | .432 |
| | narrative | 47 | | |
| revision rate | descriptive | 78 | .432 | .669 |
| | narrative | 75 | | |

*Note.* Mean total words in the descriptive text=56.63; in the narrative text=70.10.

We ran a Chi-square test on the pause location observations reported in Table 6.9: within-word and between word pauses (at 200 ms or more pauses) for both the descriptive and narrative tasks in L2/L3 English writing. The test results show a marginal difference between the descriptive and narrative writing in L2/L3 English: $\chi^2$ (12293, 1) = 3.93, p< .047.

Table 6.9 Numbers of within- and between word pauses for both L2/L3 tasks

| | total numbers of within-word pauses | total numbers of between-word pauses |
|---|---|---|
| descriptive task | 3728 | 1831 |
| narrative task | 4630 | 2104 |

The proportions shown in Table 6.9 of pause locations in the two writing tasks are only *slightly* (marginally) different: post hoc analyses show that the slight tendency towards more within-word pauses for the narrative task is hardly worth mentioning in L2/L3 English writing (+0.75, <1).

## 6.4 Comparing the French and English writing tasks

Table 6.10 shows descriptive statistics for and comparisons between writing process and productivity scores for both the descriptive and narrative tasks in L1/dominant French and L2/L3 English. The final column in Table 6.10 gives the statistical significance of L1-L2/L3 comparisons for some of the measures (with Wilcoxon Signed Rank tests performed on frequency data in column 10).

As we can see in column 11 of Table 6.10, all values observed for writing in French, and writing in English differ, apart from the product/process ratio reported in line 7 (and a marginal difference in process time for the narrative task). Line 1 shows that our learners spent more time in descriptive writing in L2/L3 English than in French. In line with previous findings on L2/L3 production, our learners paused significantly more in L2/L3 writing during both tasks (line 2), with twice as much pausing time in the L2/L3 descriptive as in L1/dominant French.

Table 6.10 Descriptive statistics for the two writing tasks (descriptive and narrative) in French and L2/L3 English writing, with the statistical significance of between-language comparisons (column 11)

| line | Writing process and productivity measures | task type | Median | Range | Min | Max | Mean | SD | Z value | p value |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Process time | FR Descriptive | 4.58 | 3.71 | 2.41 | 6.12 | 4.68 | .810 | **-3.291** | **.001**** |
| | | EN Descriptive | 5.43 | 4.86 | 3.35 | 8.21 | 5.52 | 1.10 | | |
| | | FR Narrative | 8.22 | 5.02 | 4.56 | 9.58 | 8.29 | 1.20 | -2.067 | .039m |
| | | EN Narrative | 7.27 | 9.82 | 3.50 | 13.32 | 7.12 | 2.51 | | |
| 2 | Pause time in minutes | FR Descriptive | 1.26 | 1.85 | .36 | 2.21 | 1.16 | .527 | **-4.762** | **.000***** |
| | | EN Descriptive | 2.31 | 4.15 | 1.13 | 5.28 | 2.53 | 1.02 | | |
| | | FR Narrative | 2.06 | 2.98 | 1.12 | 4.10 | 2.14 | .794 | **-3.054** | **.002**** |
| | | EN Narrative | 3.17 | 5.17 | 1.13 | 6.30 | 3.18 | 1.27 | | |
| 3 | Characters per minute | FR Descriptive | 95.71 | 105.61 | 35.43 | 141.04 | 94.98 | 26.85 | **-4.741** | **.000***** |
| | | EN Descriptive | 47.64 | 83.70 | 9.88 | 93.58 | 49.65 | 17.97 | | |
| | | FR Narrative | 78.31 | 73.36 | 56.45 | 129.81 | 82.077 | 19.58 | **-4.762** | **.000***** |
| | | EN Narrative | 50.08 | 61.99 | 25.25 | 87.24 | 49.74 | 14.09 | | |
| 4 | Words per minute | FR Descriptive | 17.81 | 21.78 | 5.85 | 27.63 | 17.63 | 4.67 | **-4.515** | **.000***** |
| | | EN Descriptive | 9.59 | 17.40 | 1.72 | 19.12 | 9.93 | 3.54 | | |
| | | FR Narrative | 14.14 | 16.31 | 10.71 | 27.02 | 14.87 | 3.74 | **-4.638** | **.000***** |
| | | EN Narrative | 10.01 | 12.77 | 4.85 | 17.62 | 9.75 | 2.81 | | |
| 5 | P-burst length | FR Descriptive | 25.75 | 48.78 | 8.92 | 57.70 | 29.73 | 13.30 | **-4.782** | **.000***** |
| | | EN Descriptive | 12.35 | 19.01 | 5.16 | 24.17 | 12.33 | 5.24 | | |
| | | FR Narrative | 23.36 | 38.12 | 12.97 | 51.09 | 25.29 | 9.23 | **-4.782** | **.000***** |
| | | EN Narrative | 11.46 | 18.56 | 4.71 | 23.27 | 12.24 | 4.22 | | |
| 6 | R-burst length | FR Descriptive | 16.13 | 31.13 | 6.50 | 37.63 | 17.89 | 7.72 | **-4.206** | **.000***** |
| | | EN Descriptive | 10.14 | 17.00 | 6.40 | 23.40 | 11.56 | 4.38 | | |
| | | FR Narrative | 13.89 | 32.82 | 8.26 | 41.08 | 17.14 | 8.83 | **-2.756** | **.006**** |
| | | EN Narrative | 11.62 | 19.50 | 4.50 | 24.00 | 12.91 | 5.14 | | |
| 7 | Revision Ratio | FR Descriptive | .892 | .396 | .578 | .974 | .883 | .081 | **-2.972** | **.003**** |
| | | EN Descriptive | .821 | .419 | .559 | .978 | .812 | .103 | | |
| | | FR Narrative | .875 | .496 | .469 | .965 | .851 | .098 | -.905 | .365 |
| | | EN Narrative | .857 | .298 | .644 | .942 | .836 | .078 | | |

*Note*. m=p < 0.05, *p < 0.01, ** p<.001, *** p<.000

The fluency measures in lines 3-5 also show much slower text production in English than in French, with an average of 96 characters per minute in French and 48 characters per minute in English, 18 words per minute in French, and 10 words per minute in English (line 4) in the descriptive tasks. In the narrative task, our participants wrote an average of 78 characters per minute in French and 50 characters per minute in English, an average of 14 words per minute in French (ranging from 10.71 to 27.02 wpm), and 10 words per minute in English (with a range of 4.85 to 17.62). P-burst length (line 5) also differs significantly between French and English, with longer runs of text between pauses in French than in English, both in the descriptive and narrative tasks.

Lines 6-7 in Table 6.10 show the results for revision behaviour. Line 6 shows that our learners' R-burst length is significantly longer in French than in English, both in the descriptive and the narrative tasks. Line 7 shows a higher product/process ratio in the French

descriptive task than in English; no significant difference was found for the product/process ratio in the French and English the narrative tasks.

Table 6.11 presents the frequency of pauses at our two basic locations – between- and within-word pauses – with both writing tasks combined. The proportions of pauses at these two locations do not differ between French and L2/L3 English: $\chi^2$ (32631, 1) = 0.21, p= .646.

Table 6.11 Chi-square results for comparisons of pause locations in French and L2/L3 writing

| | total number of within-word pauses, both texts | total number of between-word pauses, both texts |
|---|---|---|
| French writing | 13,879 | 6,459 |
| English writing | 8,358 | 3,935 |

We actually expected more within-word pauses for L2/L3 writing, in line with previous research (when pause threshold is 30 ms: Leijten et al., 2019). However, the similarity in pause location in L1/ dominant French and L2/L3 writing may well be due to the complex nature of French grammatical orthography, which surely generates more within-word pausing by native-speakers than, say, English.

Table 6.12 presents the results for pause and revision rates (per 100 words) in French and English per 100 words for the two writing tasks combined. Both pausing and revision rates are significantly different in the two production languages.

Table 6.12 Mean pause and revision rates (per 100 words) in French and English writing

| **writing process measures** | **language** | **rate (%)** | ***t*** | **p value** |
|---|---|---|---|---|
| long pause rate | L1 | 23 | **-11.600** | **.000*** ** |
| | L2/L3 | 49 | | |
| revision rate | L1 | 59 | **-4.197** | **.000*** ** |
| | L2/L3 | 76 | | |

*Note*. *** p<.000. Combined tasks (descriptive and narrative).

We see in Table 6.12 that our learners paused more than twice as much in L2/L3 English (49% of writing time) as in French (23%). This finding is in line with much L2 writing research (e.g. Breuer, 2019; Lindgren, 2004; Schoonen et al., 2003; Tiryakioglu et al., 2019). We also found that revision rates were significantly higher in L2/L3 English (76%) than in L1/dominant French (59%), a result in line with previous research (e.g. Breuer, 2019; Stevenson et al., 2006; Tiryakioglu et al., 2019).

## 6.5 Results of text quality scores in French and L2/L3 English

In this section, we present the results from our two different text quality measures: the holistic score, and the more detailed analytical assessment. Table 6.13 presents the descriptive statistics for and comparisons between the holistic text quality scores attributed by our text quality evaluators in French and English. As explained in Section 5.5.7, the maximum possible score for each text is 8 (sum of the two raters' scores for each task: 4 points each), and the maximum combined holistic text quality score for each language therefore equals 16. We found not statistical difference between the text quality scores given by our raters for the French and L2/L3 English texts, which is a surprising result[13].

Table 6.13 Descriptive statistics and comparisons for holistic text quality scores

| | Mean | SD | Median | Range | Min | Max | *t* | *p* |
|---|---|---|---|---|---|---|---|---|
| French | | | | | | | | |
| Descriptive task | 4.07 | 1.78 | 4.00 | 6 | 2 | 8 | -1.266 | .216 |
| Narrative task | 4.07 | 1.99 | 4.00 | 6 | 2 | 8 | | |
| English | | | | | | | | |
| Descriptive task | 4.40 | 2.24 | 4.00 | 6 | 2 | 8 | .088 | .931 |
| Narrative task | 4.37 | 2.16 | 4.00 | 6 | 2 | 8 | | |
| Overall English holistic score | 8.77 | 3.87 | 8.00 | 11 | 4 | 15 | -.421 | .677 |
| Overall French holistic score | 8.14 | 3.48 | 8.00 | 12 | 4 | 16 | | |

The paired Samples t-test results reported in Table 6.13 show that our participants received equivalent text quality scores in the descriptive ($M$ = 4.07, $SD$ = 1.78) and narrative tasks ($M$ = 4.07, $SD$ = 1.99) in French, and in the descriptive ($M$ = 4.40, $SD$ = 1.24) and narrative tasks ($M$ = 4.37, $SD$ = 2.16) in English.

Table 6.14 presents the descriptive statistics for and comparisons between our more analytical text quality scores, which feature three writing categories: content, organization and language use. In this second evaluation phase, the raters assessed text quality in each of the three categories, using 4-point criteria: very good/very effective/clear (4 pts), adequate (3 pts), limited (2 pts) and inadequate/dominated by errors (1pt).

[13] We ran both parametric and nonparametric tests since most of the measures were normally distributed. Both types of tests found similar results. Therefore, we chose to present parametric test results.

Table 6.14 Descriptive statistics for the analytical writing scores in French and English writing

| | French | | L2/L3 English | | | |
|---|---|---|---|---|---|---|
| | **Mean** | **SD** | **Mean** | **SD** | ***t*** | **p** |
| Descriptive task | | | | | | |
| Content | 5.40 | 1.50 | 5.07 | 2.20 | .990 | .330 |
| Organization | 4.27 | 1.60 | 5.03 | 2.37 | 2.053 | .049m |
| Language use | 4.00 | 1.60 | 4.20 | 2.15 | -.641 | .527 |
| Descriptive overall analytical score | 13.67 | 3.72 | 14.30 | 6.60 | -.729 | .472 |
| Narrative task | | | | | | |
| Content | 4.63 | 1.65 | 4.53 | 2.13 | .264 | .794 |
| Organization | 4.63 | 1.47 | 4.47 | 2.19 | -.409 | .685 |
| Language use | 4.13 | 1.87 | 3.90 | 1.88 | .720 | .477 |
| Narrative overall analytical score | 13.40 | 4.02 | 12.90 | 6.07 | .500 | .621 |
| Overall analytical score | 27.07 | 7.22 | 27.20 | 11.08 | -.092 | .927 |

m= marginal difference

The last two columns of Table 6.14 show no significant difference in the analytic text quality scores attributed to the French and English texts (by task, or combined). The content category scores do not differ between the French and English descriptive tasks, or the narrative tasks; nor do the language use scores, surprisingly. There is a marginal difference in the text organization scores, with slightly higher scores given for organization in the L2/L3 texts ($M$ = 5.03, compared to $M$ = 4.27, for French). There is no difference in the descriptive analytic text quality score between the two tasks or languages.

In order to look at if the text quality instrument works efficiently, we ran one-tailed Spearman's rho correlations between the holistic and analytical text quality scores in French and L2/L3 English. Table 6.15 shows that it works well and performs similarly in both languages. Correlation results show that there is a positive significant correlation (ranging from $r = .56^{**}$ to $r = .99^{***}$) between all analytical text quality scores within and between the languages, with effect sizes that are between medium and high. We also found that within-language correlations (highlighted in light grey, ranging from $r = .65^{**}$ to $r = .99^{***}$) are higher than between-language correlations (highlighted in dark grey, ranging from $r = .56^{**}$ to $r = .75^{**}$).

Table 6.15 Correlations between text quality scores in French and L2/L3 English writing

| | Fr Content | Fr Organization | Fr Language use | Fr Text Quality | En Content | En Organization | En Language use |
|---|---|---|---|---|---|---|---|
| Fr Organization | .727** | | | | | | |
| Fr Language use | .651** | .664** | | | | | |
| Fr Text quality | .884*** | .895*** | .861*** | | | | |
| En Content | .623** | .606** | .736** | .752** | | | |
| En Organization | .558** | .559** | .686** | .695** | .969*** | | |
| En Language use | .593** | .561** | .729** | .725** | .966*** | .960*** | |
| En Text quality | .595** | .564** | .730** | .724** | .988*** | .983*** | .986*** |

** Correlation is significant at the 0.001 level (one-tailed). *** Correlation is significant at the 0.000 level. text quality= overall analytical text quality score

The correlations between the English scores (which range from $r = .96^{***}$ to $r = .99^{***}$) are stronger than the correlations between the French text-quality scores (which range from $r = .65^{**}$ to $r = .89^{***}$). This might be explained by the higher inter-rater reliability we found for the English evaluations than for the French evaluations (Methodology Section 5.5.8).

## 6.6 Correlations between measures in French and L2/L3 English

One of our research questions is to look at whether linguistic knowledge and typing speed are related to the writing process and text quality measures for our 30 9th grade learners in French and L2/L3 English. This section presents the results of one-tailed Spearman's rho correlations to assess the relationship between linguistic knowledge (first-quarter school marks for French and English), typing skills (the French and English copy tasks), text quality (overall holistic scores) and writing process measures (fluency, pause and revision behaviour) in the narrative task both in French and English. We chose the narrative task to correlate the learner characteristics, writing processes, and text quality, because the students generated more text in narrative than descriptive writing (due to time factors, as well as the nature of the task). In the correlation tables below, we have excluded writing process measures that were not correlated with linguistic knowledge, typing speed or text quality.

### 6.6.1 Results of linguistic knowledge in French and L2/L3 English

Our 9th grade learners' linguistic knowledge was measured with their first-quarter school marks for English and French. The score is the average of various written and oral exercises and tests performed during the first three months of the school year. We need to point out that these quarterly averages are not based on standardized testing, and certainly reflect different grading practices for French (which deals with literary knowledge, as well as writing skill),

and English (taught and graded as a foreign language). Descriptive analyses show that our learners' mean scores in French are slightly higher than in English (Table 6.16). However, a paired Samples t-test shows that the difference in exam scores between the languages is only very marginal (FR: $M$ = 13.21, $SD$ = 3.22; EN: $M$ = 12.24, $SD$ = 3.87, $t$ (29) = 1.96, $p$ = .059).

Table 6.16 Descriptive statistics for first-quarter school marks (French and English)

| first-quarter average score | Mean | SD | Median | Range | Min | Max |
|---|---|---|---|---|---|---|
| French | 13.21 | 3.22 | 13.48 | 12.15 | 6.14 | 18.29 |
| English | 12.24 | 3.87 | 12.05 | 15.97 | 3.51 | 19.48 |

*Note. SD* (Standard Deviation). The grading scale is a twenty-point system in France (minimum 0, maximum 20).

### 6.6.2 Correlations between various measures in French

The first column in Table 6.17 presents the correlations between French school averages, typing speed (the copy task), text quality and writing process measures for our 30 learners in the French narrative writing task. We found significant correlations between French school grade averages and six of the writing process measures. The effect sizes are medium, ranging from .44* to .52**. Our results showed that there was a significant positive correlation between French school average and typing speed ($r$ = 52**, p< .001) as well as text quality ($r$ = 51**, p< .001) in French. The better the linguistic knowledge is, the faster the writer types on the computer and also the better quality text s/he produces.

Table 6.17 Correlations between French school average, text quality scores, typing speed (the French copy task), and writing process measures in French

| | school average | typing speed | text quality |
|---|---|---|---|
| typing speed | **.517**** | - | |
| text quality | **.515**** | **.651**** | - |
| total number of words | .092 | **.413*** | .284 |
| characters per minute | **.441*** | **.555**** | **.566**** |
| words per minute | **.349*** | **.546**** | **.482**** |
| P-burst length | **.480**** | **.625**** | **.568**** |
| pause time | **-.445*** | -.224 | **-.510**** |
| number of pauses | **-.450*** | **-.350*** | **-.372*** |
| between-word pauses | .091 | **.418*** | .272 |
| R-burst length | **.307*** | .279 | **.381*** |

*Note.* **Correlation is significant at the 0.001 level. *Correlation is significant at the 0.01 level (1-tailed). Significant results are presented in bold type.

We found significant positive correlations between French school average and two of the writing fluency measures: characters per minute ($r$ = 45*, p< .01) and P-burst length ($r$ =

48**, p< .001). Typing speed and writing fluency (as reflected by greater P-burst values) would appear to be influenced by knowledge/ mastery of the French language – which is a relatively logical finding. Measures reflecting disfluency in writing (total pause time: $r$ = -44*, p< .01), number of pauses: $r$ = -45*, p< .01 and pause time: $r$ = -45*, p< .01) were *negatively* correlated with French school average, reinforcing this relationship between knowledge of the language, and temporal measures of typing fluency. We did not find a correlation between French school average and text revision behavior (R-bursts, numbers of revisions or product/process ratio) in L1 narrative writing.

The second column in Table 6.17 presents the correlations between typing speed and the writing process measures in French. We found a significant positive correlation between typing speed and text quality ($r$ = 65**, p< .001), as well as (quite logically) typing speed and total number of words produced ($r$ = 41*, p< .01). It is perhaps an interesting finding that our faster typists produced more highly-rated texts. Predictably, column two also shows positive correlations between typing speed and all of our (temporally-based) writing fluency measures: characters per minute ($r$ = 55**, p< .001), words per minute ($r$ = 54**, p< .001) and P-burst length ($r$ = 62**, p< .001). Similarly, typing speed shows a negative relationship with pause time and numbers of pauses, but these figures do not reach significance. Nor was typing speed correlated with R-bursts.

Column 3 in Table 6.17 presents the correlations between text quality and writing process measures, with a significant positive correlation between text quality and all the writing fluency measures: characters per minute ($r$ = 56**, p< .001), words per minute ($r$ = 48**, p< .001) and P-burst length ($r$ = 56**, p< .001). We also found a significant negative correlation between text quality and pause behaviour (pause time and numbers of pauses), but not with numbers of between-word pauses. This suggests that writing disfluency is linked to lesser text quality: more hesitant writers produced texts that were less well-evaluated. We also find a marginal positive correlation between text quality and R-burst length (length of text between revisions; $r$ = 38*, p< .01) – so longer R-bursts are associated with better text quality.

### 6.6.3 Correlations between various measures in L2/L3 English

Table 6.18 shows the correlations between the first-term school averages for L2/L3 English, typing speed (the English copy task), text quality and writing process measures for our 30 learners in L2/L3 (English) narrative writing. First, we see a positive correlation between L2/L3 linguistic knowledge and typing speed ($r$ = 49**, p< .001): again knowledge of the

language being used appears to relate to or influence typing speed. The second line of the table shows a strong correlation ($r$ = 81***, p< .000) between L2/L3 linguistic knowledge and text quality. To our surprise, we did not find any correlations between L2 linguistic knowledge and writing fluency measures (characters per minute, words per minute and P-burst length); or revision behaviour in L2 narrative writing. We did find significant positive correlations between L2 linguistic knowledge and writing fluency measures in the descriptive writing task: characters per minute ($r$ = 47**, p< .001), words per minute ($r$ = 38*, p< .01), and P-burst length ($r$ = 49**, p< .001).

Table 6.18 Correlations between first-term school average, text quality scores, typing speed and writing process measures in L2/L3 English writing

| | **L2/L3 school average** | **L2/L3 typing speed** | **L2/L3 text quality** |
|---|---|---|---|
| L2/L3 typing speed | **.494**** | - | |
| L2/L3 text quality | **.810***** | **.559**** | - |
| total number of words | **.317*** | .336* | **.581**** |
| characters per minute | .244 | **.484**** | **.571**** |
| words per minute | .246 | **.479**** | **.527**** |
| P-burst length | .204 | **.488**** | **.410*** |
| R-burst length | .155 | .172 | **.421*** |

*Note.* ***Correlation is significant at the 0.000 level. **Correlation is significant at the 0.001 level. *Correlation is significant at the 0.01 level (1-tailed). Significant results are in bold type.

The second column in Table 6.18 presents the correlations between L2 typing speed and the writing process measures. We found significant positive correlations between L2 typing speed and all the measures included in the table, except for total number of words and R-bursts. L2 typing speed was correlated positively with text quality ($r$ = 56**, p< .001), as well as writing fluency measures (as measured in characters per minute: $r = .48^{**}$, words per minute: $r = .48^{**}$ and P-bursts: $r = .49^{**}$). As we found for L1 French, quite logically, the faster you type in the L2, the more fluent your writing behaviour.

The last column in Table 6.18 presents correlations between text quality and writing process measures in the L2. These are all positive and significant. We found a significant positive correlation between text quality and total number of words produced ($r$ = 58**, p< .001). There was a significant positive correlation between text quality and all of the writing fluency measures: characters per minute ($r$ = 57**, p< .001), words per minute ($r$ = 52**, p< .001), and P-burst length ($r$ = 41*, p< .01). We also found a significant positive correlation between

text quality and revision behaviour (R-burst length: $r$ = 42*, p< .01) in L2 narrative text production.

In the next chapter, we will discuss these results obtained through keystroke loggings and text-based data in French and L2/L3 English writing.

# Chapter 7: Discussion of study 1

Study 1 was designed to investigate the differences between 30 French EFL middle-school students' composing processes and text quality in L1/dominant school language French and L2/L3 English writing, as well as possible relationships between learner characteristics, writing processes and text quality, using multiple sources of data, and various analyses of this data. It also explores the role of typing speed on the one hand and linguistic knowledge on the other hand in composing processes and text quality in the two languages. In this section, we will discuss our results in comparison with the previous research on L1 and L2/L3 writing processes and text quality. After summarizing our results, we will discuss our research questions related to this part of our study.

## 7.1 Task effects:

As we saw in Chapter 6, the analysis of our data gives the following salient results:

- We found the following differences between the descriptive and narrative tasks in French: the time spent writing, total numbers of words, writing fluency (characters per minute, words per minute, P-burst length), pause behaviour (pause time, numbers of pauses, pause location) and some revision behaviour (numbers of revisions and revision rate). All other measures (R-burst length and the process/product ratio) were statistically equivalent for these two tasks in French.
- We found the following differences between the descriptive and narrative tasks in L2/L3 English: the time spent writing, total numbers of words, some of pause behaviour (numbers of pauses and within-word pauses). All other measures were statistically equivalent or showed only marginal differences between the two tasks in English; marginal ones were pause time in minutes, numbers of between-word pauses and numbers of revisions.

Our results confirm previous research that has also found significant task effects in L1 writing, but not in L2/L3 writing – for example, Beauvais and colleagues' (2011) comparison of narrative, argumentative, and expository writing. The difference in the time spent writing is statistically significant between the two tasks both in French and L2/L3 English writing. Due certainly to the time alloted, and to the nature of each task, our subjects also wrote more words in the narrative tasks in both languages. We remind our readers that there was a time difference for the descriptive and narrative tasks, for which the writers were allotted 4 and 8 minutes of composing time, respectively. This alone can explain much of the variety between the texts written, as measured in our statistical comparisons. It is therefore particularly interesting that the robust task effects observed for L1 writing did *not* characterize the

subjects' L2/L3 productions. However, see research by Maggio et al. (2012) and Spelman Miller (2000; 2006) for different findings (no task effect in L1 writing). For instance, Maggio et al. (2012, p. 2135) found that "the text type (narrative versus descriptive) had no effect on pauses or writing rate" of French teenagers aged between 10-15 in L1 writing (Maggio et al., 2012, p. 2135).

Some of more interesting results show that our learners wrote the descriptive task in French more fluently than the narrative task, with more characters per minute, words per minute and more text in their Pause-bursts. There are also more disfluent pauses (over the 2000 ms threshold) in the narrative task, which also generates significantly more between-word and within-word short pauses (over 200ms) in French. Our learners revised a little more during the narrative task than the descriptive task in French, with a marginally higher process/product ratio observed for the descriptive task. There is no difference in R-burst length between the two tasks in French.

We did not find any task effect on writing processes in English, except for the time spent writing (an external variable, linked to each task, as seen above), and total numbers of words produced (which is also, of course, linked to task duration). Other researchers have also found that between-task variation is greater in L1 than in the L2 writing, where writers' behaviour appears more stable (Tillema, 2012; Van Weijen, 2009; Van Weijen et al., 2008). Spelman Miller (2000) did not find any task differences in text production (writing fluency and pausing behaviour) between two descriptive and evaluative tasks in English as a native language and ESL. Similarly, Thorson (2000) found no significant task effect on the revision behaviour in writing an article or a letter in the L1 (English), with an unclear task effect found in L2 (German) writing. Révész et al. (2017) did not find a task complexity effect on writing fluency in the L2 but they did find an effect on pausing and revision behaviour. When dealing with more complex L2 writing tasks, writers in this study paused more between sentences and revised less at word level. However, our results show that fluency (characters per minute, words per minute and P-burst length) in L2/L3 writing does not differ between the two tasks, whereas some pausing behaviour in English differed, as it did in French; the long pause rate (for pauses at our pause threshold of 2000 ms or more) was slightly higher in the narrative task (25 %) than in the descriptive task (21 %) in French. Our learners made more disfluent pauses (over the 2000 ms threshold) in the narrative task than the descriptive task in English. The narrative task also tended to generate slightly shorter (200ms or more)

within-word pauses in English; however, no task differences were found for within-word pauses in French writing.

We also found that revision rate was significantly higher in the narrative task (65 %) than in the descriptive task (53 %) in French writing. We found marginal differences between R-burst length in descriptive and narrative writing in French, but no task differences on R-burst length in L2/L3 English. Our learners typed more text before making a revision in the French descriptive task compared to the French narrative task. This indicates that our participants tend to revise less in the descriptive task than in the narrative task in French writing, while our learners revised slightly more during the narrative task in English. There was no significant difference in product/process ratio between the two tasks in English. It seems that disfluency in text production does not bear task differences as is the case in foreign language writing, when language skills are not fully automatised yet. But text productivity in a more developed language, like L1/dominant schooling seems to be influenced by task effect.

We found significant correlation between text quality scores, writing fluency, pause behaviour and numbers of revisions in L2/L3 English descriptive writing. The reason that there are more correlations between text quality scores and descriptive writing than the narrative task in the L2/L3 might be that the students in our experiment might be more familiar with working on the descriptive tasks in their EFL courses rather than the narrative tasks. This was also reported by one of the English teachers that they do picture-description type of writing exercises in their EFL courses. The participating students might not have developed picture-narration skills in their EFL as they have recently learnt simple past structures that are necessary to narrate a story.

### 7.2 Typing speed

- We found significant differences in all the three typing speed measures between French and English writing: Targeted Bigrams, High-frequency Bigrams and Selected Component Bigrams.
- We found a significant positive correlation between typing speed and writing fluency both in French and English writing.
- We found a significant positive correlation between typing speed and text quality as well as (quite logically) typing speed and total number of words produced in both French and English writing.

Our middle-school EFL learners type faster in their dominant or native langauge (French) than in their foreign language (English). Although typing speed variables were found to be different in L1 and L2/L3, Spearman correlations also show that they are correlated between

the two languages. This indicates that the same individual level of typing skill underlies both L1/dominant language and L2/L3 keyboard production, despite slower overall performance by our learners in English. Another explanation could be that French and English share common linguistic features (a certain number of bigrams, for example). Therefore, the rate at which one can type both high- and low-frequency bigrams is correlated for French and L2/L3 English writing.

We found that typing in L1/dominant French and L2/L3 English is different between-subjects. It is also interesting to note that we observed more variance in typing speed in English than in French for the typing speed variables, an important finding similar to Leijten et al.,' results (2019) which found more variance in typing in L2 English. The range was larger in typing speed in the L2/L3, except for Targeted Bigram typing.

Researchers have become interested in whether copying a task on the computer might influence writing fluency during text production (Aldridge & Fontaine, 2019). "[T]yping requires more than simply hitting the target keys in the planned order; indeed, it is a ‘complex cognitive task’ combining perceptual and motor processes (Gentner, LaRochelle & Grudin, 1988, p. 541, quoted in Aldridge & Fontaine, 2019, p. 290). Copying a task can be different from writing a text in that copying requires the writer to” literally keep in mind the representation of what they intend to write, pay attention to the output being produced, which may include finding the keys on the keyboard" (Laves et al., 2007, p. 58). Aldridge and Fontaine (2019) who looked at the effect of typing ability on text production on computer found that when not developed efficiently, motor aspects of typing might interfere and disrupt natural writing processes with more within-word pauses, whereas automatisation of keyboard skills (keyboard efficiency) provides benefits to typists with "a slight cognitive advantage in terms of allocation of resources during the task" (Aldridge & Fontaine, 2019, p. 299).

We measured the typing speed with the *Inputlog* copy task in the two languages (and even three as we will see in Chapter 8), assuming that performing different writing tasks might result in different typing speed, confirmed by our results that our learners' fluency measures were found to be different in both the descriptive and narrative task in French. We were able to control the typing speed for both writing tasks and languages of our research. Therefore, we can safely discuss whether typing speed is related to our fluency findings.

The positive correlation between typing speed and all our temporal measures of writing fluency in both French and English provides the evidence that typing speed is related to or

influences writing fluency. Previous research shows that slow typists write fewer words, more pauses with long pause duration in the total writing process time than the fast typists (Alves, de Sousa & Strömqvist, 2007). Our findings corroborate previous research that the faster a person can type, the more fluently, apparently, s/he can produce a text. In the case of efficient typing skills, working memory is less taken up with mechanical aspects of word processing the discourse, freeing up the attentional capacity for a fluent text production (Torrance & Galbraith, 2006).

## 7.3 Language effects: comparison of French and L2/L3 English composing processes

- We found differences between typing speed, and most indicators of French and English composing processes, except for numbers of pauses and product/process revision ratios.
- The most important differences seem to be: writing fluency (words per minute, characters per minute, P-bursts), pause and revision rates. Below, we discuss our findings in more detail.

### 7.3.1 Writing Fluency

Our results corroborate previous findings that there are differences between L1 and L2 writing processes as well as similarities. Our results related to writing fluency in French and L2/L3 English are in line with research which has found that L2 writers compose less fluently than they do in their L1 (Breuer, 2019; Chenoweth & Hayes, 2001; Knospe et al., 2019; Lindgren et al., 2008; Ong & Zhang, 2010; Sasaki & Hirose, 1996; Silva, 1993; Tiryakioglu et al., 2010; 2019; Van Waes & Leijten, 2015). That is to say, they produce fewer words per minute (Chenoweth & Hayes, 2001; Sasaki & Hirose, 1996; Silva, 1993; Tiryakioglu et al., 2019). We found that our students wrote twice as fluently in the French descriptive task (M=17.62 words per minute) as in L2/L3 English (M=9.92 words per minute), with similar results for the narrative task (15 vs. 10 words per minute), and similar proportions measured in characters per minute (half as many in L2/L3 English as in French).

Writing fluency is related to the formulation process in Hayes and Flower's Writing Model (Chapter 1, Section 1.1). Writers transform their ideas into words and sentences and write or type them, and writing fluency is the indication of how fast a writer can transcribe ideas into written text (Chenoweth & Hayes, 2001; Van Waes & Leijten, 2015). Writing fluency is not determined by only one variable such as typing speed, and these have been confounded in many previous studies on L2 writing (Van Waes & Leijten, 2015).

Another writing fluency measure is P-burst length – the amount of text typed between two long pauses. Our findings which also found longer P-burst length in French than L2/L3

English, echo previous research on the subject (Breuer, 2014; Chenoweth & Hayes, 2001; Leijten, Van Horenbeeck & Van Waes, 2019). L1 writing is characterized by longer P-burst length as opposed to the shorter P-burst length in L2/L3 writing. This could indicate that our EFL learners have not developed and automatized their L2/L3 text production as their L1/dominant language (Chenoweth & Hayes, 2001; Leijten, Van Horenbeeck & Van Waes, 2019).

To look more closely at the pausing behaviour that contributes directly to our fluency findings, we remind our readers that previous research on pausing in L2 writing has resulted in mixed results (Chapter 2). Generally, learners pause more when writing in their L2 (Breuer, 2014; 2019; Chenoweth & Hayes, 2001; McCutchen, 1986; Sasaki & Hirose, 1996; Spelman Miller 2000; Tiryakioglu et al., 2019), and we did indeed find a high average rate of hesitation in English writing (49%), more than twice the pause rate in French (23%). One of our more interesting results is that our participants paused more within words in French than in L2/L3 English. This is relatively counterintuitive – since previous researchers have interpreted within-word hesitations as a sign of linguistic encoding difficulties (Alves et al., 2019; Deane & Zhang, 2015), as found by Wengelin (2006) that university students with reading and writing difficulties made more within-word pauses (736) than normal university students (101). Alves et al. (2019) suggest that

> "a more efficient composing process seems to be characterized by a higher percentage of pauses between clauses and a lower percentage of pauses within words. ... On the contrary, pauses within words may signal transcription difficulties that impede a fluent composing process". ( p. 65-66)

These within-word hesitations we found in L1 writing can probably be explained by the extreme complexity of French grammatical orthography, especially the orthographic forms of word endings (both noun and verb structures). Writing correct French requires much metalinguistic reflection during writing (Duncan et al., 2009), and these teenage writers seem to have learned to be cautious as they write in French.

In their study on modelling the keystroke units of analysis (pauses, bursts and revisions), Baaijen, Galbraith and de Glopper (2012) argue that pauses between words "might reflect lexical retrieval, phrase structure processing, and higher level message planning" (p.270). Long pauses between sentences might indicate planning of the sentence production (idem) as "Hayes assumes, PP-bursts[14] are a direct reflection of the capacity of the translator component of text production, then one would expect writers who typically pause for longer

[14] Pure-Pause bursts are texts between two long pauses in which no revision takes place.

at grammatical junctures to also produce longer PP-bursts." (p. 271). Alves and colleagues (2019) found differences on the location of long pauses. The high-quality group made more pauses between words than the low-quality group, while the low-quality group made more within-word pauses than the high-quality group. It seems that pausing more between words is an advantage in production of better quality texts, whereas within-word pauses are a disadvantage. For low-quality groups, better texts are correlated with less composing time, shorter short pauses and less within-word pauses. "Greater variability of between-word and within-word pauses and backspacing may reflect difficulties in word-finding, spelling, or typing." (Deane & Zhang, 2015, p. 7).

We found that our learners revised their texts more in during L2/L3 writing than in L1/dominant French writing (Chenoweth & Hayes, 2001; Silva, 1993; Thorson, 2000) when we consider the revision rates, which is in line with previous research findings of Thorson (2000) who found significant differences between revision processes in L1 (English) and L2 (German) writing. Revision rates show that our learners revised their French texts with an average of 59 % of revisions compared to an average of 76 % revision rate in L2/L3 English writing when both tasks are combined. This result is also confirmed with our product/process ratio results showing a significant difference in product/process ratio in the descriptive task between French and English, with a higher ratio in French. This suggests that our learners are more productive with fewer revisions in French writing than in English. Our results confirm that our learners' revisions are at word level in L2/L3 writing since their vocabulary knowledge is less-developed in their L2/L3. When the writers make revisions at word level, this is related to low-level processes; however, if they make text-level revisions, these revisions are considered to be at high-level processes (Stevenson et al., 2006).

### 7.3.2 Process characteristics and text quality

- We found positive high correlations between typing speed, temporal measures of writing fluency (characters per minute, words per minute and P-bursts), and text quality in both languages (L1 and L2/L3). R-bursts were correlated with text quality both in French and English. Below we discuss these findings in the light of previous research.

The equivalent text quality scores received by our subjects are an interesting finding, which initially puzzled us. However, different raters rated the French and L2/L3 English texts, as L1 and L2/L3 texts – so doubtless with slightly different notions of what constitutes a “higher” or “lower” quality text. Our French raters (rating L1 texts) generally provided relatively low text quality scores. French teachers might think that if they attribute higher scores to the texts, the students might suppose that they have achieved sufficient competency in writing, and

may not try to improve their writing proficiency. However, we found relatively strong correlations within and between analytical text scores between French and L2/L3 English– French and English teachers might have evaluated students' texts systematically.

There was a positive significant correlation between writing fluency and overall text quality scores for the learners both in French and L2/L3 English writing. The more fluently a person types and produces text, the higher the estimated quality of the text produced. We found positive significant correlation between P-burst length and text quality, confirming previous research findings (Connelly, Dockrell & Barnett, 2005; Connelly et al., 2012; Hayes, 2012; Kaufer et al., 1986; Spelman Miller et al., 2008). The more text a writer produces between two long pauses, the better quality texts s/he can write in both L1 and L2/L3. Connelly et al. (2012) found a correlation between writing fluency (measured as burst length) and text quality (holistic scale) of the students in L1 English writing. Spelman Miller et al. (2008) found that writing fluency (measured as bursts and fluency in bursts) is a strong predictor of text quality in the development of L2/L3 writing of Swedish 14 -year old students although the writers' text quality did not increase in the second year of the longitudinal study. They did not find a significant effect of pausing and revision behaviour on the text quality scores. The correlation between writing fluency (measured as (characters per minute, words per minute and P-bursts) and overall text quality scores confirms that writing fluency may be an important predictor of writing quality for 9$^{th}$ grade middle school students both in L1/dominant French and L2/L3 English (Ransdell & Levy, 1996; Thorson, 2000; Xu & Ding, 2014).

Our findings are in line with previous research results, showing that text quality can be affected by the pause behaviour during writing (Alves, Castro & Olive, 2008) and hesitation in written production appears to be related to lower text quality. We found a negative significant correlation between first term exam scores, pause behaviour (pause time and number of pauses) and text quality scores in French writing. This shows that the high language proficient the writer is, the less time s/he pauses during text production, the better quality texts s/he produces with fewer pauses when writing a French narrative text. Previous research also found that while editing and planning (pause between sentences, cut/paste-jump events) behaviour seemed to have correlation with text quality scores, pauses between words and backspacing did not correlate (Deane & Zhang, 2015) since

> we observe that time on task and burst length in words have consistent positive correlations and that pauses within words have a consistent negative correlation with writing scores for fundamental text

> production. On the other hand, while some events potentially reflecting editing and planning (i.e., cut/paste/jump events and pauses between sentences) appear to have a consistent relationship with writing scores, other events, such as pauses between words and backspacing, do not. (Deane & Zhang, 2015, p.13)

We found a significant relationship between revision behaviour (R-burst length) and text quality results both in French and English writing as opposed to previous research which did not find significant relationships between the total numbers of revisions and text quality in L1 Dutch and EFL as in Stevenson et al. (2006). Our learners who wrote more texts before making revisions seem to have better quality texts both in French and English. Overall, different components of writing seem to contribute in different ways to writing performance (Babayigit & Stainthorp, 2010; Berninger, 1999).

### 7.3.3 Relationship between linguistic knowledge, writing processes and text quality

We found a positive high correlation between the first term school averages, writing fluency and text quality scores both in French and L2/L3 English writing. This finding indicates that the higher the language proficiency, the more fluently the writer produces a text and the better quality texts s/he writes both in the L1 and L2/L3, confirming Chenoweth and Hayes' (2001, p.93) conclusion that "increased experience with a language was associated with increased fluency in writing in that language" brings increased fluency in writing. The formulation process is more efficient with a better expression of meaning when a learner is more proficient in the language of production. Accordingly, our writers seem to benefit from their linguistic knowledge in French writing. Accesibility to linguistic resources enables them to plan more and generate text more fluently.

Our analysis of the correlations in L2/L3 English descriptive writing showed that there was a positive significant correlation between linguistic knowledge and the writing fluency measures (measured as characters per minute, words per minute and P-Bursts) in L2/L3 writing descriptive writing, as opposed to Palviainen and colleagues (2012) who found little relationship between fluency measures and L2/L3 writing proficiency. Schoonen and colleagues (2011) found that linguistic knowledge such as lexical retrieval, grammatical knowledge and spelling are significant contributors in prediction of EFL writing proficiency of the 9$^{th}$ grade Dutch students. They found more relationship between EFL writing proficiency and the grammatical knowledge in the 8$^{th}$ grade than the 9$^{th}$ grade in which lexical retrieval became a more important contributor in the prediction of EFL writing proficiency.

Lexical processing is an important cognitive activity in text production. In the L1, this process is highly automatized. However, in L2/L3 text production, the writers spend most of their time on linguistic concerns rather than the rhetorical concerns (Van Gelderen, Oostdam & Van Schooten, 2011; Whalen & Ménard, 1995) especially on searching for the meaning of the words (Roca de Larios et al., 2008; Tiryakioglu et al., 2019). Lexical retrieval is an important sub-process of the linguistic concerns that influence writing processes. If the writers' lexical capacity is not well-developed, they could experience text-generation problems while writing either in the L1, or L2 (Van Gelderen et al., 2011). Our stimulated recall interviews, which we will discuss in Chapter 10, revealed that they did indeed experience difficulty in finding vocabulary to express what they mean in L2/L3 writing process.

Research shows that L2/L3 proficiency level may have an effect on L2/L3 rhetorical patterns as shown in Cook's study that the subjects produced significantly more disunified texts in English than in Spanish (Cook, 1988; cited in Silva, 1993). Writers' vocabulary size and lexical knowledge may influence text quality (Engber, 1995) and text organization (Kubota, 1998). For beginner L2/L3 learners whose linguistic knowledge is not yet automatically activated during production, writing in the L2/L3 puts metalinguistic demands on working memory. When linguistic knowledge is not well developed, the writer's attention is directed to lower-order knowledge (vocabulary, spelling and grammar). "Perhaps these less able EFL writers with poor English grammatical proficiency need to devote far more of their memory capacity to finding the right words and constructions, leaving less capacity to deal with organization" (Berman, 1994, p.40). Working memory resources are therefore taken up with encoding issues, and are not free for higher-level activities such as planning, and discursive organization of the content in L2 writing (Breuer, 2019; Chenoweth & Hayes, 2001, Leijten et al., 2019; Lindgren, 2004; Schoonen et al., 2003; 2009; Tiryakioglu et al., 2019; Van Gelderen et al., 2011; Whalen & Ménard, 1995).

We found that the more proficient the learner is in one language, the more fluently s/he writes a text in a better quality in that language (Tiryakioglu & Hilton, 2018b). When writers' fluency is stopped either due to grammatical, lexical or rhetorical reasons to translate the ideas from L1 into L2/L3, this reduces the writing fluency (Sasaki, 2002). This can be attributed to the differences in automatization of language processing between the L1 and L2/L3. Text generation process, distinct from transcribing, can hardly ever be automatized among L2/L3 writers (Hayes & Chenoweth, 2007). Therefore, text generation in the L2/L3

becomes more costly for working memory, which slows down the L2/L3 writing process (Berman, 1994; Breuer, 2019; Leijten et al., 2019; Lindgren, 2004; McCutchen, 2000; Schoonen et al., 2003; 2009; Tiryakioglu et al., 2019; Van Gelderen et al., 2011). As Hilton (2008, p.162) puts forward, " if a speaker's attention is monopolized at the 'lower' (formal) level, where processes of lexical selection, morphological formulation, or even articulatory gesture have not been automatized through extensive repetition, the fluent exchange of 'higher'-level meaning will be impossible, or at least time-consuming, and laborious."

# Chapter 8: Results of study 2

This study explores writing processes and text quality in texts by 15 3rd grade Turkish-French bilingual students (14 to 15-year-old), written in their dominant school language (French), their heritage language (Turkish), and a third, foreign, language (English) (see Methodology Section 4.3).

In this section, we report the results of three kinds of data that we collected from our multilingual sub-corpus to answer our research questions: (1) keystroke logging results, (2) text quality data, and (3) first term school averages in French, Turkish and English. Our 3rd grade Turkish-French bilingual students (whose texts are included in the results presented in Chapters 6 and 7) performed three writing tasks (copy task, descriptive, and narrative tasks) in dominant French, heritage Turkish, and L3/FL English since the sample size is small (n=15), most of the tests used to compare the writing process measures in the three languages will be non-parametric. However, we are also particularly interested in where the difference lies between the two tasks and three languages, and will also use a General Linear Model analysis (within-subjects repeated measures) to look at the task, language and the task*language interaction effects in text production. We used 2x3 level ANOVAs; two levels of task type (narrative and descriptive) and three levels of languages (French, Turkish and English). Below we will report the results from the parametric tests (General Linear Model Repeated Measures) first, since we got the same results from both our parametric and non-parametric tests. To go further into our analysis of pause and revision behaviour, we calculated the pause and revision percentage rates per 100 words, in relation to each learner's text. We also performed Chi-square tests to look at the proportions of hesitations at different locations (within-word and between-word pauses). We will also present results from Spearman's rho correlations between linguistic knowledge (obtained through first-quarter exam scores), various writing process measures, and text quality. These correlations are run with our data from the narrative tasks in three languages, since the students produced more text in the narrative than in the descriptive task.

## 8.1 The keystroke logging (Inputlog) data

### 8.1.1 The copy task results

As we saw in Chapter 5 the *Inputlog* copy task furnishes a baseline typing speed figure that can be used to interpret the keystroke logging data from writing tasks. Writing fluency may

differ between task types, so it is useful to have a more standardised typing variable to measure typing speed in the two languages.

Table 8.1 Descriptive statistics for the copy tasks in three languages: French, Turkish and English

| copy task measures | Median | Range | Min | Max | Mean | SD | F (1,14) | post-hoc comparisons | $\eta_p^2$ |
|---|---|---|---|---|---|---|---|---|---|
| **Targeted bigrams** | | | | | | | | | |
| French | 206 | 99 | 153 | 252 | 199.00 | 27.52 | **6.78**** | Fr>En | .33 |
| Turkish | 187 | 112 | 145 | 257 | 191.60 | 29.15 | **(.004)** | Fr=Tr | |
| English | 174 | 71 | 144 | 215 | 178.87 | 23.14 | | Tr=En | |
| **High frequency bigrams** | | | | | | | | | |
| French | 206 | 102 | 157 | 259 | 210.00 | 29.76 | **34.13**** | Fr>Tr | .71 |
| Turkish | 177 | 90 | 134 | 224 | 178.73 | 26.52 | **(.000)** | Fr>En | |
| English | 181 | 86 | 144 | 230 | 184.93 | 27.50 | | Tr=En | |
| **Selected component bigrams** | | | | | | | | | |
| French | 198 | 110 | 147 | 257 | 202.20 | 30.85 | **6.57*** | Fr>En | .32 |
| Turkish | 187 | 87 | 145 | 232 | 187.60 | 23.89 | **(.005)** | Fr=Tr | |
| English | 182 | 86 | 138 | 224 | 183.27 | 25.71 | | Tr=En | |

**p* < .05. ***p* < .01.

The results of our keystroke logging copy-task data indicate that multilingual students' typing speed measures (characters per minute) are different in French, Turkish and L3 English. Descriptive statistics in Table 8.1 show that the mean Targeted Bigram typing rates (all tasks consisting of both High- and Low-Frequency Bigrams) are significantly higher in their dominant/schooling language (French) than in their heritage language (Turkish) and L3 (English) (Fr: *M*=199, *SD*=27.52; Tr: *M*=191.60, *SD*=29.15; and En: *M*= 178.87, *SD*=23.14). There was a significant main effect of language on typing the Targeted Bigrams, $F$ (2, 28) = 6.78, $p$<.004, $\eta_p^2$ .32. Post-hoc Bonferroni pairwise comparisons show that the difference in typing the Targeted Bigrams between French and English is significant (p<.000), but the difference between French and Turkish is not significant (p=.894) nor is the difference between Turkish and English (p=.139). These multilingual learners appear to be equally at ease when typing French and Turkish, less so for L3 English.

The second typing speed measure in Table 8.1 is High Frequency Bigrams (in characters per minute). Our bilingual students typed High Frequency Bigrams significantly faster in French (*M*= 210, *SD*=29.76) and L3 English (*M*=184.93, *SD*=27.50), than in Turkish (*M*=178.73, *SD*=26.52), $F$ (2, 28) = 34.13, $p$<.000, $\eta_p^2$ .71. Post-hoc Bonferroni pairwise comparisons

showed that the difference in the typing of High Frequency Bigrams between French and Turkish is significant (p=.000), as is the difference between French and English (p=.000). There is no difference between Turkish and L3 English. This could be due to the fact that the students are used to typing High Frequency Bigrams in their dominant written language (French) more than their L3 English as a foreign language and Turkish (heritage language).

The third typing speed measure is Selected Component Bigrams (in characters per minute) which are related to the sentence typing and word formation tasks. Our bilingual students typed Selected Component Bigrams in French (*M* = 202.20, *SD*=30.85) significantly faster than in L3 English (*M* = 183.27, *SD*=25.71) or Turkish (*M* = 187.60, *SD*=23.89), *F* (2, 28) = 6.57, *p*<.005, $\eta_p^2$ .32 (Table 8.1).

Table 8.2 Correlations between the copy task measures of the three languages (French, Turkish and L3 English)

| | French | | | Turkish | | | English | | |
|---|---|---|---|---|---|---|---|---|---|
| | SCB | TB | HFB | SCB | TB | HFB | SCB | TB | HFB |
| French | | | | | | | | | |
| Selected component bigrams | 1.000 | .928*** | .973*** | .579* | .561* | .900*** | .836*** | .873*** | .861*** |
| Targeted bigrams | .928*** | 1.000 | .945*** | .527* | .484* | .824*** | .849*** | .838*** | .833*** |
| High frequency bigrams | .973*** | .945*** | 1.000 | .614** | .589* | .918*** | .819*** | .876*** | .821*** |
| Turkish | | | | | | | | | |
| Selected component bigrams | .579* | .527* | .614** | 1.000 | .986*** | .818*** | .532* | .619** | .539* |
| Targeted bigrams | .561* | .484* | .589* | .986*** | 1.000 | .796*** | .511* | .597** | .521* |
| High frequency bigrams | .900*** | .824*** | .918*** | .818*** | .796** | 1.000 | .804*** | .877*** | .807*** |
| L3 English | | | | | | | | | |
| Selected component bigrams | .836*** | .849*** | .819*** | .532* | .511* | .804*** | 1.000 | .939*** | .986*** |
| Targeted bigrams | .873*** | .838*** | .876*** | .619** | .597** | .877*** | .939*** | 1.000 | .937*** |
| High frequency bigrams | .861*** | .833*** | .821*** | .539* | .521* | .807*** | .986*** | .937*** | 1.000 |

*Note*. Spearman's rho 1-tailed correlation test. ***Correlation is significant at the 0.001 level. **Correlation is significant at the 0.01 level. *Correlation is significant at the 0.05 level. SCB: Selected Component Bigrams. HFB: High Frequency Bigrams. TB: Targeted Bigrams

Post-hoc Bonferroni pairwise comparisons show that the difference in typing the Selected Component Bigrams between French and L3 English is significant (p<.001), but not between

French and Turkish (p=.111) or Turkish and L3 English (p=.100). This result indicates that learners type faster in their more developed languages than their less developed language (L3 English).

We also looked at the correlation between copy task measures in each language. We found significant positive correlations between the copy task measures within and between languages, presented in Table 8.2. The correlations within language measures (ranging from .79 to .98) are higher than the correlations between languages (ranging from .48 to .91). This shows that typing speed measures are more stable within the language than between the languages.

We also found that the correlations between copy task measures are higher for French and English (ranging from .82 to .88) than for French and Turkish (ranging from .48 to .92). This is probably because French and English are Indio-European languages (with an overlapping linguistic history), and thus share similar linguistic characteristics. Turkish is linguistically different from French and English.

Table 8.3 Correlation between the High Frequency Bigrams of the copy task measures of the three languages (French, Turkish and L3 English)

| | French | Turkish |
|---|---|---|
| Turkish | .918*** | |
| L3 English | .821*** | .807*** |

*Note.* Spearman's rho correlations. *** significant at the 0.001 level (1-tailed).

Since one of the aims of our research is to look at the relationship between typing speed and writing process measures and text quality, we need to choose one of these three typing speed measures from the copy task. The typing speed measure that we will use in our analyses here is High Frequency Bigrams, since we found a higher correlation between the High Frequency Bigrams in the three languages (Table 8.3) than the Selected Component or Targeted Bigrams. Table 8.3 shows that the correlation was positive and significant ranging from .81 to .92 at p<.001.

### 8.1.2 Differences in writing process measures between the three languages

Our keystroke logging data illustrates interesting difference in our 9th grade Turkish-French bilingual students' composing processes in French, Turkish, and English. Table 8.4 presents writing measures that combine the descriptive and narrative tasks, for each of the three languages of production; columns 9-11 report comparisons between the languages based on General Linear Model analysis (the results from the non-parametric Friedman's Test are

presented in Appendix T). Nine of the writing measures (shaded in grey) display significant differences between the three languages. The results in Line 1 shows no significant difference in the overall composing time between the three languages (French: *M*= 6.1, *SD*=1.14; Turkish: *M*= 6.2, *SD*=1.28; English: *M*= 5.52, *SD*=.814), $F$ (2, 28) = 2.05, $p$=.147, $\eta_p^2$ .12.

Lines 2 through 6 in Table 8.4 present various measures of productivity and fluency, all of which exhibit differences between the writers' languages. Line 2 shows a significant main effect of language on the numbers of total words produced ($F$ (2, 28) = 33.11, $p$<.000, $\eta_p^2$ .70), and post-hoc Bonferroni comparisons showed that our bilingual learners produced more words in their French, and similar quantities of words in Turkish and English (French: *M*=95.60, *SD*=22.64; Turkish: *M*=58.16, *SD*=18.71; English: *M*=56.10, *SD*=19.63). Lines 3-5 show significant differences in writing fluency measures (characters per minute, words per minute and P-burst length, respectively) in the three languages. Line 3 shows a significant main effect of language on characters per minute (French: *M*= 82.45, *SD*=17.59; Turkish: *M*= 62.78, *SD*=18.22; English: *M*= 49.51, *SD*=16.19, $F$ (2, 28) = 26.84, $p$<.000, $\eta_p^2$ .66).

Table 8.4 Comparisons for writing process measures (both tasks combined) for French, Turkish and L3 English (General Linear Model repeated measures)

| | measure | French | | Turkish | | L3 English | | F (2,28) | Post Hoc Comparisons | $\eta_p^2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| | | mean | SD | mean | SD | mean | SD | | | |
| 1 | total process time | 6.11 | 1.14 | 6.24 | 1.28 | 5.52 | .814 | 2.05 | Fr=Tr=En | .12 |
| 2 | number of total words | 95.60 | 22.64 | 58.16 | 18.71 | 56.10 | 19.63 | **33.11**** | Fr>Tr=En | .70 |
| 3 | characters per minute | 82.45 | 17.59 | 62.78 | 18.22 | 49.51 | 16.19 | **26.84**** | Fr>Tr>En | .66 |
| 4 | words per minute | 15.18 | 8.63 | 9.04 | 2.74 | 9.90 | 3.27 | **32.10**** | Fr>Tr=En | .70 |
| 5 | P-burst length | 24.33 | 8.44 | 16.59 | 6.40 | 11.37 | 3.39 | **26.40**** | Fr>Tr>En | .65 |
| 6 | pause time in min | 1.85 | .602 | 2.45 | .747 | 2.70 | .918 | **6.07**** | En>Tr>Fr | .30 |
| 7 | number of pauses | 23 | 5.51 | 25 | 6.82 | 25.50 | 6.26 | 1.29 | Fr=Tr=En | .08 |
| 8 | number of within-word pauses | 225 | 71.33 | 220 | 77.99 | 125 | 49.99 | **27.40**** | Fr=Tr>En | .66 |
| 9 | number of between-word pauses | 99 | 23.37 | 60 | 18.01 | 59 | 20.07 | **33.99**** | Fr>Tr=En | .71 |
| 10 | number of revisions | 56.73 | 21.58 | 42.93 | 16.73 | 36.90 | 14.17 | **6.90*** | Fr>Tr=En | .33 |
| 11 | R-burst length | 18.89 | 7.90 | 22.31 | 8.99 | 13.35 | 3.93 | **9.46*** | Tr=Fr>En | .40 |
| 12 | ratio | .862 | .062 | .838 | .103 | .856 | .055 | .45 | Fr=Tr=En | .03 |
| 13 | overall text quality | 8.53 | 3.72 | 13.27 | 2.61 | 8.60 | 3.54 | **18.74**** | Tr>En=Fr | .57 |

*$p$ < .05. **$p$ < .01. Pairwise post-hoc comparisons are based on Bonferroni. Significant results are in bold type and grey shading.

Our participants also produced significantly more words per minute when writing in French (*M*= 15.18, *SD*=8.63), than in Turkish (*M*= 9.04, *SD*=2.74) or English (*M*= 9.90, *SD*=3.27), *F* (2, 28) = 32.10, *p*<.000, $\eta_p^2$ .70. Our bilingual writers also produced significantly more text between two long pauses (P-bursts) in French (*M*= 24.33, *SD*=8.44), than in Turkish (*M*=16.59, *SD*=6.40) or English (*M*=11.37, *SD*=3.39), *F* (2, 28) = 26.40, *p*<.000, $\eta_p^2$ .65. We also found a significant main effect of language on pause time, *F* (2, 28) = 6.07, *p*<.006, $\eta_p^2$ .30 (Fr: *M*= 1.85, *SD*=.602; Tr: *M*=2.45, *SD*=.747; En: *M*=2.70, *SD*=.918), with equivalent pause times in Turkish and English. We did not find a main effect of language on numbers of pauses, *F* (2, 28) = 1.29, *p*=.291, $\eta_p^2$ .08.

Lines 8 and 9 of Table 8.4 show differences in pause location (both within and between word pauses[15]) between the languages. Line 8 shows that our learners produced more within-word hesitations in their dominant written language (French) and heritage language (Turkish) than in L3 English, *F* (2, 28) = 27.40, *p*<.000, $\eta_p^2$ .66. Post-hoc Bonferroni pairwise comparisons show that the difference in within-word pauses between French and English as well as between Turkish and English is significant (p=.000), but we found no significant differences between French and Turkish (p=.1000). Line 9 shows that between-word hesitations during writing were longer in French than in Turkish and English writing, (*M*=99, *SD*=23.37; *M*=60, *SD*=18.01; *M*=59, *SD*=20.07, respectively) *F* (2, 28) = 33.99, *p*<.006, $\eta_p^2$ .71.

In Table 8.4, lines 10 through 12 concern revision behavior (numbers of revisions, R-burst duration and ratio). We found a main significant effect of language on numbers of revisions between the three languages, *F* (2, 28) = 6.90, *p*<.004, $\eta_p^2$ .33 (line 10); deletions and additions were more frequent in French and Turkish, than in English (French: *M*=56.73, *SD*=21.58; Turkish: *M*=42.93, *SD*=16.73; L3 English: *M*=36.90, *SD*=14.17). There was a significant main effect of language on R-burst length, *F* (2, 28) = 9.46, *p*<.001, $\eta_p^2$ .40. Line 11 shows that our bilingual learners produced significantly more text before making revisions (R-burst length) when writing in Turkish, than in French or English (French: *M*=18.89, *SD*=7.90; Turkish: *M*=22.31, *SD*=8.99; L3 English: *M*=13.35, *SD*=3.93). However, the product/process revision ratio does not differ in the three languages (*F* (2, 28) = 45, *p*=.291, $\eta_p^2$ .03).

[15] Although raw numbers' results may depend largely on numbers of total words and writing process time, we wanted to include them (numbers of pauses, numbers of within-and between -word pauses, numbers of revisions) in our descriptive tables in order for the comparability of our results to the studies using keystroke loggings which involve any one of them in their data analysis (Alves et al., 2008; Leijten & Van Waes, 2015; Tiryakioglu et al., 2019).

Analysis of our text quality scores in Table 8.4 (line 13) show a significant main effect of language on text quality, $F$ (2, 28) = 18.74, $p$<.000, $\eta_p^2$ .57, with much higher text quality scores for Turkish ($M$= 13.27, $SD$=2.61) than for French ($M$= 8.53, $SD$=3.7) or L3 English ($M$= 8.60, $SD$=3.54) (Line 13, Table 8.4). We will discuss these differences below.

As we did in Chapter 6, we also wanted to look at the distribution of pauses at the two key processing locations: within and between words. Table 8.5 presents the number of pauses (200ms or more) observed at these two locations for the combined task data in each language.

Table 8.5 Chi-square results for within-word and between word pauses for both tasks in the three languages

| | **(total number of) within-word pauses (both tasks)** | **(total number of) between-word pauses (both tasks)** |
|---|---|---|
| French texts | 6762 | 2972 |
| Turkish texts | 6589 | 1811 |
| English texts | 3767 | 1773 |

Chi-square analysis of the observations presented in Table 8.5 shows a significant difference between pause locations in the writers' three languages: $\chi^2$ (23.674, 2) = 248.41, p< .001. Residuals show that our bilingual learners produced far more between-word pauses in French and English, and more within-word pauses in Turkish. This might be related to the fact that they generated less text in Turkish.

Table 8.6 presents the results from pause and revision rates in the three project languages; these rates, as in Chapter 6, are pauses per 100 words; revisions per 100 words. Our results show that Turkish-French bilingual students' pause rate is lower in French as their dominant/schooling language (25 %) than in L2 Turkish as their heritage language (48 %) and L3 English as a foreign language (49 %), the last two of whose show almost similar pause rates. We found a significant main effect of language on pause rate, $F$ (2, 28) = 24.92, $p$< .000, $\eta_p^2$ .64.

Table 8.6 Pause and revision rates in French, Turkish and L3 English writing (both tasks combined)

| writing process measures | language | mean numbers | rate (%) | F (2,28) | Post Hoc | $\eta_p^2$ |
|---|---|---|---|---|---|---|
| long pauses | Fr | 23 | 25 | **24.92 (.000)** | En=Tr>Fr | .64 |
| | Tr | 25 | 48 | | | |
| | En | 26 | 49 | | | |
| numbers of revisions | Fr | 57 | 60 | **4.10 (.027)** | Tr>En=Fr | .22 |
| | Tr | 43 | 82 | | | |
| | En | 37 | 69 | | | |

Significant results were in bold type and grey shading.

The results from revision rates in Table 8.6 show that revision rate is relatively lower in French (60 %) than in L3 English (69 %) and in Turkish (82 %), we did only find marginal effect of language on revision rate, $F$ (2, 28) = 4.10, $p$=.027, $\eta_p^2$ .22. We will discuss these findings further in discussion section.

### 8.1.3 Task and interaction effects

Table 8.7 summarizes the previous findings on task, language, and task*language interaction effects found in the data obtained from our Turkish-French bilingual learners' written texts. Task and task*language interaction effects were found for five writing process measures, and language effects for seven measures. We also see that when there is a task effect, we also find a task*language interaction effect. Line 1 shows no effect of language for the total process time, however, there is a task and task*language interaction effect here.

Table 8.7 Task, language and task*language interaction effects on the writing process measures based on General Linear Model Multivariate Tests

| Line | writing process measures | task effect | language effect | task*language interaction effect |
|---|---|---|---|---|
| 1 | total process time | √ | | √ |
| 2 | total number of words | √ | √ | √ |
| 3 | characters per minute | √ | √ | √ |
| 4 | words per minute | | √ | |
| 5 | P-burst length | | √ | |
| 6 | pause time in minutes | √ | √ | √ |
| 7 | number of revisions | √ | √ | √ |
| 8 | R-burst length | | √ | |

*Note.* √: a significant effect was established. An empty cell: no effect was established. Effects on the three languages are in grey shading.

We found task, language and task*language interaction effect for the numbers of total words ((Line 2), characters per minute (Line 3) as well as pause time (Line 6) and number of revisions (Line 7). We found that there was the language effect for the three writing fluency measures (characters per minute, words per minute and P-burst length) (Lines 3-5), pause behaviour (pause time) (Line 6) and revision behaviour (Lines 7-8).

## 8.2 Correlations between text quality measures

Table 8.8 presents a sercorrelation matrix for our analytical text quality measures (measured as content, organisation and language use) and the overall (analytical) text quality score, within and between the three languages of the study. There is a positive correlation ranging

from $r$ = .52* to $r$=.99*** between overall text quality and analytical text quality measures (content, organisation and language use) within each language.

Table 8.8 Correlations between analytical text quality measures in multilingual writing

| | FR OVER | FR CONT | FR ORG | FR LANG | EN OVER | EN CONT | EN ORG | EN LANG | TR OVER | TR CONT | TR ORG | TR LANG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FR_OVER | 1.000 | .897*** | .729** | .833*** | .763** | .816*** | .291 | .610* | .385 | .449 | .447 | .419 |
| FR_CONT | .897*** | 1.000 | .519* | .678** | .772** | .828*** | .313 | .613* | .267 | .422 | .384 | .288 |
| FR_ORG | .729** | .519* | 1.000 | .415 | .730** | .769** | .276 | .569* | .439 | .488 | .460 | .346 |
| FR_LANG | .833*** | .678** | .415 | 1.000 | .752** | .795** | .273 | .611* | .194 | .134 | .161 | .351 |
| EN_OVER | .763** | .816*** | .291 | .610* | 1.000 | .994*** | .991*** | .979*** | .343 | .465 | .467 | .340 |
| EN_CONT | .772** | .828*** | .313 | .613* | .994*** | 1.000 | .978*** | .971*** | .333 | .468 | .474 | .326 |
| EN_ORG | .730** | .769** | .276 | .569* | .991*** | .978*** | 1.000 | .966*** | .345 | .466 | .471 | .348 |
| EN_LANG | .752** | .795** | .273 | .611* | .979*** | .971*** | .966*** | 1.000 | .357 | .446 | .500 | .340 |
| TR_OVER | .385 | .267 | .439 | .194 | .343 | .333 | .345 | .357 | 1.000 | .934*** | .942*** | .929*** |
| TR_CONT | .449 | .422 | .488 | .134 | .465 | .468 | .466 | .446 | .934*** | 1.000 | .934*** | .841*** |
| TR_ORG | .447 | .384 | .460 | .161 | .467 | .474 | .471 | .500 | .942*** | .934*** | 1.000 | .831*** |
| TR_LANG | .419 | .288 | .346 | .351 | .340 | .326 | .348 | .340 | .929*** | .841*** | .831*** | 1.000 |

Spearman's rho 1-tailed.***Correlation is significant at the 0.001 level.** Correlation is significant at the 0.01 level. * Correlation is significant at the 0.05 level. OVER: Overall analytical text quality score. CONT: Content. ORG: Organization. LANG: Language Use

Between-language correlations on these text quality measures show interesting differences in how the raters seem to have operated in each language. Significant correlations are found only for French and L3 English writing text quality measures. The very low values observed between Turkish and French are particularly interesting, illustrating that these raters were operating on very different principles.

## 8.3 Correlations between text quality and writing process measures in the three languages

One of our research questions is to look at whether text quality measures are related to writing process measures for these teenage Turkish-French bilingual writers. This section presents the results of Spearman's rho correlations between text quality (holistic scores) and writing process measures (typing speed, fluency, pause and revision behaviour) in the narrative task in the three languages concerned. We chose the holistic score for the text quality correlation measure since correlates well with writing process measures within each language. Table 8.9 presents these correlations for the writing measures in French.

Table 8.9 Correlations between overall text quality scores and writing process measures in French writing

| writing process measures | French overall text quality score | |
|---|---|---|
| | Correlation Coefficient | Sig. (2-tailed) |
| typing speed (high-frequency bigrams) | **.816*** ** | **.000** |
| words per minute | **.520* ** | **.047** |
| characters per minute | **.746** ** | **.001** |
| P-burst length | **.828*** ** | **.000** |
| total number of words | .157 | .575 |
| R-burst length | .244 | .381 |

Spearman's rho 2-tailed. *** Correlation is significant at the 0.001 level. ** Correlation is significant at the 0.01 level.*Correlation is significant at the 0.05 level. Significant correlations were in bold type and grey shading.

The grey-shaded lines in Table 8.9 show significant correlations between the holistic French text quality score and: typing speed ($r$ = 82***, p<.000); words per minute ($r$ = 52*, p= .047); characters per minute ($r$ = 75***, p< .001); and P-burst length ($r$ = 83***, p< .000). So, again we see the possible connection between faster typing skill, writing fluency, and better text quality in French. We did not find significant correlations between text quality and any of pause and revision behaviour in French writing.

Table 8.10 Correlations between holistic text quality scores and writing process measures in Turkish writing

| writing process measures | Turkish overall text quality score | |
|---|---|---|
| | Correlation Coefficient | Sig. (2-tailed) |
| high-frequency bigrams | **.643** ** | **.010** |
| characters per minute | **.721** ** | **.002** |
| number of total words | **.822*** ** | **.000** |
| words per minute | **.706** ** | **.003** |
| P-burst length | **.745** ** | **.001** |
| R-burst length | -.134 | .634 |

Spearman's rho 2-tailed. *** Correlation is significant at the 0.001 level. ** Correlation is significant at the 0.01 level. * Correlation is significant at the 0.05 level. Significant correlations are in bold type and grey shading.

Table 8.10 presents the correlations between text quality and writing process measures in Turkish, with a significant positive correlation between text quality and typing speed ($r$ = 64**, p< .010), total numbers of words produced ($r$ = 82***, p< .000) and all the writing fluency measures: characters per minute ($r$ = 72**, p< .002), words per minute ($r$ = 71**, p<

.003) and P-burst length ($r$ = 75**, p< .001). As for our French writing data, we did not find significant correlations between text quality and any revision behaviour in Turkish writing.

Table 8.11 presents the correlations between text quality and the writing process measures in L3 English narrative writing. Similar to the results from Turkish, we found a significant positive correlation between text quality and typing speed ($r$ = 59*, p< .021), as well as (quite logically) text quality and total number of words produced ($r$ = 68**, p< .005).

Table 8.11 Correlations between holistic text quality scores and writing process measures in L3 English writing

| writing process measures | English overall text quality score | |
|---|---|---|
| | Correlation Coefficient | Sig. (2-tailed) |
| high-frequency bigrams | **.587*** | **.021 (m)** |
| characters per minute | **.796***** | **.000** |
| total number of words | **.678**** | **.005** |
| words per minute | **.753**** | **.001** |
| P-burst length | **.671**** | **.006** |
| pause time | **-.533*** | **.041 (m)** |
| R-burst length | .483 | .068 |

Spearman's rho 2-tailed. *** Correlation is significant at the 0.001 level. **Correlation is significant at the 0.01 level. *Correlation is significant at the 0.05 level. Significant correlations are in bold type and grey shading.

As is the case for English and Turkish, once again we find positive correlations between text quality and our (temporally-based) writing fluency measures in English: characters per minute ($r$ = 80***, p< .000), words per minute ($r$ = 75**, p< .001) and P-burst length ($r$ = 67**, p<.006). We also find a marginal negative correlation between text quality and pause time ($r$ = -.53*, p=.041). We did not find a significant correlation between text quality and R-burst length in L3 English writing.

## 8.4 Correlations between linguistic knowledge and writing process measures

Table 8.12 shows the correlations between the first-term school averages for French, Turkish and L3 English and the writing process measures for our bilingual learners in narrative writing. Linguistic knowledge is correlated with typing speed in both French ($r$ = .54*, p=.039), and English ($r$ = .71**, p<.003), but not for Turkish. The second line of the table shows a positive significant correlation between linguistic knowledge and text quality in all three languages (French: $r$ = 75**, p< .001; Turkish: $r$ = 72**, p< .003; L3 English: $r$ = 79**, p< .000). Line 3 shows a strong correlation between linguistic knowledge and the total

number of words produced in the Turkish narrative task, but not in French and L3 English. In Line 4, we see significant positive correlations between linguistic knowledge and characters per minute in all three languages of the study: French ($r$ = 56*, p= .030), Turkish ($r$ = 55*, p= .033), and L3 English ($r$ = 52*, p= .048).

Table 8.12 Correlations between first-quarter school averages and writing process measures

| | first-term school averages | | | | | |
|---|---|---|---|---|---|---|
| | French | | Turkish | | L3 English | |
| | *r* | *p* | *r* | *p* | *r* | *p* |
| typing speed (HFBs) | **.537*** | **.039** | .395 | .145 | **.711**** | **.003** |
| text quality | **.748**** | **.001** | **.717**** | **.003** | **.787**** | **.000** |
| total words | -.114 | 685 | **.823***** | **.000** | .366 | .180 |
| characters per minute | **.561*** | **.030** | **.552*** | **.033** | **.518*** | **.048** |
| words per minute | .296 | .283 | **.535*** | **.040** | **.557*** | **.031** |
| P-burst length | **.600*** | **.018** | .431 | .109 | **.636**** | **.011** |
| pause time | **-.518*** | **.048** | -.471 | .077 | -.629. | .012 |

*Note.* Spearman's rho 2-tailed. ***Correlation is significant at the 0.001 level. **Correlation is significant at the 0.01 level. *Correlation is significant at the 0.05 level (1-tailed). Significant correlations are in bold type and grey shading.

We did not find any correlations between linguistic knowledge and other writing fluency measures: words per minute in French, or P-burst length in Turkish. We found a very marginal negative correlation ($r$ = -.52*, p= .048) between pause time and linguistic knowledge in French (not in Turkish or English). Below we discuss these findings in more detail.

## 8.5 Discussion

A quick summary of these lengthy results reminds us that:

- Turkish-French bilingual students' typing behaviour (based on our copy task measures) differs in the three languages of the study. Our bilingual learners type faster in dominant French than in heritage Turkish or L3 English.
- There are more differences in our 15 Turkish-French bilingual learners' writing processes between French, heritage Turkish and English as a foreign language, than between Turkish and English, their less-developed written languages.
- Our bilingual students wrote more fluently in dominant French than in heritage Turkish or L3 English.
- Pause behaviour varies during the writing process when our bilingual learners write in different languages depending on their knowledge of the language.
- The bilingual students' pause rate is lower in French (25 %) than in Turkish (48 %) or English (49 %).

- There was a marginal main effect of language on revision rates: with less revising in French– our bilinguals' more-developed written language than their heritage Turkish and L3 English.
- Significant correlations were found between writing process measures and text quality in the three languages. However, the correlated writing process measures vary depending on the language; similar correlations were found for Turkish and for English.
- There were significant positive correlations between linguistic knowledge and text quality as well as writing fluency (characters per minute) in all three languages of the study.

Our findings suggest that writing processes show similarities as well as differences between the three project languages, with similar differences as those found between L1 and L2 writing by other researchers (Breuer, 2019; Chenoweth & Hayes, 2001; Ransdell & Levy, 1996; Tiryakioglu et al., 2019). We also found L1 and L3 differences, as well as L2 and L3 differences for our bilingual learners. Overall, we found more differences between dominant French writing, and both heritage Turkish and L3 English, than between Turkish and English, our learners' less-developed written languages. This result confirms the hypothesis that automatization of language skills eases the text production in that language (Lindgren, 2004; McCutchen, 2000; Schoonen et al., 2003; Van Gelderen et al., 2011). For instance, our bilingual learners wrote more fluently with lower pause and revision rates in French than in Turkish or English. Our learners' writing in their native language (Turkish) is less developed than the dominant school language (French), because they have not received as much instruction in Turkish as in French, which is the language of daily education. They have been receiving instruction in Turkish for about an hour per week for seven years. Our results illustrate the theory the multilingual systems vary according to the instruction and learning context of each of the child's languages (Yang & Sun, 2015).

### 8.5.1 Typing speed (copy tasks)

Analyses of our *Inputlog* copy task measures reveal important differences between typing skill in our learners' L1, L2 and L3, but they correlate well with each other within the language, and between the three languages of production. Our bilingual learners are faster at typing both high- and low-frequency bigrams in all the word and sentence typing tasks in French than in Turkish or English. This result is due to their acquisition of literacy via French, starting from the nursery school years. They are not as familiar with typing high-and-low frequency bigrams in Turkish, even though it is their native/heritage language. These bilingual learners generally use Turkish in the oral modality, and have had less training in

written production, with only one hour a week of Turkish literacy training (which also includes oral and cultural work, of course).

We found in study 1 (Chapter 6) that the Selected Component Bigrams test in the copy task measures can be used to predict typing speed, which turns out to be similar for two linguistically languages such as French and English. However, this study shows knowledge of high frequency bigrams in one language predicts writing fluency in an unrelated language (in this case, Turkish). Knowing how to type in French might facilitate typing in English, but not typing in Turkish, since it is a Ural-Altaic language whose high frequency bigrams are completely dissimilar to French and English. Written Turkish is phonetic, that is, there is a much more transparent, one-to-one grapheme and phoneme correspondence, than either French or English. In addition, there are no *digraphs*, two alphabetic letters that spell a single sound. Therefore, typing a Turkish word may take less time than typing a French or an English word: for example, "*technological*", requires 13 characters in English, and the same number in French, "*technologique*"; Turkish requires only 10 characters to spell out the same number of phonemes, *teknolojik*. Despite this orthographic transparency, our bilingual students have apparently not developed their written production in Turkish as well as in French, as the high-frequency bigrams task reveals (Tiryakioglu & Hilton, 2018a). Furthermore, looking for the right key in Turkish slows them down a lot. English and French use the same alphabet–and they used the AZERTY keyboard for typing and writing the tasks in three languages. It is obvious that keyboard familiarity plays a big role here.

### 8.5.2 Writing fluency

Our bilingual writers show similarities and differences in descriptive and narrative text production in three languages, for various writing fluency measures (including pause and revision behaviour). In general, they wrote their French texts more fluently than either their Turkish or English texts (characters per minute, words per minute, P-bursts). *Inputlog* also captured fewer pauses and revisions (additions and deletions) during task completion in French.

However, this was not true for L3 English writing which is a less fluent process with more pauses at the threshold level (Leijten & Van Waes, 2006). That is to say, they produced fewer words per minute and characters per minute while composing L2/L3 texts than an L1 text (Chenoweth & Hayes, 2001; Lindgren, Sullivan, & Spelman Miller, 2008; Sasaki & Hirose, 1996; Schoonen et al., 2009; Silva, 1993; Van Waes & Leijten, 2015). We obtained the same

results from Turkish. Turkish writing is less fluent than French, although Turkish is their native heritage language; but more fluent than English writing since their English is less developed as a foreign language that is learnt at school.

However, more pauses in Turkish and English writing indicate that our bilingual writers' text production was less fluent than French, with more frequent and longer hesitations, and frequent revisions; and shorter P- bursts. Our analysis of the pause locations automatically tagged by *Inputlog* during these writing activities show that our bilingual writers made more within-word pauses in Turkish than in French and L3 English. I would expect the learners to be looking for keys in Turkish, since the keyboard is different from the other two languages. Pausing more at within-word locations in Turkish is probably at least partially connected with their unfamiliarity with the Turkish keyboard – they probably spent at least some of this time looking for the appropriate key which would also explain their lower fluency in typing high-frequency bigrams during the Turkish copy task (Tiryakioglu & Hilton, 2018a). Our learners produced proportionally more between-word pauses in French and English than in Turkish. This might be related to the fact that they generated less text in Turkish. Between-word pauses are hard to interpret. Révész et al. (2019) found that pausing more at between-word locations is concerned with lower-order writing processes: lexical retrieval and syntactic encoding. They also found that between-word pauses also reflect planning behaviour compared to pauses at within-word locations.

Our learners' make more frequent revisions (deletions and insertions) in Turkish (Stevenson, Schoonen & De Glopper, 2006; Thorson, 2000) and in L3 English than in French (Kowal, 2014; Yang, 2015). This could illustrate the fact that L2 and L3 formulating processes are more difficult than in the L1 (Schoonen et al., 2003, 2009, 2011; Silva, 1993). As Table 8.7 showed, there is a language effect only for the R-burst length revision measure. We expected that the more proficient the learner is at one language, the longer R-burst s/he has during writing of that language. What is interesting, is that despite our bilinguals' problems of typing in Turkish, they do not seem to have much need to go back over and make changes in the text once they wrote it. This would indicate that the within-word hesitations we found are indeed linked to keyboard issues, rather than encoding into Turkish. However, to our surprise, our bilingual learners produced slightly more text between revisions in Turkish than in French or English. Perhaps this is due to the transparent orthography of Turkish, with its one-to-one grapheme/ phoneme correspondences. This is also the learners' native language, and they would not have much trouble "translating" their ideas into string of words, but simply in

typing out the words they know with an unfamiliar keyboard for typing high frequency bigrams in Turkish.

### 8.5.3 Language knowledge

Our findings indicate that there is a relationship between linguistic knowledge (as measured by the learners' first-term grades in French, English, and Turkish) and composing processes in these languages, confirming findings from previous research (Chenoweth & Hayes, 2001; Lindgren, Sullivan, & Spelman Miller, 2008; Palviainen, Kalaja & Mäntylä, 2012; Spelman Miller et al., 2008). As linguistic expertise increases, the formulation process becomes more efficient; and attention (in working memory) can be devoted to the effective expression of meaning. Automatic activation of linguistic resources enables a writer to write more fluently, and to devote more attention to planning, and discourse organization and content.

Our results also show that knowledge of the language being used (as measured in the semester grades) appears to relate to or influence typing speed in French and English, but not in Turkish. This is an interesting finding, which raises the question of an individual's writing behaviour, and its contribution to overall expertise in the language: do the learners do better in French or English class because they type better? Or do they type better because they have better general language skills? Our study does not enable us to answer these questions. We do note, however, the positive significant correlation between linguistic knowledge and text quality in all three languages. Again, higher language proficiency probably enables a writer to "transcribe" her ideas more automatically (lexical, and grammatical encoding, spelling), leaving cognitive resources free for higher-level issues of content and its organisation – which are reflected in the holistic text quality score as well as analytical scores which show strong correlations within each language and between French and English.

### 8.5.4 Text quality

With our text quality rating scales, we were able to compare text quality directly in the three languages as in Tillema (2012). Text quality was rated higher in Turkish than French, which confirms other findings that native speakers provide lower ratings to L1–texts (Shi, 2001). Our French raters appeared to be relatively demanding in their rating of these non-native learners' texts; the Turkish and English raters appeared more indulgent, probably hoping to encourage writing behaviour (even though these assessments were not shown to the learners, of course).

Significant correlations between writing process measures and text quality in three languages shows that, logically enough, the faster a bilingual writer types on the computer, the more fluently s/he produces the text: "high typing skill allows the concurrent activation of writing processes, while low writing skill does not" (Alves, Castro & Olive, 2008, p.972). But this fluency is also associated with better text quality in the language concerned. So, again we see the possible connection between faster typing skill, writing fluency, and better text quality in French. We did not find significant correlations between text quality and any of pause and revision behaviour in French writing. Perhaps better typing skill directly influences writing fluency (although the contribution of language knowledge needs to be analyzed as well), which in turn affects text quality. If a writer is more comfortable with the dactylographic and linguistic aspects of writing (the lower-level processes), she seems more able to think about the content and organization of her text.

Therefore, P-burst length is an important predictor of both writing process and product quality (Baaijen et al., 2012; Chenoweth & Hayes, 2001) in multilingual writing, and we did indeed find high positive correlations between P-burst length and writing fluency (characters per minute, word per minute) in text production in all the project languages; we also found high positive correlations between P-burst length and text quality measures in all the three languages. P-burst appears therefore to be a powerful indicator of writing fluency, and can be adopted in future studies on writing processes.

# Chapter 9: Results of study 3

In our third study, we will look at the relationship between learner characteristics (linguistic knowledge, typing speed), writing processes (writing fluency, pause and revision behaviour) and text quality for our French monolingual (n = 13) and bilingual (n = 17) learners in L1/dominant French and L2/L3 English writing. As stated in Chapter 4, Section 4.2, our bilingual learner group consists of 15 Turkish-French bilingual learners and 2 other (Arabic-French) bilingual learners. In this section, we will analyze three of the data sets that we collected from the initial study to answer our research questions: (1) keystroke loggings, (2) text quality data, and (3) first term school averages in French and English. Our analysis will focus on the significant results.

Initial analyses of this data showed no significant difference in L1/dominant language writing (French) processes and copy task measures in both languages between our mono- and bilingual writers; we will not, therefore, present the details of these findings here (see Table a and b in Appendix U for the descriptive and Mann-Whitney comparisons for both writing tasks in L1 French writing); only key results related to our Chi-square analyses will be discussed. Furthermore, we will not present the results comparing the descriptive and narrative tasks, since our main focus is on language related differences between our monolingual and bilingual writers and also we have already presented the results from task differences in Chapter 6 (see Section 6.4 for our whole-group results and analyses). In this chapter, we will be focusing on the differences in L2/L3 English text production by monolingual and bilingual writers.

In the comparisons that follow, we performed non-parametric Mann-Whitney's U and Chi-square tests, since our sample is small, and some of the data are not normally distributed. We also looked at pause and revision rates per 100 words.

## 9.1 Results of linguistic knowledge in French and L2/L3 English

Table 9.1 gives the descriptive statistics, showing that our monolingual learners' median first-quarter school averages in French are higher than the bilinguals. Mann-Whitney comparisons show that the difference in French school marks between these two subgroups is significant (monolinguals: *Mdn* = 15.19; bilinguals: *Mdn*= 12.78, z = -2.34, p < .019*). The difference in median school averages in L2/L3 English is not significant (monolinguals: *Mdn* = 11.87; bilinguals: *Mdn* = 12.23, z = -1.109, p=.267). It could be that if the monolinguals are "better

in French" (according to their term grades), they may outperform the bilinguals in our French writing tasks. We will analyse these results in the following section.

Table 9.1 Descriptive statistics for first-quarter school averages for both L1/dominant language and L2/L3 comparing monolinguals and bilinguals

| | **monolinguals** | | | | | | **bilinguals** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Mean** | **SD** | **Median** | **Range** | **Min** | **Max** | **Mean** | **SD** | **Median** | **Range** | **Min** | **Max** |
| French | 14.70 | 2.99 | 15.19 | 9.08 | 9.21 | 18.29 | 12.08 | 2.99 | 12.78 | 9.56 | 6.14 | 15.70 |
| L2/L3 English | 13.39 | 3.64 | 11.87 | 10.37 | 9.11 | 19.48 | 11.36 | 3.90 | 12.23 | 13.87 | 3.51 | 17.38 |

*Note. SD* (Standard Deviation). L1: French. L2/L3: English. The grading scale is a twenty-point system in France (minimum 0, maximum 20).

Table 9.2 shows correlations between the first-term school averages for L1 French and L2/L3 English and overall text quality scores for our sub-group learners in our French and English writing activities.

Table 9.2 Correlations between first-term school average and text quality scores in L1/dominant French and L2/L3 English writing for comparing monolingual and bilingual sub-groups

| | **overall text quality scores** | | | |
|---|---|---|---|---|
| | monolinguals | | bilinguals | |
| | Correlation Coefficient | Sig. (1-tailed) | Correlation Coefficient | Sig. (1-tailed) |
| French grades | .475 | .051 (m) | **.714**** | **.001**** |
| English grades | **.767**** | **.001**** | **.818***** | **.000***** |

Spearman's rho 1-tailed. *** Correlation is significant at the 0.000 level. ** Correlation is significant at the 0.001 level. * Correlation is significant at the 0.01 level. Significant correlations were in bold.

This table shows strong correlations between language knowledge and text quality scores for second- and third-language writing: English for the monolinguals, French and English for the bilinguals (for whom French is a second – although possibly dominant – language. That is, higher L2 linguistic knowledge is associated with better text quality for both sub-groups, but we only see a very weak (marginal) correlation between the school average for French and the French text quality scores – written in the monolingual learners' native language.

## 9.2 L1 dominant language French writing

An investigation of between-group differences (monolinguals and bilinguals) in the frequency of occurrence of pauses, total number of words produced and different types of pause locations has been carried out, using Chi-square tests in their L1 dominant language French (along the lines of Hilton, 2008). Our results demonstrate that although our

monolingual learners wrote more words than bilingual learners in both the descriptive (monolinguals: *Mdn* = 105; bilinguals: *Mdn* = 83) and narrative tasks (monolinguals: *Mdn* = 120; bilinguals: *Mdn* = 107) in French, the difference was not significant, p=.276 (see Table a and b in Appendix U). Chi-square analysis of the total number of words produced (both tasks combined) does not show a significant difference in productivity between monolinguals and bilinguals: $\chi^2$ (6243, 1) = 0.01, p= .920 (Table 9.3).

Table 9.3 Chi-square test results for the number of words for both tasks in L1/dominant French comparing monolingual and bilingual sub-groups

| | total number of words descriptive task | total number of words narrative task |
|---|---|---|
| monolingual writers | 1223 | 1693 |
| bilingual writers | 1391 | 1936 |

$X^2$(6243, 1) = 0.01, p=.920

We also ran a Chi-square test on the total number of long pauses (≥2000 ms) recorded for both tasks (descriptive and narrative) in French (Table 9.4). As the table (and reported Chi-square value) shows, the proportion of the total number of long pauses produced by the mono- and bilingual learners during our writing activities does not differ according to group.

Table 9.4 Chi-square test results for the number of pauses for both tasks in L1/dominant French comparing monolingual and bilingual sub-groups

| | total number of pauses (descriptive task) | total number of pauses (narrative task) |
|---|---|---|
| monolingual writers | 226 | 349 |
| bilingual writers | 294 | 477 |

$X^2$(1346, 1) = 0.14, p=.708

There is, however, a significant difference between our learner sub-groups in the distribution of all pauses (greater than 200ms) in our writing tasks. Table 9.5 presents the raw numbers of pauses observed, at the two locations retained for analysis – within or between words.

Table 9.5 Chi-square results for within-word and between-word pauses for both tasks in L1/dominant French comparing monolingual and bilingual sub-groups

| | total number of within-word pauses (both tasks) | total number of between-word pauses (both tasks) |
|---|---|---|
| Monolingual writers | 6194 | 2999 |
| Bilingual writers | 7685 | 3460 |

$X^2$(20338, 1) = 5.71, p<.01**

The Chi-square values reported just below the table show that the distribution of pauses is different in the monolingual and bilingual learners' text production; post-hoc analysis shows that the bilingual learners produced proportionally more within-word pauses in French writing.

## 9.3 Comparisons for monolingual and bilingual students' L3 English writing

Having found few differences in writing processes in French for our two learner groups, we now turn to their writing behavior in L2/L3 English. An initial set of analyses shows that writing behavior was not the same for the descriptive and the narrative tasks, and we will therefore present these results separately.

Table 9.6 Comparisons for writing process measures for the descriptive task in L2/L3 English writing (medians, minima, maxima, and Mann Whitney U test) between monolinguals and bilinguals

| | | monolingual (n=13) | | | bilingual (n=17) | | | Mann Whitney *U* | *Z* value | P value |
|---|---|---|---|---|---|---|---|---|---|---|
| line | writing process measures | Median | Min | Max | Median | Min | Max | | | |
| 1 | process time | 5.41 | 4.23 | 7.36 | 6.02 | 3.35 | 8.21 | 93.000 | -.733 | .464 |
| 2 | number of words | 55 | 31 | 93 | 54 | 8 | 93 | 107.000 | -.147 | .883 |
| 3 | characters per minute | 52.02 | 31.15 | 93.58 | 45.75 | 9.88 | 74.55 | 97.000 | -.565 | .572 |
| 4 | words per minute | 9.60 | 6.23 | 19.12 | 9.59 | 1.72 | 15.02 | 103.000 | -.314 | .754 |
| 5 | P-Burst length | 15.12 | 5.16 | 24.17 | 8.34 | 6.46 | 18.66 | 86.500 | -1.005 | .315 |
| 6 | pause time in minutes | 2.24 | 1.13 | 3.40 | 2.34 | 1.22 | 5.28 | 84.000 | -1.110 | .267 |
| 7 | number of pauses | 25 | 17 | 32 | 24 | 6 | 36 | 98.000 | -.524 | .600 |
| 8 | number of within-word pauses | 107 | 60 | 221 | 108 | 24 | 241 | 110.000 | -.021 | .983 |
| 9 | number of between-word pauses | 71 | 31 | 90 | 58 | 7 | 93 | 105.500 | -.209 | .834 |
| 10 | number of revisions | 46 | 25 | 79 | 37 | 3 | 81 | 64.000 | -1.947 | .052 (m) |
| 11 | R-Burst length | 8.73 | 6.40 | 23.40 | 11.94 | 7.07 | 19.00 | 62.000 | -2.030 | .042m |
| 12 | ratio | .800 | .576 | .900 | .887 | .559 | .978 | 63.000 | -1.988 | .047m |

*Note.* m= marginal difference. The marginal results were highlighted in light grey.

Table 9.6 shows comparisons for writing process measures for the descriptive task in L2/L3 English writing (medians, minima, maxima, and Mann-Whitney's U) between our monolingual and bilingual sub-groups. We found no significant between-group differences for the writing process measures in lines 1-9 (measures of productivity and writing fluency),

but we did find a marginal difference in revision behaviour and process-product ratios (lines 10-12). Line 10 shows that number of revisions is marginally different between monolinguals and bilinguals. Line 11 shows that our learners' R-burst length (number of characters between revisions) is marginally shorter for monolinguals (about 9 characters) than bilinguals (just under 12 characters) in the L2 descriptive task. Line 12 also shows a marginal difference in product/process ratio for the sub-groups, with bilinguals showing slightly higher ratio productivity (.89) than monolinguals (.80).

Table 9.7 Comparisons for writing process measures for the narrative task in L2/L3 English writing (medians, minima, maxima, and Mann Whitney U test) between monolinguals and bilinguals

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | **monolingual (n=13)** | | | **bilingual (n=17)** | | | **Mann Whitney *U*** | ***Z* value** | **P value** |
| **line** | **writing process measures** | **Median** | **Min** | **Max** | **Median** | **Min** | **Max** | | | |
| 1 | process time | 8.13 | 6.15 | 13.32 | 5.43 | 3.50 | 7.49 | 9.000 | -4.248 | .000*** |
| 2 | number of words | 86 | 43 | 123 | 55 | 26 | 103 | 56.500 | -2.262 | .024 m |
| 3 | characters per minute | 43.83 | 29.95 | 65.05 | 51.71 | 25.25 | 87.24 | 88.000 | -.942 | .346 |
| 4 | words per minute | 8.61 | 6.33 | 12.51 | 10.77 | 4.85 | 17.62 | 82.000 | -1.193 | .233 |
| 5 | P-Burst length | 12.21 | 6.10 | 23.27 | 11.15 | 4.71 | 19.27 | 102.000 | -.356 | .722 |
| 6 | pause time in minutes | 4.10 | 1.13 | 6.30 | 3.08 | 1.22 | 4.16 | 59.000 | -2.156 | .031 |
| 7 | number of pauses | 38 | 11 | 58 | 27 | 11 | 39 | 52.500 | -2.431 | - |
| 8 | number of within-word pauses | 207 | 102 | 289 | 128 | 55 | 260 | 51.500 | -2.470 | - |
| 9 | number of between-word pauses | 88 | 11 | 122 | 62 | 27 | 109 | 68.000 | -1.780 | - |
| 10 | number of revisions | 72 | 40 | 115 | 31 | 19 | 83 | 22.500 | -3.687 | - |
| 11 | R-Burst length | 9.64 | 5.30 | 24.00 | 13.04 | 4.50 | 22.30 | 65.000 | -1.904 | .057 |
| 12 | ratio | .798 | .644 | .888 | .880 | .703 | .942 | 51.500 | -2.471 | .013* |

*Note.* *$p$ < .01. **$p$ < .001. ***p<.0001, marginal effect $p$<.05. m= marginal difference. The significant results were highlighted in light grey.

Table 9.7 presents writing process measures for our second, narrative task in L2/L3 English writing, for our monolingual and bilingual sub-groups (medians, minima, maxima, and Mann-Whitney's U). We see more significant between-group differences for this more complicated task (the seven lines that have been highlighted). The Mann-Whitney

comparisons in column 9 show significant differences in total writing process time and total number of words produced during the narrative task; these basic differences in productivity naturally lead to significant differences in the dependent phenomena of total pause time and numbers of pauses, number of within-word pauses, number of revisions and the product/process ratio in L2 narrative writing between these two groups.

Since one of the sub-groups spent more time on the task – and produced more words – this automatically means that all the other measures are going to be different, since they all depend either on the time allotted to the task, or the number of words produced (Table 9.7), or both. Because of this difference, we will present rates and Chi-square test results for these measures.

### 9.3.1 Pause behaviour

Since we found a significant difference in total writing process time in the L2 narrative task, we calculated pause rate by considering the number of pauses per 100 words for each writer. Table 9.8 shows rates of pausing and revision for both tasks combined in French and English writing; we did not find any significant differences between our learner sub-groups for the pause and revision rate measures in French writing. However, we found significant differences between our learner sub-groups for the revision rate measures in English writing (p<.011*).

Table 9.8 Mean pause and revision rates per 100 words between French and L2/L3 English writing

| writing process measures | French | | *p* value | English | | *p* value |
|---|---|---|---|---|---|---|
| | monolinguals | bilinguals | | monolinguals | bilinguals | |
| long pause rate | 21 | 24 | .391 | 47 | 50 | .601 |
| revision rate | 59 | 59 | .601 | 88 | 67 | .011* |

*Note*. * p<.01. Combined tasks (descriptive and narrative). The significant results were highlighted in light grey.

Chi-square analysis of numbers of disfluent pauses (≥2000 ms) in Table 9.9 shows a significant task effect for our monolingual and bilingual sub-groups. Post-hoc analyses (Kruskal Wallis Test) show that the monolingual writers produced proportionally fewer pauses in the descriptive task and more in the narrative task in English. However, the difference is significant only for the narrative task (p<.015).

Table 9.10 compares pause location (within-word, between-word), and finds a significant task effect on pause distribution. Post-hoc analyses show that our bilingual learners produced

proportionally more within-word and fewer between-word pauses than monolinguals in L2/L3 English writing (for both tasks).

Table 9.9 Chi-square test results for the number of pauses in both English tasks for learner sub-groups

| | total number of pauses descriptive task | total number of pauses narrative task |
|---|---|---|
| monolingual writers | 317 | 483 |
| bilingual writers | 427 | 453 |

$X^2(1680, 1) = 13.049, p<.0003^{***}$

Table 9.10 Chi-square results for within-word and between-word pauses in both English tasks for learner sub-groups

| L2/L3 English | total number of within-word pauses (both tasks) | total number of between-word pauses (both tasks) |
|---|---|---|
| Monolingual writers | 4101 | 1864 |
| Bilingual writers | 4257 | 1071 |

$X^2(11293, 1) = 181.24, p<.0001^{***}$

We also looked at pause locations for each learner group, comparing their productions in French and in English. Table 9.11 shows the data and Chi-square values for the monolingual learners, and Table 9.12 shows this information for the bilingual learners. The post-hoc analysis shows that monolinguals produced proportionally more within-word and between-word pauses in French writing than in English writing; however, the differences are not significant ($p<.07$). This is logical since monolinguals produced more text in French writing than in English writing.

Table 9.11 Chi-square results for pause location (both tasks, both languages) for the monolingual sub-group

| monolingual learners | within-word pauses (both tasks) | between-word pauses (both tasks) |
|---|---|---|
| French texts | 6194 | 2999 |
| English texts | 4101 | 1864 |

$X^2(15158, 1) = 3.07, p<.07$

In Table 9.12, Chi-square tests comparing the location of hesitations (within-word and between-word pauses at threshold level of ≥200 ms) produced by the bilinguals reveal that the proportions of hesitations at these two locations differ among bilinguals in French and L2 English writing (both tasks combined). The post-hoc analysis shows bilinguals produced proportionally more within-word and between-word pauses in French writing than in English writing and the differences are significant ($p<.0001$). This indicates bilinguals' difficulty in lexical retrieval processes in their schooling/dominant language.

Table 9.12 Chi-square results for pause location (both tasks, both languages) for the bilingual sub-group

| bilingual learners | within-word pauses (both tasks) | between-word pauses (both tasks) |
|---|---|---|
| French texts | 7685 | 3460 |
| English texts | 4257 | 1071 |

$X^2(16473, 1) = 215.97, p<.0001$***

### 9.3.2 Revision behaviour

Going back to Table 9.5, we can look more closely at differences in revision behaviour in our two learner sub-groups. Line 11 shows that there was a slight marginal difference in median characters per minute of Revision-bursts between monolingual and bilingual students in English narrative writing. Line 12 shows that there was a significant difference in product/process ratio in L2 narrative writing between monolinguals and bilinguals, although monolingual learners producing more texts; median total number of the words written by the monolinguals: 86 words; bilinguals: 55 words.

For further investigation, we calculated a revision rate (number of revisions per 100 words) for both French and L2/L3 English writing (both tasks combined) (see Table 9.8). The Mann-Whitney test shows that in French writing (both tasks combined); there was no significant difference in revision rate between monolinguals and bilinguals. However, revision rate was significantly higher among monolinguals (88 %) than bilinguals (67 %) in L2/L3 English writing, which is an interesting result. This difference might be explained by task perception differences between the sub-groups. It could be possible that monolinguals might have perceived the task more importantly than bilinguals, so spent more time to revisions during text production in English. Another explanation could be the fatigue on the part of bilinguals, who had to perform each task three and not two times compared to their monolingual peers.

## 9.4 Results of text quality in French and L2/L3 English

We found no significant differences in text quality scores (holistic or analytical) obtained for the French texts (descriptive, narrative) written by our mono- and bilingual writers. Nor were there significant differences in the holistic or analytical text quality scores for their English descriptive texts. However, we found significant differences in analytical text quality scores (measured as content, organization and language use) in English narrative writing between our monolinguals and bilinguals (Table 9.13). Therefore, we will only report these significant results here. The clearest effect is that monolingual writers are better at text organization,

which is very interesting, especially in light of the fact that they revised more. The two other measures (content and language use) are only marginally different.

Table 9.13 Comparisons for analytical text quality scores for the narrative task in L2/L3 English writing (Mean, standard deviation and *t* test) between monolinguals and bilinguals

| analytical text quality criteria | Language profile | Mean | SD | *t* | p value |
|---|---|---|---|---|---|
| content[a] | monolingual | 5.54 | 2.43 | 2.448 | .021m |
| | bilingual | 3.76 | 1.52 | | |
| organization[a] | monolingual | 5.62 | 2.29 | 2.786 | .009** |
| | bilingual | 3.59 | 1.70 | | |
| language use[a] | monolingual | 4.77 | 2.00 | 2.384 | .024m |
| | bilingual | 3.24 | 1.52 | | |
| analytical overall score[b] | monolingual | 15.92 | 6.65 | 2.611 | .014* |
| | bilingual | 10.59 | 4.54 | | |

*Note.* [a]: min=2, max=8. [b]: min=6, max=24. *$p < .01$. **$p < .001$. m=marginal effect $p<.05$.

Finally, our monolingual learners' overall analytical text scores (sum of content, organization and language use criteria) were significantly higher than bilinguals in L2 narrative text production (Table 9.13). And the significant difference in overall analytical score is therefore doubtless due to the bigger difference in organisation on writing tasks (see Chapter 10). We will discuss these findings below in the light of writing research.

## 9.5 Discussion

Our results show that the major differences in monolingual and bilingual text production concern productivity, pause location and revision behaviour. We found more differences between monolinguals and bilinguals in L2/L3 English writing than in French writing. Our monolingual learners produced significantly more numbers of words in their EFL writing. However, we did not find significant differences in typing speed and writing fluency (characters per minute, words per minute and P-burst length) between monolinguals and bilinguals either in L1 French or L2/L3 English writing. So, the monolinguals either took the L2 writing task “more seriously” than the bilinguals, or they had more to say, for reasons we have not yet explored.

Our bilingual subgroup also produced proportionally more within-word and between-word pauses than the monolingual writers in French. It is difficult to interpret the pauses during writing (Leijten et al., 2019; Spelman Miller, 2006). So, pauses can be interpreted in different ways to underlie the cognitive processes (e.g. Alves et al., 2008; 2009; Olive et al., 2009; Chenu et al., 2014; Leijten & Van Waes, 2013; Schilperoord, 1996; Spelman Miller, 2006). Galbraith and Baijen (2019) put forward that:

> [a] pause can reflect a multiplicity of processes, from higher level reflection about the global structure of the text, through planning of an individual sentence, to struggling with the spelling of a word. (p. 322)

During pauses, writers can do anything (apart from mere transcription; Latif, 2012): global planning, word retrieval and metalinguistic reflection, conceptual reflexion, sentence planning, text evaluation or organization; they may even be thinking about other things than the text. Foulin (1998, cited in Olive, 2011, p. 63) also suggests that pauses between paragraphs[16] are concerned with conceptual and global planning and organization of ideas; pausing at between-word locations might be related to difficulties in lexical retrieval or grammatical encoding. Research with eye-tracking methods (Révész et al., 2019, p.26) found similar results that "pauses between words tended to involve looking back at shorter textual units and engaging in lower-order writing processes including lexical retrieval and syntactic encoding". The higher number of between-word pauses by our bilingual subgroup may be a consequence of the fact that their second-language (French) and third language lexicons are slightly smaller than their monolingual counterparts, since they divide their language use time between two languages out of school (Bartolotti & Marian, 2012), and three languages in school. This explains the monolinguals' higher first-term school averages in French, and confirms the monolinguals' higher L1 proficiency and automatization, as previous research has also found (Schoonen et al., 2003). Regarding the automatization of language production, Hilton (2011a, p. 248) suggests that "[t]he lexical encoding of conceptual information is largely automatic in L1 speech, and much more frequently effortful – an explicit process -- in a less familiar language". In this respect, morphological processes, such as checking the spelling of the word, during pauses may be linked to lexical retrieval processes of inflectional rules from declarative knowledge (Hilton, 2011a) since writers or speakers "focusing on lower-level processes have less working memory capacity available to monitor discourse construction" (Hilton, 2011a, p. 250).

However, our monolingual sub-group produced more within-word pauses in English narrative writing than the bilingual sub-group. This is an interesting indication of possible differences in the L2 and L3 writing processes. Leijten et al. (2019, p. 88) suggest that within-word pauses seem to be "associated with low-level operations such as spelling and lexical decision making which is more complex in L2". Our writers seem to pause word

[16] *Inputlog* also provides pauses between the sentences and paragraphs. However, in this study we did not project to look at these types of pause locations since the students were asked to produce at least four sentences in the descriptive task. We assumed that we could not obtain sufficient information related to that pausing behaviour from the low quantity of students' texts.

internally to correct their spelling/typing mistakes in EFL writing, which they also mentioned frequently in the stimulated recall interviews (Chapter 10). During within-word pauses, they seem to be engaged in retrieving spelling and/or morphosyntactic encoding. Linnemann (2019, p. 342) states that "correcting more typing errors can mean less control of the process. A [...] control at the level of characters would probably bring the writing process to a halt." For instance, writers with reading and writing difficulties produce more within-word pauses than the control group (Wengelin et al., 2019).

Not only were our bilingual writers less productive in the English tasks, but they were also less careful writers, revising less frequently, as the significantly different “R-burst” measure and revision rates show. What, exactly, are revisions a sign of? L2 writing research considers revisions to provide information on the underlying cognitive processes during text production (Chenoweth & Hayes, 2001; Lindgren, 2004; Lindgren, 2005; Schoonen et al., 2009; Stevenson et al., 2006). A revision in writing may illustrate a greater capacity to manage the metalinguistic aspects of the writing process – or exactly the opposite. Our bilinguals may not be paying close attention to the details of their English expression (proof that they are less engaged, metalinguistically, than the monolingual writers); or they may have more automatic text generation processes. It seems debatable to say that longer R-bursts illustrate better working memory capacity (Chenoweth & Hayes, 2001; Stevenson et al., 2006; Spelman Miller, 2006), even though this would corroborate research pointing to better executive function in bilinguals (Bialystok, 2009). However, Hilton (2011b; 2014) concluded that higher rates of restarts in more advanced L2 (and in L1) speaking illustrates the availability of greater attentional capacity available for adapting the ongoing message for the listener; lower-level learners struggling with formal encoding repeat and perform formal reformulations, but revise their syntactic or semantic plans less frequently.

Our findings demonstrate that our bilingual learners' text quality was not different from that of monolinguals in L1 French (both tasks) or in the English descriptive task, but it did differ for English narrative writing. Our bilinguals' content development, organization and language use in L2/L3 English narrative writing were found to be of lower quality than our monolinguals. Our monolingual writers produced texts that were judged to be more well-organized (both in French and in English) than the bilingual writers’ texts. This result is in line with the result of Schoonen and colleagues (2003) to some extent who found that bilingual (Turkish-Dutch and Moroccan-Dutch) grade 8 students produced significantly poorer quality texts in the L1 Dutch and L2 English. Stevenson and colleagues (2006) also

found that the bilingual students produce somewhat poorer quality texts in both languages. In these studies, bilinguals were rated as displaying poorer text quality in both L1 and L2 writing. However, our bilingual learners showed poorer performance only in L2/L3 English narrative writing. It is very interesting that despite much shorter texts, the L2/L3 text quality is considered to be equal. In what way/ how are these much shorter texts (almost half as long) be able to communicate as much meaning/ as much of the story? We could argue that the L2/L3 English raters might have attributed higher marks for their L2/L3 texts, due to a policy of motivation grading strategies (encouraging, rather than discouraging written production).

# Chapter 10: Results from questionnaires and stimulated recall data

This chapter reports the results from a series of pre-/post-writing questionnaires to obtain information related to our students' learner characteristics: *Student Writing Profile Questionnaire*, *Post-writing Questionnaire* in three languages, the *Student Motivation for English*, and the *Student Motivation for Turkish*. It also reports the results from our stimulated recall data with a small subset of volunteer subjects.

As reported in Chapter 4, we designed our *Student Writing Profile Questionnaire* based on Bosredon (2014) and Hilton's Seine & Marne Primary project (Hilton et al., 2016), to obtain information related to students' perceptions of their own writing behaviour, notably their general writing activities in their dominant language French. The items in this questionnaire attempt to reflect the students' attitudes towards writing in and out of school: writing habits, their approach to writing, types of texts they write, tools they prefer to write with, etc. (see Section 5.3.3 and Appendix C). We gave scores between -1 to 3 to each answer, and then calculated the sum of the scores to reflect writing activity. This overall score ranged from 4 to 23, with a median of 12.25; higher scores are interpreted as reflecting a more active writing profile. In the first section below, we report the results from comparison of expert and less-expert groups in French and English.

The *Post-writing Questionnaire* was administered in each of the project languages, immediately after the narrative writing task, to assess our students' attitudes towards the project writing tasks. Responses to a set of nine items were registered on a likert scale, ranging from "I don't agree" to "I totally agree" with 1 to 3 points for each answer. These responses were summed into one overall score for each learner. Higher scores are associated with a more positive appreciation of the narrative writing experience, language by language. We used the results from the *Post-writing questionnaire* to correlate with writing process measures in the three project languages.

We also developed a *Student Motivation for English Questionnaire* to obtain information about the students' motivation towards learning English as a foreign language (see Appendix D). Answers were also indicated on a three-point likert scale (from "I don't agree" to "I totally agree"), in response to each of 16 questions, and scored between 1 to 3 points each. We summed all the points into one overall score representing each learner's level of motivation for learning and using English; higher scores are interpreted as reflecting greater motivation

for learning English. The *Student Motivation for Turkish* questionnaire is essentially the same instrument, adapted for Turkish as a heritage language (see Appendix E). It was used to probe the bilingual students' motivation to learn more about their heritage language Turkish. The assessment of this questionnaire is similar to the *Student Motivation for English* questionnaire. We used the results from our motivation questionnaires to correlate with writing process measures in Turkish and English.

## 10.1 Results from pre- and post-writing questionnaires

Table 10.1 shows the descriptive statistics for the pre- and post-writing questionnaires that were completed by our 30 middle-school learners in French and English (Turkish results from 15 Turkish-French bilinguals). The first column reflects the group average for the sum of the scores in each questionnaire. Line 1 shows our learners' writing profile results ranging from 4 to 23 with a median of 12.25. Lines 2-4 show our writers' post-writing perceptions in the narrative task of the three languages. The Friedman test results show significant differences in our learners' post writing perceptions of narrative writing in French, English and Turkish (Fr: *Mdn* = 22.00; En: *Mdn* = 20.00; Tr: *Mdn* = 23.00, respectively, $\chi 2(2) = 13.32$, $p<.001$). Our writers' perceptions of their French narrative writing are more positive than their perceptions of English narrative writing, based on the overall questionnaire scores. Since English is a foreign language at school, these teenage learners perceived the L2/L3 English writing activity as being slightly more difficult or stressful than French and Turkish writing. Our Turkish-French bilinguals' post-writing perceptions of the Turkish task are even more positive than the whole group's post-writing perceptions of the French and English narrative tasks. These learners perceive the Turkish narrative task easier than the French and English narrative tasks.

Table 10.1 Descriptive statistics for writing profile, post-writing perceptions in narrative writing in French, Turkish and English and motivation for learning English and Turkish

| | | median | range | min | max | mean | SD |
|---|---|---|---|---|---|---|---|
| writing profile | | 12.25 | 19 | 4 | 23 | 12.20 | 4.46 |
| Post-writing perception | FR | 22.00 | 19 | 7 | 26 | 21.50 | 3.89 |
| | EN | 20.00 | 23 | 7 | 30 | 19.03 | 5.48 |
| | TR | 23.00 | 9 | 18 | 27 | 22.73 | 2.63 |
| Motivation for language learning | EN | 31.50 | 28 | 14 | 42 | 31.30 | 7.47 |
| | TR | 41.00 | 16 | 32 | 48 | 41.73 | 4.17 |

Lines 5-6 in Table 10.1 show the group averages for the sum of the scores in motivation for learning English and Turkish, ranging from 14 to 42 with a median of 31.50 in English; and

ranging from 32 to 48 with a median of 41 in Turkish. Wilcoxon Signed Rank tests show a significant difference in motivation for learning English and Turkish: Z= -3.099, p<.002. This result seems to suggest that our Turkish-French bilingual learners are more motivated to learn their heritage language Turkish than their L3 English. We also ran Spearman correlation tests for all these measures in Table 10.1 and found only one marginal correlation between motivation for learning English and post-writing perception in English writing among our focus group learners: (*r*= .40m, p< .029). This indicates that when learners are more motivated for learning English, they perceive the narrative writing task in English as easier. Overall, we can conclude that our writing data does not seem to be too heavily influenced by the learners' perception of the task.

### 10.1.1 Comparison of expert and less-expert writing groups

Scores from the *Writing Profile* questionnaire were used to identify two new sub-groups for our data analyses: 15 learners reporting less writing behaviour outside class (with scores ranging from 4-12 points on the questionnaire) and 15 learners reporting more writing behaviour (scores from 13-23 points on the questionnaire): we will call them our "less-expert" and "more-expert" writer sub-groups. Table 10.2 shows Independent Samples T Test comparisons of the expert and less-expert writers, for various production and fluency measures in our writing data. We only included in this table the writing process measures that are significantly different for the writing sub-groups.

Table 10.2 Comparison of writing process measures between expert and less-expert subgroups in French and English

| | **less expert writers** | | **more expert writers** | | | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | *t* | *p* |
| **French descriptive task** | | | | | | |
| number of total words | 75.40 | 23.9 | 98.87 | 18.16 | -3.026 | .005 |
| characters per minute | 82.35 | 26.92 | 107.60 | 20.68 | -2.881 | .008 |
| words per minute | 15.28 | 4.60 | 19.97 | 3.49 | -3.151 | .004 |
| between-word pauses | 78.67 | 23.08 | 99.67 | 20.27 | -2.648 | .013 |
| **French narrative task** | | | | | | |
| characters per minute | 74.08 | 13.52 | 90.07 | 21.77 | -2.415 | .023 |
| words per minute | 13.48 | 2.38 | 16.27 | 4.38 | -2.167 | .039 |
| Pause-bursts | 21.17 | 5.16 | 29.42 | 10.65 | -2.699 | .012 |
| **English descriptive task** | | | | | | |
| writing process time | 4.85 | .757 | 6.18 | 1.00 | -4.074 | .000 |

Table 10.2 shows us that learners who report more time writing outside of school also demonstrated more fluent and productive writing (longer descriptive texts) in our French writing tasks, with higher writing speeds and longer pause-bursts. It is interesting to note that the writer's expertise seems to play a stronger role in the descriptive task than the narrative task, where the group differences are marginal. It is also interesting that the expert writers' tests were not judged more favourably than their less-expert peers': there is no difference between the two groups on the text quality scores.

Reported writing behaviour outside of class did not appear to give much of an advantage in foreign-language writing, since we found only one significant difference between expert and less-expert writers: the amount of time spent on the descriptive writing task in English, with more time spent by the more expert writers (on might have imagined that less-expert writers would require more time). As we observed during data collection, the less-expert writers seemed to "give up" before the time allotted for the activity had expired, perhaps due to a lack of inspiration, or of the linguistic means to express more ideas. This type of behaviour was not observed for the narrative task, where we also found no sub-group differences for the productivity and fluency measures.

***Writing expertise and typing skill***

Table 10.3 shows the copy task results for the writing expertise sub-groups. There are only very marginal differences between the two writing groups on the French copy task measures, but not in any of the English copy task measures. The more expert writers typed faster in French than their less-expert peers, but this was not the case when they were typing in English.

Table 10.3 Comparison of copy task measures between expert and less-expert groups in French and L2 English

| | **less-expert writers** | | **expert writers** | | | |
|---|---|---|---|---|---|---|
| **French copy task** | Mean | SD | Mean | SD | *t* | *p* |
| targeted bigrams | 191.33 | 36.16 | 222.87 | 38.13 | -2.324 | .028 |
| high frequency bigrams | 197.87 | 36.94 | 228.93 | 39.40 | -2.228 | .034 |
| selected component bigrams | 190.20 | 37.05 | 222.27 | 37.60 | -2.353 | .026 |
| **English copy task** | | | | | | |
| targeted bigrams | 177.00 | 30.62 | 196.07 | 39.59 | -1.476 | .151 |
| high frequency bigrams | 176.27 | 33.42 | 199.80 | 38.41 | -1.790 | .084 |
| selected component bigrams | 174.67 | 33.86 | 198.27 | 35.74 | -1.857 | .074 |

### 10.1.2 Correlation results from pre-/ post-writing questionnaires

We also looked at the relationship between the students' writing profile, the writing process and productivity measures recorded by *Inputlog* for the narrative task, and the post-writing perceptions for all of the project languages. Table 10.4 presents the results for French, where the post-writing questionnaire scores did not correlate with any of the writing process measures in our data set. However, the writing profile did correlate with several writing process and productivity measures in French narrative writing; Table 10.4 reports only the significantly correlated measures. We found that the students' writing profile was significantly correlated with the copy task in French, text quality, numbers of total words all three writing fluency measures (ranging from $r = .51^{**}$ to $r = .54^{**}$) and pause behaviour in their French.

Table 10.4 Correlation between students' writing profile, text quality and writing process measures in French narrative writing

| | writing profile | Post-writing French |
|---|---|---|
| typing speed | $.482^{**}$ | ns |
| text quality | $.390^{*}$ | ns |
| total words | $.492^{**}$ | ns |
| CPM | $.528^{**}$ | ns |
| WPM | $.514^{**}$ | ns |
| P-Bursts | $.538^{**}$ | ns |
| pause time in minutes | $-.452^{*}$ | ns |

*Note.* *p<.01; ** p<.001, *** p<.000. ns= not significant

All the correlations in Table 10.4 are positive except for pause time in minutes, which shows a limited negative correlation. It is interesting – and of course logical – to see that more experienced writers type faster, and their texts were longer, and considered by our raters to be of better quality (although this correlation is very modest, at .39). A stronger writing profile is also associated with writing fluency, as the higher correlations for the fluency figures above show; again, more expertise in writing (in French) generates more ease in producing the narrative text.

Table 10.5 shows several correlations between motivation towards learning English and post-writing perceptions of the English narrative task, and our writing process and productivity measures. There is a weak correlation between the two questionnaires ($r = .40^{*}$, $p<.05$). Motivation for English was positively correlated with the total number of words written in

English ($r$ = .49$^{**}$), an interesting finding. These motivated learners also write more fluently, as the table shows: characters per minute ($r$ = .45$^{*)}$; words per minute ($r$ = .57$^{**}$), and between-word pauses ($r$ = .40$^{*}$) all show moderate correlations with the motivation score. It is a little troubling to note that we found no correlation between our motivation questionnaire and the learners' grade average in English.

Table 10.5 Correlation between English motivation and post-writing perceptions in English narrative writing

| | Motivation to learn English | Post-writing English | Writing profile |
|---|---|---|---|
| post-writing English | .399$^{*}$ | - | ns |
| English school average | .244 | .395$^{*}$ | ns |
| total words | .487$^{**}$ | .347 | ns |
| CPM | .456$^{*}$ | .207 | ns |
| WPM | .570$^{**}$ | .221 | ns |

*Note.* ***Correlation is significant at the 0.000 level (2-tailed). **Correlation is significant at the 0.001 level (2-tailed). *Correlation is significant at the 0.01 level (2-tailed). ns= not significant

No significant correlations were found between the Writing Profile and the writing process measures in English narrative writing. And again, the post-writing questionnaire did not correlate with many of our project measures, which is once again reassuring: perception of the activity did not seem to influence the quality of the texts written, or the effort required to produce them, although perception of the task does seem to bear some vague relation to how the learners do in English class. The link between motivation and fluency that is illustrated by the moderate correlations in our data shows that enjoying a subject seems to increase the learner's capacity to learn it, since more fluid writing, as we saw in Chapters 7 and 8, is a sign of stronger linguistic encoding skills (Barkaoui, 2007; Dornyei, 2001; Sasaki, 2011).

### 10.1.3 Questionnaire results for Turkish

We also looked at the relationship between our 15 Turkish-French bilingual learners' motivation for learning both Turkish and English, their post-writing perceptions for Turkish and English, in relation to the *Inputlog* writing process and productivity measures in each of the project languages.Table 10.6 shows a relatively strong correlation between our multilingual students' Writing Profile scores, and their perception of the French narrative writing task. No significant correlations were found between the Writing Profile and the writing process measures in French narrative writing, apart from a negative correlation

between post-writing perceptions and pause time in French narrative writing (r= -.59*, p<.021): the more disfluent writers were apparently less sure of the task.

Table 10.6 Correlation between writing processes, Writing Profile and post-writing perceptions in French narrative writing

| | Writing profile | Post-writing French |
|---|---|---|
| Post-writing French | .678** | |
| number of pauses | | -.588* |

*Note.* **Correlation is significant at the 0.001 level (2-tailed). *Correlation is significant at the 0.01 level (2-tailed).

Table 10.7 shows a moderate correlation between our bilingual students' motivation to learn Turkish as a heritage language, and post-writing perception of the Turkish narrative task. There is a marginal correlation between motivation for Turkish and numbers of pauses, which may indicate a slight tendency for more motivated learners to think about what they are writing. However, there is an interesting correlation (.62) between perceptions of the Turkish task and the number of revisions the learners made in Turkish: their writing behaviour corroborates their impression of the task.

Table 10.7 Correlation between writing processes, Turkish motivation and post-writing perceptions in Turkish narrative writing

| | Turkish motivation | Post-writing Turkish |
|---|---|---|
| number of pauses | .565m | |
| number of revisions | | .621* |

*Note.* *Correlation is significant at the 0.01 level (2-tailed). [m] Correlation is marginal at the 0.05 level (2-tailed).

We find far more correlations between our questionnaires and the writing data for L2/L3 English, as shown in Table 10.8. First, we found a significant correlation between motivation for learning English and post-writing perceptions of the English task (r= .66**). We also found a correlation between motivation and three fluency measures: words per minute, the process/product revision ratio, and a negative correlation with total pause time: motivation for learning English seems to have had a positive effect on writing fluency in this language. Once again, text quality is not correlated with our qualitative measures.

Table 10.8 Correlation between writing process measures, English motivation and post-writing scores in English narrative writing

| | English motivation | Post-writing English |
|---|---|---|
| English motivation | - | .658** |
| L3 English school average | ns | .747** |
| overall text quality | ns | .778** |
| CPM | ns | .734** |
| number of total words | ns | .559* |
| WPM | .522* | .771** |
| product/process ratio | .539* | .749** |
| Pause-bursts | .364 | .637* |
| pause time | -.680** | -.692** |

*Note.* ***Correlation is significant at the 0.000 level (2-tailed). **Correlation is significant at the 0.001 level (2-tailed). *Correlation is significant at the 0.01 level (2-tailed).

Column 2 in Table 10.8 shows interesting high correlations between the post-writing questionnaire and various English writing measures: both fluency and production measures (ranging from .56 to .78): our writers seem to have had a well-founded impression of the ease or difficulty with which they carried out the task. In addition, there is a high correlation with the overall text quality score (.78), which again shows that these learners were themselves aware of the quality of the text they managed to produce. Correlations between the post-writing scale, fluency and productivity simply show that our learners are well aware of the ease or difficulty of the L2/L3 writing process.

Our questionnaire data shows more of a connection between attitudes and performance in L2/L3 English, than for native or heritage French and Turkish. This is an interesting illustration of more sensitive metalinguistic – or meta-writing – awareness for the foreign language, than for the languages the learners use more regularly in their daily lives. It is, perhaps, an effect of the specific type of learning activities that take place in communicative language classrooms.

## 10.2 Stimulated recall interviews

In order to obtain data on what individual learners thought and did during the writing sessions, as reported in Chapter 5, we also used stimulated recall interviews. Seven volunteer students out of our overall group of 30 learners formed a "qualitative" -focus group, four monolingual and three bilingual learners (two Turkish-French bilingual subject, one Arabic-French bilingual). During the stimulated recall interview, we recorded each learner's verbal reactions, as s/he watched her/his *Inputlog* file in the replay mode, for the narrative task in

French, English, and Turkish (for the Turkish-French bilingual subjects). More precisely, we stopped the file at all the pauses of two seconds or more, and asked the learner about his/her writing behaviour at that point. As explained in Section 5.3.4 (Chapter 5, and Appendix L), our questions to stimulate recall were neutral, designed to find out "what you were doing" during a particular pause or revision sequence.

Before analyzing the results of these stimulated recall interviews, we looked at the holistic text quality score obtained by each of the retrospective sub-group participants for the narrative writing task in question, and classified each participant as a "skilled" or "less-skilled" writer. The results are presented in Table 10.9, below. The focus group participants with a text quality score between 10 and 16 points were considered to be skilled writers in that language (n=3); participants who got fewer than 8 points were regarded as less-skilled writers (n=2).

Table 10.9 Individual scores for focus group's typing and writing skills in French and English

| | French | | | | English | | | |
|---|---|---|---|---|---|---|---|---|
| **subjects** | **text quality score** | **typing speed (in CPM)** | **pause rate** | **revision rate** | **text quality score** | **typing speed (in CPM)** | **pause rate** | **revision rate** |
| skilled writers | | | | | | | | |
| C | 16 | 312 | .20 | .58 | 15 | 291 | .34 | .82 |
| S | 12 | 189 | .14 | .55 | 14 | 156 | .41 | .65 |
| L | 10 | 239 | .14 | .65 | 12 | 217 | .36 | .88 |
| less-skilled writers | | | | | | | | |
| M | 6 | 136 | .22 | .54 | 5 | 159 | .38 | .47 |
| MG | 4 | 135 | .32 | .78 | 4 | 135 | .81 | 1.18 |

*Note.* Maximum text quality score is 16. CPM = characters per minute

We also classified the focus group participants according to their typing speed behaviour (as measured through the keystroke loggings' Selected Component Bigrams) as fast and slow typists, considering the highest and the lowest values within the focus group. Focus group participants who typed between 189 and 312 characters per minute were considered to be fast typists; participants who typed between 135 and 159 characters per minute were considered to be slow typists.

The individual scores in Table 10.9 show that the skilled writers in French (based on the French text quality scores) are also skilled writers in L2/L3 English (based on the English text quality scores). This result is in line with study 1 (Chapters 6 and 7), which showed a high correlation between French and English text quality scores. Echoing our full-group analyses, Table 10.9 also suggests a relationship between writing and typing skill – since the

best writing score is obtained by the best typist, and the two less-skilled writers are also less-skilled typists. One of the focus-group members has a different profile: learner S, a competent writer, has a lower typing speed in English.

Table 10.10 presents performance measures for the two Turkish participants who participated in the stimulated recall interviews; both of whom are skilled writers in their heritage language (columns on right), according to their text quality scores. Learner E is a skilled writer in L2 French and L3 English; MS is less skilled in these non-native languages. Subject E is a skilled typist–faster on the AZERTY keyboard in French than in Turkish and English, but competent all the same. She manages to write good-quality texts in all three languages, and particularly in Turkish. It is also interesting to note that subject MS is a less-skilled typist, particularly for English, but her typing skills lie above-average speed for our larger learner group. She has a low text-quality score in L2 French and L3 English, but her text quality score in Turkish in the high range.

Table 10.10 Descriptive statistics for Turkish-French bilingual focus group's typing and writing skill in three languages

| | French | | | | English | | | | Turkish | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| subject | text quality score | typing speed (in CPM) | pause rate | revision rate | text quality score | typing speed (in CPM) | pause rate | revision rate | text quality score | typing speed (in CPM) | pause rate | revision rate |
| E | 12 | 219 | .18 | .31 | 13 | 182 | .37 | .60 | 15 | 197 | .22 | .36 |
| MS | 4 | 171 | .33 | .34 | 6 | 157 | .89 | .73 | 14 | 167 | .49 | .62 |

As reported in Section 5.6.1, each transcription of the recall interviews was segmented according to the reasons the learners gave for their pausing or reviewing behavior: vocabulary, spelling, grammar, pragmatics, reference (to the task or writing prompts), and "other" (anything that didn't fit in any of these coding categories).

For a more systematic comparison between the project languages and our skilled and less-skilled sub-groups of writers, we used the coded transcriptions to quantify the reasons given for pause and revision behaviour for the narrative tasks. The strategic behavior of our skilled and less-skilled writers (as observed in their stimulated recall protocols) is presented in Table 10.11. Illustrations of their comments are provided in our individual analyses section that follows. We will first present and discuss the most remarkable differences between writing behaviour in L1 and L2, with regard to linguistic and pragmatic issues, and illustrate the differences by extracts from the interviews. In reporting the stimulated recall interviews, it is important to hear the voices of the learners through the comments made in their reflective interviews, in hopes that this qualitative data will shed light on French and English writing

processes, on the one hand, and multilingual writing processes on the other. I will therefore quote the focus group learners' extracts according to themes. The learners' comments are provided in the language of production in quotation marks, with English translations just after the quotations in square brackets.

## 10.3 Results from stimulated recall protocols in French and English writing

Table 10.11 shows the frequencies of the themes that skilled and less-skilled focus group learners mentioned in stimulated recall protocols in French and L2/L3 English writing. We found that, apart from two exceptions (learners S and MG), the skilled writers seemed to have more to say (min=3'02", max= 7'49") in the stimulated recall interviews than the less-skilled writers.

Table 10.11 Frequencies of the reasons for hesitating mentioned in stimulated recalls, according to language and skill group

| | skilled writers | | | | | | less-skilled writers | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **reasons for hesitating** | **Learner C** | | **Learner L** | | **Learner S** | | **Learner M** | | **Learner MG** | |
| | Fr 7'49" | En 6'59" | Fr 7'12" | En 5'23" | Fr 3'02" | En 5'41" | Fr 2'50" | En 2'53" | Fr 5'10" | En 2'37" |
| **Spelling** | 8 | 7 | 6 | 9 | 2 | 1 | 3 | 4 | 1 | 0 |
| **vocabulary** | 0 | 6 | 1 | 1 | 3 | 1 | 0 | 2 | 1 | 4 |
| **grammar** | 5 | 4 | 3 | 7 | 2 | 4 | 1 | 0 | 4 | 0 |
| **pragmatics** | 11 | 5 | 6 | 5 | 6 | 5 | 0 | 1 | 3 | 0 |
| **referential** | 4 | 2 | 4 | 2 | 3 | 7 | 0 | 0 | 1 | 1 |
| **other** | 0 | 0 | 2 | 3 | 1 | 0 | 0 | 2 | 3 | 1 |
| **Total** | 28 | 25 | 22 | 27 | 17 | 17 | 4 | 9 | 13 | 6 |

(min=2'37", max= 5'10").

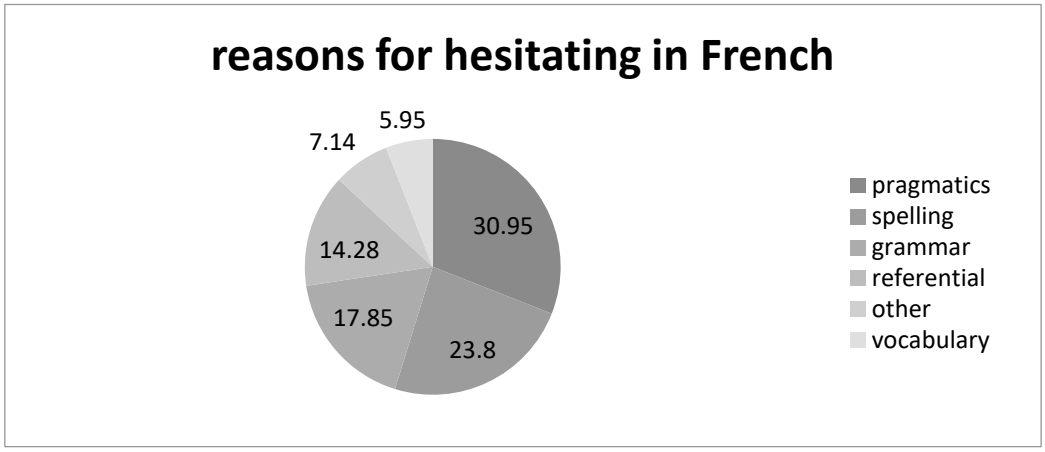
This is also an effect of the fact that the skilled writers wrote longer texts. Since the skilled writers devoted more talking time to the recall task (6 minutes on average for the subgroup) than the less-skilled ones (3 minutes on average), they also produced more comments (136 total) than the less- skilled writers (32 in total); this can also be partially attributed to the fact that the less-skilled writers wrote shorter texts.

### 10.3.1 French writing

Figure 10.1 shows the percentages of themes mentioned during the recall protocol by all five monolingual members of our sub-group, as they watched their French writing behaviour unfold in *Inputlog*. Pragmatic reflections and decisions are the most-frequently mentioned source of hesitation and revision by our learners as they write in French, accounting for

almost one-third (31%) of the reasons given. These learners reported that they paused to deal with pragmatic issues like organizing the content and the discourse, and attempting good writing style. A skilled writer, subject L, mentions that he is concerned about the structure and the clarity of his French: "*Là, donc, j'ai fait des paragraphes par rapport aux images pour que ce soit plus clair pour les lecteurs.*" [So here, I made paragraphs corresponding to the pictures, so that it would be clearer for the reader.]

Figure 10.1 Distribution of themes mentioned in stimulated recalls for French (n=5)




Subject S, another skilled writer, also reports attention to his writing style: "*J'ai ajouté ça, <u>'étant de l'aide'</u>, parce que je voulais être un peu plus détaillé avec des adjectifs.... C'était une sorte de conclusion."* [I added 'étant de l'aide' because I wanted to give more details with adjectives. ... It's a kind of conclusion.] Subject S is intent on developing what he said earlier, and seems to be thinking about what the reader needs to know and how to make his text more complete. Subject C, a skilled writer, also expresses her concern with her written style: "*Parce que en fait la phrase je voulais faire après, ça n'allait pas avec le debout de ma phrase donc je rajoute 'pendant', pour que ça fasse une phrase correcte française."* [Because in fact the sentence I wanted to put next didn't go with the beginning of my sentence, so I add 'during' to make a correct French sentence.]

The next most-frequently mentioned phenomenon in the French retrospective protocols is spelling, which accounts for one-fifth (24%) of the reasons given for hesitation and revision. As they watched the *Inputlog* playback, our learner even noticed spelling mistakes that they hadn't caught while typing, since they watched their spelling revisions unfold during the playback of their keystroke-loggings. For instance M, a less-skilled writer, comments: " *Oups*, *j'ai fait une faute de frappe."* [Oops, I made a typing error.]. A skilled writer, subject L also reported spelling mistakes: "*J'aurais pu éviter plus de fautes, des fautes de frappe,*

*j'aurais su corriger."* [I could have avoided more mistakes, typos, I could have corrected them.]

The third most-frequently mentioned phenomenon in the French protocols is grammar, which accounts for 18 % of the comments made by the learners (syntax, morphology and grammatical orthography). These learners express particular concern about word endings while writing in French, since these are indeed one of the most difficult aspects of the French orthographical system, and heavily emphasized in their French classes. For instance, a skilled writer, subject C, expresses her concern with noun endings reflecting gender in French writing: "*J'ai rajouté un 'e' à l'éléphant parce que ça signifie l'éléphante. J'ai rajouté un 'e' à tous les 'éléphantes."* [I added a final 'e' to *éléphant* because it signifies a female. So I added an 'e' to the word everywhere.] Most of the students reported needing to think about how to inflect verbs, adjectives and nouns while writing a French text. When asked to generalize about his major difficulties when writing in French, subject S (a skilled writer but slower typist), said: "*C'est la conjugaison qui est le plus compliqué, des choses comme ça, sinon ça va."* [Conjugation is the hardest, things like that. Otherwise it's okay.]

The fourth most-frequently mentioned phenomenon (14 % of the time) in the French protocols is the relationship between the drawings and the text (the referential value of what is being encoded). Subject MG, a less-skilled writer, reports attention to construction of meaning in the task: "Researcher: '*Tu as ajouté quelque chose ici'?* [Did you add something here?] Subject MG "*Et bien oui, à la fin j'ai vu que c'est un téléphone."* [Well, yes, at the end I saw that it's a telephone [in the drawing].]

Seven percent of the comments in the French protocols fall into our "other" category, frequently relating to the use of the computer, or to strategies used to carry out the writing task. For example, one skilled learner, subject L, reports that: "*J'ai commencé plusieurs fois et des fois j'arrive bien. Mais je le fais avec le stress je me dépêche si je peux le faire correctement. Je me suis dépêché."* [I started several times and sometimes I manage okay. But I was stressed out here, I rushed to do it right. I hurried.] Subject E, another skilled writer, also reports attention to task management: *"Parce qu'il faut poser la question, il faut réfléchir et après il faut l'écrire."* [Because you have to ask the question, you have to think and then you have to write it down.]

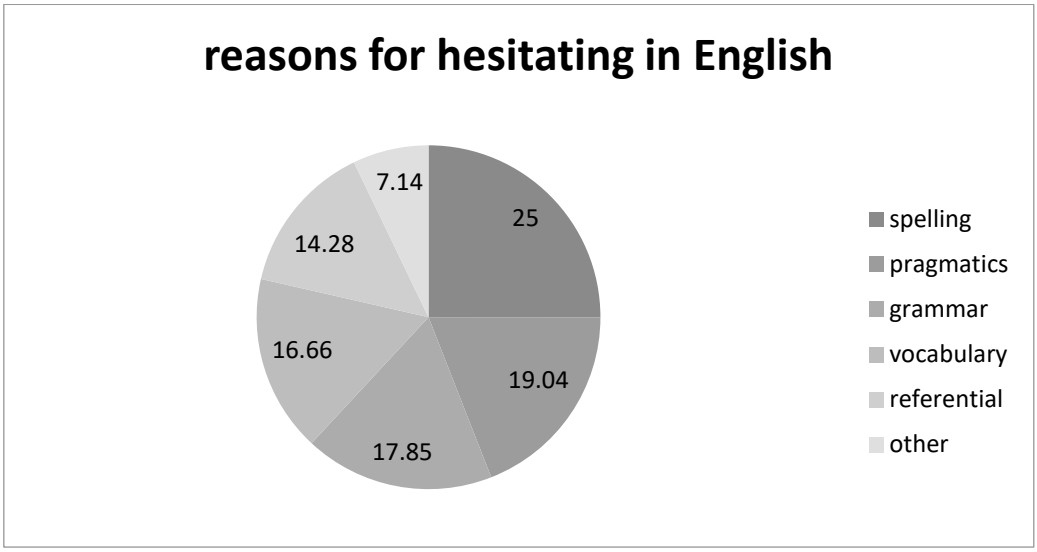
The least-frequently mentioned phenomenon (6% of the comments) in our French protocols is vocabulary. Since French is the L1 for some (n=4) of the focus learners and the school-

dominant language for one other, finding the appropriate vocabulary to express the story in the pictures seems to be a minor issue for these middle-school learners. A skilled writer, subject L, reports hesitating on a word: "*Là, je suis revenue en arrière. En fait j'avais une hésitation sur le mot..."* [Here, I backtracked. I was wondering about the word.] A less-skilled writer, subject MG mentions that he is concerned about finding better words to express his ideas in his French text: Researcher: "*Pourquoi tu as effacé ça?* " Why did you erase this? Subject MG: "*J'ai voulu mettre 'maître nageur'. Ça doit être 'maître'."* [I wanted to put 'lifeguard'. It needs to be '*maître*'.]

### 10.3.2 English writing

Figure 10.2 shows the distribution of the themes mentioned in the stimulated recalls by our five focus group learners as they watched their English *Inputlog* writing files. Spelling is the problem they mention most frequently (25 % of their comments). A skilled writer, Subject E reported stopping to correct spelling mistakes: "*j'avais écrit 'ballon' comme en français. En anglais c'est 'ball'."* [I had written '*ballon'* like in French, but it is '*ball'* in English.]. Another skilled writer, subject L commented spelling mistakes consecutively: "the ballon to the elefant." Là j'ai oublié un 'o'. "Finally," Là j'ai oublié le 'y'. "the elefant is very happy, " Là j'ai oublié un 's'. ["the ballon to the elefant." Here I forgot the 'o'. "Finally," Here I forgot the 'y'. "the elefant is very happy, " Here I forgot the 's'. ].

Figure 10.2 Distribution of themes mentioned in stimulated recalls for English (n=5)




The focus group learners mentioned "typing errors" frequently, which were categorized under the "spelling" theme. A less-skilled writer, subject M, reported a problem spelling the word "with": "*J'ai mis 'whith'. Je ne savais pas comment il s'écrit."* [I wrote 'whith'. I didn't know

how to spell it.] A skilled writer, subject C, who is the fastest typist, mentions recurrent typing mistakes: *Et après, ce qui est dur pour moi en anglais et en français souvent sur l'ordinateur, j'inverse des lettres si j'écris plus vite que ce que je pense. Du coup j'inverse des letters dans que j'écris, je dois les effacer et recommencer.* [What's hard for me in English and in French is that sometimes on the computer, I invert the letters, if I'm writing faster than I think. So, I invert the letters, then I need to erase and rewrite them.] This is an interesting statement, coming from the fastest typist in these sub-groups. She types so fast that apparently switching letters is a problem.

The next most-frequently-cited reason for hesitating in English (20% of the comments) is pragmatics; this type of comment occurs slightly less frequently than in French writing (where it is mentioned a third of the time). The skilled writers, in particular, often referred to pragmatic issues. For instance, subject C (highest text quality score in L2 English), considers rhetorical issues in her L2 English writing: *"Ah tu as effacé 'and'."* [You erased 'and' here. Why?] Subject C: *"Parce que après la phrase est trop longue... Il ne faut pas repeter la meme chose*" [Because the sentence is too long with it... We shouldn't repeat the same thing.] A skilled-writer, subject L also expresses pragmatic concerns: "<u>the giraffe jump into. As a consequence,</u> *Là j'ai voulu ajouter un mot, ça rend plus riche le vocabulaire.*" [I wanted to add a word there, to enrich the vocabulary.]

Grammatical preoccupations are expressed in about 18% of the learners' comments. In response to the interviewer's question (What do you think about the most when you write in English?), Learner S (a skilled writer in English), answers in English: "*I think it is not so hard. But it is difficult to write correct sentences."* Skilled writer L states: "*Des fois, la conjugaison, je ne sais pas instantanément quel il faut utiliser. Il faut plus de temps."* [Sometimes, for conjugation, I don't know right away what form to use. I need more time.]

Vocabulary is mentioned as a problem about 17% of the time; lexicon seems more problematic in this foreign language, than in L1 French writing (where it is the least-cited problem, as we saw above). Our learners repeatedly reported trying to find the words they need in English to express the picture story. Below is an extract from a stimulated recall interview with a less-skilled L2 writer, Subject MG (who is also dyslexic): "*Là je voulais écrire 'piscine'."* [I wanted to write the word for *piscine.*] However, subject MG couldn't remember (or didn't know) the word, so he wrote "water" instead: "<u>the balle is go a water</u>".

He used a more frequent, known word to replace it. At other points, he also used a French word: "son friend" (for *his friend*) and "the two friends 'se souris'" (for *smile*).

When asked the open question related to problems in L2 English writing, both the skilled and less-skilled writers mention this problem with vocabulary. Subject L, a skilled writer said:*"Il me manque un peu de vocabulaire. Même beaucoup de vocabulaire."* [I lack a little vocabulary. Well, even a lot of vocabulary.] Another writer, less-skilled MG, also says: "*En français, ça va à raconter mais en anglais c'est un peu galère. Il y a des mots que je ne savais pas comment dire*."[In French writing, I manage to tell the story, but in English, it is a struggle. There are words that I didn't know how to say.] Similarly, subject E reported: *"Comme je n'ai pas beaucoup de vocabulaire, je ne sais pas comment dire des certains mots. C'est difficile."* [Since I don't have a big vocabulary, I don't know how to say certain things. It's hard.]

Problems with referential meaning are mentioned 14% of the time in the English recall protocols. A less-skilled writer, MG, expresses his concern with encoding what is shown in the pictures: Researcher: "*On regarde. Tu as effacé ça. Pourquoi?"* [Let's look. You erased that. Why?] MG: *"Parce que vu sur l'image, il y a un éléphant qui driblait. Il faut le dire."* [Because in the picture, there is an elephant dribbling the ball. I have to say that.] A skilled writer, C, says: "*ça m'a permis de m'entrainer d'écrire des phrases en anglais et d'analyser des images pour transcrire exactement ce qui s'est passé*." [It (this exercise) allowed me to practice writing sentences in English and to analyze images to transcribe exactly what happened.]

The smallest category of comments (only 7%) are related to the strategies used by our focus group learners to carry out the writing task (our "other" category). Skilled writer L says: "*Je n'ai pas l'habitude de taper sur l'ordinateur."* [I'm not used to typing on the computer.] Subject MG reports that: *"J'ai commencé comme ça."* [I started like that.] These are in effect "backchanelling" comments – with the learners talking about how they approached various aspects of the task.

### 10.4 Stimulated recall results for multilingual writing

We obtained stimulated recall interview data from two volunteer Turkish-French bilingual students. The stimulated recall interviews were recorded at the end of each narrative writing task (French, Turkish and English), making six interviews in all for both bilingual learners. As shown in Table 10.12, one of them is a skilled writer (Subject E) in the three languages;

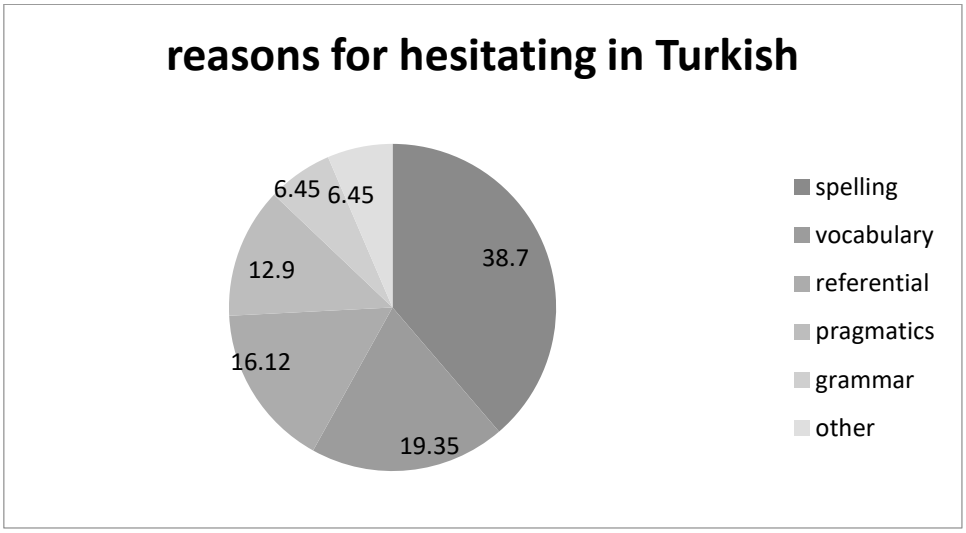
the other (Subject MS) is a less-skilled writer in French and English, but a skilled writer in L1 Turkish; this learner also commented much less than subject E.

Table 10.12 Frequencies of themes mentioned in stimulated recalls of Turkish-French bilingual learners in French, Turkish and English writing

| | skilled | | | less-skilled | | |
|---|---|---|---|---|---|---|
| | Learner E | | | Learner MS | | |
| themes | Fr | Tr | En | Fr | Tr | En |
| Spelling | 10 | 6 | 7 | 4 | 6 | 6 |
| vocabulary | 2 | 5 | 5 | 0 | 1 | 3 |
| grammar | 6 | 1 | 2 | 0 | 1 | 1 |
| pragmatics | 5 | 4 | 2 | 1 | 0 | 1 |
| referential | 1 | 1 | 2 | 2 | 4 | 2 |
| other | 1 | 1 | 0 | 0 | 1 | 0 |
| Total | 25 | 18 | 17 | 7 | 13 | 13 |

Below I report the percentages of themes mentioned by the two Turkish-French bilingual learners for the Turkish writing to look at what the learners thought during pauses and revisions while performing the Turkish narrative task (Figure 10.3).

Figure 10.3 Distribution of themes mentioned in stimulated recalls for Turkish (n=2)




We found that, as in the English writing recall protocol, spelling is the most-frequently mentioned problem in Turkish writing (close to 40% of the comments made). These learners seem to have problems with spelling Turkish as a heritage language, since it is not the language of schooling, and a language they use primarily in oral forms. Subject E, reports stopping to check for spelling mistakes, or the use of capital letters: "*'kara' mı 'karar' mı*

*yazmalıyım. Onu düşündüm. Büyük harfleri düzelttim.*" [Whether I should write 'kara' or 'karar', I thought about that. I corrected the capital letters.] When asked the open question relating to problems with Turkish writing, both writers express spelling problems. Subject MS says she still confuses some Turkish letters, hesitating between "ğ" and "y", which in Turkish are usually silent letters, and therefore harder to predict in writing: "*'ğ' ve 'y' leri bazen karıştırıyorum*." [I sometimes get confused with writing the letters 'ğ' ve 'y']. Similarly, subject E reports: "*Kelimeleri doğru yazıp yazmadığımı bilmiyorum."* [I don't know whether I wrote the words correctly or not.]

Vocabulary is mentioned as a reason for hesitating in Turkish writing close to 20% of the time. Subject MS reported stopping to recall a word: "*'Sürgülü arabayı' düşündüm*." [I thought about 'the rolling car'.] When asked the open question about problems in Turkish writing, subject E said: "*Kelimeleri hatırlamaya çalışıyorum."* [I have to think about the words. I have to try to remember the words.]

Referential meaning causes the learners to hesitate in Turkish just over 16% of the time. Subject MS also reported stopping before each picture to think about what to write. Researcher: *"Ucan balona bakiyor. Burada durdun. Neden?"* [It is looking at the flying balloon. You stopped there. Why?] Subject MS says: "*resimde ne söyleyeceğimi düşündüm."* [I thought what I should say about the picture.] Subject E also thinks about expressing the story in the pictures: "*Ee kafamda biraz düşündüm ne yazayım diye. "* [Um, I thought for a while in my mind what I should write].

Pragmatic aspects of writing are mentioned about 13% of the time, compared to 31% of the time in French writing. Subject E comments: *"Nasıl daha iyi ifade edebilirim başka bir şekilde, onun için düşünüyorum."* [I was thinking about how I could express myself better in another way.]. Subject MS did not make any comments related to pragmatics.

Grammatical problems, and the "other" category are each featured in 6.5% of the comments. It is interesting that grammar is one of the least-frequently mentioned problems in Turkish writing. Subject E, stopped once to express his concern with grammar: "*Ee kafamda biraz düşündüm .... Cümleyi nasıl kurayım diye*." [Um, I thought for a while... how to build the sentence.] Subject E was preoccupied with plural forms: *"'göğe' mi 'göklere' mi yükseliyor? demeliydim. Onu düşündüm. Orada tereddüt ettim."* [Is it rising in the 'sky' or 'skies'? How should I say? I thought about that.] In the 'other' category, Subject E, a skilled writer, commented on the type of methodology she used and reported that: *"Başa döndüm, okudum."*

[I backtracked and reread it.] She made a task-related comment such as a methodology she uses to deal with the writing task. This comment can be considered to refer to the task.

We ran a Chi-square test, comparing the learners' reasons for pausing and revising in French, Turkish and English, presented in Table 10.13.

Table 10.13 Chi-square test results for the proportions of remarks in the three languages

| reason for pause/ revision | number of times mentioned in French | number of times mentioned in English | number of times mentioned in Turkish |
|---|---|---|---|
| spelling | 14 | 13 | 12 |
| vocabulary | 2 | 8 | 6 |
| grammar | 6 | 3 | 2 |
| pragmatics | 6 | 3 | 4 |
| reference | 3 | 4 | 5 |
| other | 1 | 0 | 2 |

$\chi^2$ (91, 8) = 7.42, p< 0.49

The chi-square test shows that the proportions of these different reasons given for pausing and revising do not differ for our bilingual writers when they write in French, Turkish or L3 English; however, residuals show that there is a slightly higher tendency towards grammar and pragmatics in French writing, vocabulary in English writing, and referential and vocabulary in Turkish writing. This indicates our bilinguals' concern with morphological and pragmatic issues in their schooling/dominant language French; lexical retrieval processes both in English and Turkish as well as task management in Turkish writing.

## 10.5 General discussion and conclusion for stimulated recall data

In the second section of this chapter, we presented the results obtained through stimulated recall interviews to reveal what the students thought and did during the writing process. The replay function in *Inputlog* proved to be an interesting, concrete basis for stimulated recall interviews with a subset of volunteer learners from our wider subject pool. We asked these writers to explain what they were thinking and doing when they revised their narrative texts, or paused for more than 2 seconds (following Spelman Miller, 2006). They were able to describe – at least partially – some of their writing behaviour, within the limits of their own conception of the process and ability to talk about such matters. We observed that while they were watching their writing process unfold, both skilled and unskilled learners recognized their grammatical or spelling mistakes, and commented upon grammar, spelling, vocabulary, pragmatics, referencing and other issues during long pauses and revisions in French, English,

and Turkish. Our analyses confirm previous research that found that writers watching their own writing processes in keystroke logging files become more aware of their own writing behaviour (Lindgren, 2004; Lindgren & Sullivan, 2003; Sullivan & Lindgren, 2002).

If we look more closely at reported behaviour after revisions and pauses, we find that this small subset of learners was most concerned with pragmatics in their French texts; and that their comments while watching the *Inputlog* playback for English and Turkish writing tend to mention these pragmatic concerns less frequently as confirmed by our Chi-square results in Section 10.5. The results for the reasons for pauses during French writing were largely aligned with other research in L1 writing, and our own expectations, anticipating that learners would pay attention to pragmatic aspects like text organization and style. These 9th grade learners developed their French texts like their peers in Aillaud's (2016, p. 318) study. They try to vary the words they use, especially adjectives, applying pragmatic skills that they have learned at school for narrative writing of this type. However, in English and Turkish writing, we found that our sub-group learners dealt more frequently with language-related issues (correct spelling and recalling a word), which is also in line with previous research (Barkaoui, 2015; Révész et al., 2019; Stevenson et al., 2006), and confirms our analysis of the keystroke logging results (for English and Turkish. The stimulated recall interviews confirm that greater disfluency in English and Turkish writing reported in Section 8.1.2 (9 words per minute in Turkish and 10 words per minute in English writing as opposed to 15 words per minute in French writing) is linked to problems of lexical encoding (including spelling).

Spelling is the second most frequent reason given for revisions in L1 French writing. We also found that typing errors (which we categorized under the heading of spelling), were also frequently reported by our subset focus group learners in English and in Turkish. These typing errors are generally related to deletions of a letter typed wrongly or correcting inverted the letter pairs; because of trying to type fast. When we look at the students' General Analysis *Inputlog* files, we see many typing errors, and we can thus confirm the students' perceptions about their frequency. Learners also expressed moments of metalinguistic reflection about grammatical structures and orthography as the third most frequent reason for pausing, both in English and in French. This is, of course, totally predictable for French, given its complex grammatical orthography. The learners also reported paying attention to using correct accent marks, inflection and gender forms of words.

The major difficulties while writing in English, in order of mention, are: 1) spelling, 2) pragmatics 3) grammatical accuracy 4) vocabulary-related difficulties. These results are in line with Akyel and Kamisli's (1997) and other researchers (e.g. Breuer, 2019; Cumming, 1989; Raimes, 1985; Schoonen et al., 2003; Tiryakioglu et al., 2019), who have found that foreign-language writers face grammatical and vocabulary-related encoding problems. Our learners report all sorts of these preoccupations when writing in English. In general, limited linguistic knowledge in L2/L3 English led our writers to try to express their intended meaning by using a French word, or by changing their intention of meaning, reformulating an idea with simpler words.

The two Turkish-French bilingual learners who participated in the retrospective interviews gave the following reasons for pausing and revising, in order of frequency of mention: spelling, vocabulary, reference, pragmatics, grammar and other comments. Although Turkish is a phonetically-transparent heritage language (spoken at home), the written forms of well-known words may be unknown at the time of writing. The second most frequently mentioned theme in the Turkish protocols is vocabulary. As we saw in Chapter 8, keystroke logging data for Turkish narrative writing shows a high rate of within-word pausing, which explains why spelling and vocabulary are the most frequently-mentioned reasons for hesitating and revising. As we say in Chapters 1 and 2, pauses at word level have been associated with vocabulary retrieval processes (e.g. Alves et al., 2008). Our learners may also have been involved in key-finding activity, since they are less familiar with typing High Frequency Bigrams in Turkish, as confirmed by our keystroke logging results, although – interestingly enough – this was not mentioned in the retrospective protocols, perhaps because we did not ask questions to our learners about their difficulty in typing behaviours during our recall interviews. We found that our focus group learners appear to be less concerned with grammar-related issues in Turkish writing, perhaps because the transparent orthography of Turkish makes grammatical orthography simple, or perhaps because they have fewer metalinguistic concepts about Turkish grammar, than French grammar (which they learned explicitly at school).

We found that the recall protocols by the more skilled writers reflect a desire to "transform knowledge". They seem to follow Bereiter and Scardamalia's *knowledge-transforming* model while writing: they seem to *transform* their ideas during the writing process, rather than just telling them. They seem to engage in content organization and make pragmatic decisions, taking the reader into account: they seem to have communicative goals, and are able to take

their audience into account. Consequently, they appear to approach the task with detailed, analytic, reflective and explicit problem-solving strategies (Bereiter & Scardamalia, 1987). This is possible largely because their attention is free to focus on these higher-level components of meaning communication, because linguistic forms can be activated automatically – i.e., without the need for conscious attention.

However, less-skilled writers' recall protocols reflect Bereiter and Scardamalia's *knowledge-telling* strategies while composing, in which they just *tell* their ideas without making pragmatic decisions. They do not seem to use complex problem-solving strategies, but rely on converting their ideas into written form without worrying about pragmatic issues. This is probably due to the fact that working memory capacity is not left free for content and organization when writers are trying to cope with both linguistic forms and encoding. In this respect, the less-skilled writer focuses on one aspect of writing, such as checking the spelling or punctuation while expert ones deal with pragmatic issues such as content and organization (Bereiter & Scardamalia, 1987).

Another important finding observed in our retrospective interviews is the interference of one language on the other one during text encoding. An interaction occurs between the writer's languages, which is frequently called "linguistic interaction" or "language influence", as we described in our Multilingual Writing Model in Chapter 2, in Section 2.9. Although research suggests that interference is most likely from the learner's dominant language (e.g. Bialystok, 2009), we found that interference can take place in various directions. For instance, our interviews show that a recently-learnt L3 or L4 (Spanish) can interfere with lexical encoding in English (or Turkish) for one of our learners.

> The most visible evidence of joint activation and conflict for selection by bilinguals is in code switching –sometimes bilinguals will insert a word or phrase from the other language, having either intentionally or unintentionally chosen the non-target form. The choice is necessary because only one of the two forms can be produced at one time. (Bialystok, 2009, p.8)

Thus, interference of languages during writing might not depend on the learner's proficiency in the influencing language, but it might depend on the recency of use of linguistic components such as lemmas, syntactic patterns, spelling, or even discourse structures.

### 10.5.1 A quick look at writing strategies

Although this project was not directly concerned with the study of "writing strategies" (Graham et al., 2005; Torrance et al., 2007), we would like to present a few observations made by our seven learners as they watched their *Inputlog* files in the replay mode. We have also noticed some techniques used to structure their texts, for example, in the picture-

description texts (in French, English and Turkish), all learners began their text with the same type of introductory sentence: a pragmatic technique doubtless developed in their English classrooms (since descriptive writing is part of the final exams for Middle School certification). Another technique that we find in several texts is summarizing the main idea of the text at the end of the picture-story in all three languages. One learner reported that she learnt to write about the moral of the story in French class; and this is transferred to her texts in English and in Turkish. These incidents illustrate Cummins' Interdependence Hypothesis (1980), in which textual organization skills explicitly developed at school for French are applied in both Turkish and English writing.

During the stimulated recall interview sessions, several of the learners said they found the writing activities useful for learning. A skilled writer, C, says: "*ça (cette exercice) m'a permis de m'entrainer d'écrire des phrases en anglais et d'analyser des images pour transcrire exactement ce qui s'est passé*." [It (this exercise) allowed me to practice writing sentences in English and to analyze images to transcribe exactly what happened.] They also reported that they do not do these kinds of activities in their English courses, and suggested spending more time in the ICT room, writing narrative and descriptive tasks of the same types.

### 10.5.2 Limitations of the stimulated recall interviews

Using the play mode for keystroke-logged files for our stimulated recall interviews is an interesting means of investigating writers' revision behaviour, since additions and deletions are easily observable while watching the writing process unfold (Lindgren & Sullivan, 2003). However, using the play mode could have been more efficient if pause location and pause duration were also featured in this mode. Watching the logged file without including actual pause times gives the false impression that the writer wrote the text fluently. When we asked our learners what they were thinking during a long pause (over 2000 milliseconds), there are a few times when they remained silent or could not explain their behaviour. It is, perhaps, not surprising that young teenagers might be unable to describe, explicitly and especially *retrospectively*, metalinguistic or other metacognitive processes they were engaged in, since this is a rarely or never requested of them. It could also be that we should have targeted longer pauses – only those over 3 seconds, for example. For instance, Kobayashi and Rinnert (2013) used 5 seconds as a pause threshold level for a stimulated recall with one participant, in their study of L1 Japanese, L2 English and L3 Chinese writing processes.

In conclusion, our stimulated recall protocols revealed to a certain extent what our focus learners remembered thinking and doing during the pauses and revisions while writing in their L1, L2 and L3. Although keystroke-loggings allow us the precise analysis of typing, pause and revision behaviour during writing, they do not reveal to us what is happening in writers' minds. Stimulated recall interviews can help fill this gap (at least in part) by providing the learner’s view of various metalinguistic or cognitive processes underway during certain revisions or hesitations.

# GENERAL CONCLUSION AND PEDAGOGICAL IMPLICATIONS

The present PhD thesis presents multiple types of data, which we collected to investigate the differences in middle-school students' composing processes and text quality in both their native and foreign or second languages. Our first study compares text quality and writing processes in the first or dominant school language (French), and English as a foreign language. Our second study compares writing and text quality in French as a dominant second language, with Turkish as a native heritage language, and English as a foreign language; the third study looks more closely at mono- and bilingual writers' views of the writing process in two languages. We also hoped to contribute to the understanding of the role of typing speed on text production in three languages. Our study has shown that using different types of data -- such as keystroke loggings, stimulated recall interviews and pre- and post-writing questionnaires – can offer interesting insights into the composing processes used by 14-15 year old middle-school students, when they write in different languages.

Based on our literature review of L1 and L2 writing and the evidence obtained from our studies, we attempted to develop a writing model which could describe writing process in multilingual writing. Our Multilingual Writing Model (Chapter 2, Section 10) highlights how different components interact with each other during text production. In this model, when the writer is given an L2 or L3 writing task, s/he uses her/his existing social/pragmatic knowledge to decide about the pragmatic dimensions of the text s/he will write. At conceptual processing, linguistic operations are triggered once the writer has formulated a concept (or set of concepts) to write down. Working memory plays an active role in retrieving necessary vocabulary and grammar knowledge from long-term memory. There are two different paths for text generation in the L2/L3: direct, and indirect. Direct text generation happens in the L2/L3 when the writer has necessary linguistic knowledge in L2 resources to organize and encode her/his ideas in that language. In this respect, s/he directly generates new ideas in the L2/L3. Indirect text generation is more characteristic of writing when linguistic knowledge of the L2/L3 is low: the new idea may first be generated in the L1, activating L1 vocabulary and grammatical knowledge, before being translated into the L2 or L3. At this point, an interaction occurs between the writer's languages, which is frequently

called "linguistic interaction" or "language influence". The interactions between the writer's languages depend on various factors: linguistic, social, pragmatic, contextual. While the dominant language or L1 might influence and interfere with text production in the L2/L3, another less dominant language (L2, L3) might also trigger linguistic transfers of various sorts. Our results certainly suggest that multilingual students' languages are not isolated from one another. They interact with each other during written language production, which is a non-linear, complex and dynamic process (Yang & Sun, 2015).

In our study, we used multiple research methods to collect writing process data. Each type of data has provided us with different information about writing processes, writing skill and behaviour. Little research comparing L1 and L2 writing processes so far has used keystroke loggings combined with multiple data collection techniques. Using keystroke loggings to capture typing, pause and revision behaviour during writing allowed us to have an accurate online data analysis of writing activities (Leijten & Van Waes, 2013; Spelman Miller & Sullivan, 2005) not only in comparison of text production between the L1 and L2 but also between L1, L2 and L3. Stimulated recall interview data provided us with information on what the writers thought and did when they paused, revised and formulated the text: operations that we categorized according to attention paid to language use and lexicon, pragmatics, and writing tools. More qualitative pre-/and post-writing data were used to complete the quantitative data obtained with *Inputlog*. The pre-writing data also provided information on the learners' linguistic profiles and motivation for learning and writing profiles; the post-writing data offered a closer look at their attitudes towards writing tasks across languages. The combination of keystroke loggings with a series of pre-/post questionnaires and stimulated recall interviews has enabled us to collect data to answer our research questions. In the following paragraphs, I will summarize the results for each of the three studies reported in this dissertation.

***Summary of findings***

To sum up the results for study 1, there are differences between L1 and L2 composing processes for our 30 French EFL middle-school students. The writers paused more, revised more and spent more time during the L2 writing tasks; however, they produced more words in their L1/ school-language writing, which is more fluent (as measured by our temporal variables). Our writers' pause and revision rates were found to be higher during the L2 composing process; when writing in their L1/ dominant language, the writers participating in our stimulated-recall protocol expressed more pragmatic concerns, and more linguistic

concerns when writing in their L2 or L3. These L2 difficulties involved searching for vocabulary, spelling and the grammatical accuracy of the L2 text, behaviour that was less frequently observed in L1 French task, except for diacritical marks in spelling, and grammatical orthography. We found strong positive correlation between the first quarter exam scores and text quality in French and English writing. Our findings confirm previous results, showing that linguistic knowledge influences text quality in L1 (Breetvelt, Van den Bergh & Rijlaarsdam, 1994; Rijlaarsdam & Van den Bergh, 1996; Torrance, Thomas & Robinson, 2000; Van den Bergh & Rijlaarsdam, 1996, 2001) and L2 writing (Cumming, 1989; Jones & Tetroe, 1987; Hirose & Sasaki, 1994; Pennington & So, 1993; Sasaki, 2002, 2004; Sasaki & Hirose, 1996; Schoonen et al., 2011; Van Weijn, 2009: Van Weijn et al., 2008, 2009; Wang & Wen, 2002; Wolfersberger, 2003). The more knowledge of the language the learner has, the better the quality of her/his texts. Linguistic knowledge is thus a factor that appears to affect the written text – or text production process – directly.

In study 2, we compared writing processes in three languages for our subset of bilingual writers: French (the dominant school language), Turkish (the native heritage language) and English as a foreign language. We found that multilingual learners' writing processes show both similarities and differences between the three languages. These 15 learners wrote more fluently in their school language (French), than in FL English and in Turkish – despite the fact that it is their native heritage language. They wrote more texts with longer text burst-length and lower pause and revision rates in French than in Turkish and English. The keystroke logging data show that our bilingual learners' within-word pauses are high in Turkish. Research suggests that pauses at word level can be concerned with vocabulary retrieval processes (e.g. Alves et al., 2007). During these pauses, our learners reported they were thinking about either finding the correct word to fit into the context, or the spelling of that word. They might also have been involved in key-finding activity, since they are much less familiar with writing and typing in Turkish than in French. Our Turkish-French bilingual learners' limited knowledge of written Turkish (and typing in Turkish) certainly hindered their fluency in Turkish writing; as is frequently the case for heritage languages – and always the case for native languages – their use of Turkish is primarily oral, with only one hour per week of instructed Turkish at school, over a period of eight years (so only a tiny fraction of the time they spend learning to read and write the school language, French).

In fact, we found more similarities between the writing processes in English and in Turkish – both less-developed for these learners in this written modality. In most cases, although they

are of course more at ease with oral language production in L1 Turkish, we did not find much difference for our bilingual learners between Turkish and English text production. Analyses of copy task measures reveal important differences between typing in French, Turkish and English; but they correlate well with each other within the language and between the three languages of production. We also found that there is a relationship between our copy task measures, linguistic knowledge, text quality and writing process measures, the degree of which varies according to the languages. More importantly, we found strong positive correlations between the first quarter exam scores and text quality in French, Turkish and English writing. These findings provide strong evidence in multilingual writing for the influence of linguistic knowledge on text quality.

In study 3, we compared the writing processes and text quality of 9$^{th}$ grade monolingual and bilingual learners. We found a slight difference in pausing behavior between the two groups, with a higher rate of within-word pausing in French for the bilingual learners. This indicates that our bilingual learners (who are not writing in their L1) paused longer during French text production than their monolingual peers, to formulate and check for French grammar and spelling in sentence construction. Another interesting result is that we found significant differences between monolinguals and bilinguals in EFL: a lower rate of between-word pausing and lower revision rates for the bilingual writers in English. This might be due to a bilingual capacity for faster mental revision before they write down a sentence in a foreign language, or perhaps to greater use of written English outside the classroom.

Finally, our study of a subset of seven learners, who reported introspectively on their pauses and hesitations shows that we found that their reported writing behaviour was significantly correlated with the copy task in French, text quality, numbers of total words, all three writing fluency measures and pause behaviour in their French. We found a positive correlation between motivation for learning English and our learners' post-writing perceptions in L2/L3 English narrative writing. Motivation for FL learning (for writing) was also positively correlated with productivity and writing fluency and pause beahviour, but not with revision processes and their school average in English. These positive correlations with motivation for learning English (or motivation for writing) suggest that the more motivated the learners are to learn English as a foreign language, the more fluently they write and the more words they produce in EFL writing. We found that the English school average was also correlated with our learners' L2 English post-writing perception. This might indicate that the more a learner knows about the foreign language, the better s/he perceives her own narrative text production

in this language. Once again, greater linguistic knowledge seems to ease writing processes in EFL, with more fluent, less effortful text production.

***Significance of the research***

First, and most importantly, this is the first study which looks at French middle-school teenagers' writing processes in both their L1/dominant French and L2/L3 English, although there are studies comparing L1 French writing processes according to age groups (e.g. Aillaud, 2016; Alamargot & Chanquoy, 2001; Olive et al., 2009), or L1 and L2 writing processes of French university students (Barbier, 1998). Second, our results also contribute to our better understanding of text production processes in monolingual and bilingual writers. Our results suggest that monolinguals' produce longer texts in French; however, bilinguals produce marginally longer texts between two long pauses (P-burst length) in English. More importantly, bilinguals make revisions at text level less frequently than the monolinguals when writing in the foreign language. This result provides strong evidence for the hypothesis that bilinguals plan before they put their ideas into transcription. This could suggest that their control mechanisms must have been more developed since they have to control the code-switching between the languages. This control behaviour might develop executive functioning of bilingual learners (Bartolotti & Marin, 2012).

Third, our research is the first study that focuses on writing processes of 14- to 15-year-old trilingual learners in three languages using keystroke loggings. We were able to compare their typing speed, fluency, and pause and revision behaviour in addition to text quality across three languages. We found that writing in any language was heavily influenced by the writer's linguistic proficiency in that language. The more developed the language is, the more fluently the student produced the text in that language (with less pause time and fewer revisions), and with better text quality.

Fourth, one of the concrete contributions of our research to the writing research field is the development of a copy task in Turkish. The *Inputlog* copy task is a recently-developed keystroke logging tool for measuring motor- and language-specific typing skills. It is available in ten languages (Van Waes et al., 2020). I helped develop the Turkish version of the copy task for the purpose of this study and as a scientific research tool. This study is the first to use three versions of the copy task (French, Turkish, and English) to measure mono- and bilingual students' typing skills in their different languages. We found that the writers' typing behaviour is different for different languages. Typing skills in one language seem to

be related to proficiency in that language. The more developed the writer's language is, the better an individual types in that language. Moreover, typing in one language seems to be related to skill in typing in orthographically similar languages (such as French and English), due to the writer's knowledge of and practice in high frequency bigrams.

***General discussion and conclusion***

Our results demonstrate that our 9th grade learners compose a foreign-language writing text less fluently than an L1/ dominant language text (corroborating findings by: Breuer, 2014; Chenoweth & Hayes, 2001; Lindgren, Sullivan, & Spelman Miller, 2008; Sasaki & Hirose, 1996; Schoonen et al., 2009; Silva, 1993; Tiryakioglu et al., 2019; Van Waes & Leijten, 2015). Our subjects produced fewer characters per minute and words per minute during English writing than in French. They formulate more text between two long pauses in French. In addition, our findings related to word-search operations show that our learners devoted their attention to linguistic concerns and compensatory problems in FL writing, as in Manchón and Larios (2007).

Like all complex human communication, writing places high demands on an individual's attentional capacity (working memory), to manage the formulation of ideas and their organization, while putting them "into words". In foreign-language writing, our limited attentional capacity is saturated with issues of formal encoding, which take place more automatically (without consuming attentional capacity) in L1 writing. Lack of linguistic knowledge therefore constrains the students' expression of meaning, and higher-level pragmatic and semantic processes (Chenoweth &Hayes, 2001; Whalen & Ménard, 1995), as pointed out by Hilton (2008, for oral production):

> If a speaker's attention is monopolized at the 'lower' (formal) level, where processes of lexical selection, morphological formulation, or even articulatory gesture have not been automatized through extensive repetition, the fluent exchange of 'higher'-level meaning will be impossible, or at least time-consuming, and laborious (p.162).

Our stimulated recall protocols show that when our 9th grade learners are faced with a difficult FL writing task, they report spending most of their pause time finding the words to express their ideas, spelling them, and building up grammatically appropriate sentences. Their revisions consist mostly of deleting and adding words, according to our keystroke analyses. Overall, our students produced their English texts less fluently. As Chenoweth and Hayes (2001) and Schoonen et al. (2011) suggest, they are unable to activate the language forms they need automatically – that is, without a cognitive (metalinguistic) effort. The

formulation process, the central process in writing, seems to be the most influenced by the writer's linguistic resources; because in this process propositional content is transformed into linguistic form (Chenoweth & Hayes, 2001; Schoonen et al., 2003). Having rich linguistic resources -- "lexical, morphosyntactic and orthographic knowledge" – enables the formulation process (Schoonen et al., 2011, p. 33), and turns the attentional focus from lower-level activities (spelling, word choice, grammatical operations) towards higher-level pragmatic aspects of writing (taking the reader into account, narrative effects and structure; Chenoweth & Hayes, 2001; Schoonen et al., 2003; Whalen & Ménard, 1995).

Our results for multilingual writing processes are in line with Lindgren et al.'s findings (2019) that writing proceses are different when a multilingual learner writes a text in three languages depending on her/his language competence in each language. Our Turkish-French bilingual learners focused more on lexical issues with less writing fluency in their Turkish heritage language writing compared to their French dominant language writing, in which they focused more on pragmatic concerns with the more fluent writing. Similar to Lindgren's case study results obtained from a multilingual writer, it seems that our bilingual learners' familiarity with French language for writing enabled them to focus more on meaning, "while the cognitive constraint coming with the use of the other two languages restricted him to focus more on form" (p. 362-363). Our results corroborated the previous research that writers focus on meaning in their L1, whereas they focus on form when they write a second/foreign language text (Lindgren & Sullivan, 2008; Lindgren et al., 2019; Silva, 1993).

Our results have also provided evidence that L1 writing skill is transferred to L2/L3 writing, as suggested in previous studies (Arndt, 1987; Berman, 1994; Cummins, 1982; Jones & Tetroe, 1987; Woodall, 2002); as we saw in Chapters 7 and 8, this transfer is multidirectional, between all of the writer's languages: "[…] boundaries between languages used in writing processes have been found to be blurred or overlapping, just as they are for text features" (Kobayashi & Rinnert, 2013, p.6).

To conclude, the specificity of our results in terms of L1, L2 and L3 writing is that we were able to obtain results and shed light into the differences between French, Turkish and L3 English composing processes and text quality of middle school EFL students.

***Limitations***

There are some limitations to our research. First, as the number of participants is small (n=30), we should be very cautious in generalizing our results. Future studies into learners'

composing processes could be performed using similar tools to increase the basis of our conclusions. We should also be cautious about the generalizibility of the results obtained from comparison of the writing processes in French, Turkish and English into other languages, since writing in other languages could produce different types of results.

It is important in future research to use writing tasks in different genres (other than descriptive and narrative texts), since different writing tasks also yield different results. More detailed linguistic analyses would help to determine the relationship between the use of certain linguistic features, composing processes and text quality. Our study was not designed to look into causal relationships of this type, but more experimental research designs (using keystroke loggings) could look into the effects of learning certain words, structures, or typing patterns, for example.

***Pedagogical implications***

Since our results do show relationships between linguistic knowledge and the fluency and quality of text production, we can think about the types of teaching and learning activities that might improve writing proficiency in the foreign (and maybe even native) language classroom. It is important to improve language knowledge as a route to better writing. Fluency in use of language depends crucially on automatic linguistic encoding; L2 writing fluency will certainly improve if learners have a large, automatically-available lexicon that they can use to encode ideas. Students need to learn more words and train to use them automatically to develop fluency in L2 production (Hilton, 2008; Van Gelderen et al., 2011). They can learn how to build up formulaic sentences in EFL writing classes (Hilton, 2008; Peters & Pauwels, 2015):

> Formulae are those groups of words that co-occur regularly in a language, ranging from idiomatic expressions and clichés, through collocations, to simple recurring sequences, such as *turn off the light*, or *fall off* + *noun*. (Hilton, 2008, p.162)

Better linguistic knowledge is related to more automatic language knowledge – the only way of "lowering the cognitive cost" of writing. The easier the students activate their lexicon, the more fluently they produce a written text.

***Writing Strategy Instruction in the L1 and L2***

Research has found that writing strategy instruction is beneficial for improvement of writing skills of learners (e.g. Graham & Harris, 2013; Graham, Harris & Mason, 2005; Kellogg, 2008; Limpo & Alves, 2013; Tiryakioglu et al., 2014; Torrance et al., 2007; Van Steendam et

al., 2010; Van Steendam et al., 2014). While composing a foreign-language text, we expect our learners to transfer their L1 writing strategies into L2 writing. Although highly-proficient writers may achieve this, low-proficiency or novice writers may not have many strategies to transfer. Unskilled writers can be explicitly taught writing strategies, and how to implement them (Sasaki, 2000); a supportive learning environment will help them move from a "knowledge-telling" model towards the "knowledge-transforming" model that is used by expert writers (see Chapter 1 Section 1.4, Bereiter & Scardamalia, 1987).

Strategy instruction provides students with explicit and systematic teaching of strategies such as planning, sentence generation, and revising to accomplish writing-specific processes. These strategies involve ''how to'' knowledge for performing a particular writing process (Harris & Graham, 1996). Graham and Perin (2007) investigated the effective instructional practices in teaching writing to adolescents in L1 and found that strategy instruction (0.82) and summarization (0.82) have the greatest effect size compared with the other instructional approaches approaches, like peer assistance (0.75), setting product goals (0.70), word processing (0.55), sentence combining (0.50), inquiry (0.32), prewriting activities (0.32), process writing approach (0.32), study of models (0.25), grammar instruction (- 0.32). They suggest that teachers should encourage their students to look at writing as a process and teach them how to plan, draft, revise and edit.

Graham, Harris and Mason (2005) studied how Self-regulated Strategy Development instruction (SRSD) is effective in the improvement of L1 writing performance and self-regulated skills of students with learning disabilities. They taught students specific writing strategies (POW–*Plan, Organize, What/When/How*) while writing stories and persuasive essays in five phases: 1) develop background knowledge for content generation; 2) discuss it (the story); 3) model it (the writing process); 4) support it (the writing process); 5) independent performance. In a series of studies on strategy-focused training in L1 writing (Fidalgo & García, 2012; Fidalgo et al., 2008; 2017; Torrance et al., 2007), Cognitive Self-Regulation Instruction (CSRI) resulted in an increase in the amount of time spent for planning, but not revising. Over time, the quality of texts written by students having received CSRI was found to be higher than the control group. However, this study does not give a clear idea of which writing strategies were most effective, since CSRI is a multi-variable intervention.

As for the effects of strategy instruction in L2 writing research, it is suggested that student writers having received L2 writing strategy instruction improve their use of vocabulary (Muncie, 2002), planning strategies (Sasaki, 2002; 2004), synthesis writing (Zhang, 2013), and text quality scores (e.g. Akyel & Kamisli, 1997; Sengupta, 2000; Shehadeh, 2011; Zhang, 2013). Collaborative writing instruction improved the quality of university students' L2 texts significantly, in terms of content, organization and vocabulary – but not grammar and mechanics (Shehadeh, 2011). L2 strategy instruction also influenced the development of writing strategies in English and Turkish with an increase in the use of deep level revision strategies in English composition and a decrease in the students' use of surface level revision strategies in composing process of English and Turkish essays (Akyel & Kamisli, 1997).

Teaching writing strategies might also contribute to more positive attitudes towards L2 writing. Pennington and colleagues (Pennington et al., 1996) found that teachers developed a more positive attitude towards teaching writing processes after implementing strategy instruction. More academically successful students in two classes had positive attitudes towards writing in a second language, while low-achieving students responded negatively to the questionnaires. Akyel and Kamisli (1997) found that student writers developed positive attitudes towards L2 writing strategy instruction. The students also felt that they gained self-confidence not only in writing in English but also in Turkish (Akyel & Kamisli, 1997).

Writers appear to benefit from L2 writing strategy instruction differently at different level of writing or language proficiency. For instance, Van Steendam and colleagues (Van Steendam et al., 2010) found that more proficient college student writers benefited more from short-term revision strategy instruction than the weaker students. Eckstein (2013) implemented a L2 writing conference program for international L2 writers (n=546) and evaluated its effect on students' preferences according to L2 proficiency levels. The results showed lower-proficiency students preferred less collaborative feedback and feedback on local concerns–immediate linguistic preoccupation such as grammar, mechanics, and word choice – whereas high-proficiency students favored more collaborative feedback with global concerns – such as text organization and content.

Unskilled L2 writers can be taught how to implement writing strategies (Sasaki, 2000) through pair-work, group-work and drama activities to improve their text production. In this respect, for low-proficiency students, sentence-building and combining strategies, and vocabulary use strategies should be taught; the whole composing process should also be

modelled, to make learners aware of writing processes not only in their L1, but also in EFL lessons.

***Pilot study on L2 writing strategy instruction***

Most research on L2 writing instruction has focused on developing L2 planning and revision skills and strategies at university level. There is little research on the effectiveness of L2 writing strategy instruction for low-proficiency EFL learners in middle schools (Sengupta, 2000). In a study with Turkish EFL high school students, I carried out a pilot study to investigate the possible effects of L2 writing strategy instruction on writing performance and perceptions at different L2 proficiency levels. The results of that pilot study were presented at a writing conference (Tiryakioglu, Peters & Verschaffel, 2014). Below I describe and present the results from this study in detail. The participants were twenty-eight 9$^{th}$ (n=14) and 10$^{th}$ (n=14) grade 14-16-year-old Turkish high-school EFL students at A1 and A2 levels according to *Common European Framework for References of Languages* (CEFR) levels. Both groups received process-based L2 writing strategy instruction (adapted from Harris and Graham's (1996) SRSD model), which involves planning, drafting, revising and editing strategies. The planning and drafting strategies of brainstorming, mind-mapping, text generation and text organization were instructed explicitly; for revising and editing strategies, the students were simply shown how to revise and correct their own EFL compositions. Two instructional sessions were organized on writing an argumentative task. The teacher's role was to model how to use planning and drafting strategies, thinking aloud during writing, and scaffolding students by encouraging them to participate in the writing process. The students' role involved brainstorming, suggesting ideas, words and sentences while observing their teacher during text production, thinking aloud while composing an L2 text. The students wrote two texts; one prior to this strategy instruction, the other afterwards. Their texts were evaluated using Jacobs and colleagues' (1981) *ESL Composition Profile*.

Data drawn from pre-and post-writing tasks, student writing questionnaires and student lesson evaluation questionnaires showed that L2 Writing Strategy Instruction positively influenced the writing performance of these EFL learners at both levels. Both A1 and A2 level students showed improvement in their L2 writing performance. Our findings indicated that the A2 level EFL students benefited more from L2 Writing Strategy Instruction, with more gains in their English writing performance scores than their A1 level counterparts. A closer analysis of the students' texts revealed that A2 level students tended to use more

discourse markers than the A1 level students, and that these seemed to reflect better organized texts. L2 Writing Strategy Instruction also positively influenced the perceptions of these EFL learners towards Writing Strategy Instruction at both levels. Both A1 and A2 level students liked the brainstorming strategy better than mind mapping, text-generation or text-organization strategies. Brainstorming was listed as the most-liked activity by 71% of the students in both groups.

Students' responses to open-ended questions in the *Lesson Evaluation Questionnaire* showed that both groups developed positive attitudes towards the intervention. However, each group found different writing strategies beneficial in improvement of their L2 writing performance: a) A1 level students found strategy instruction more difficult to use than A2 level students, b) the A1 students favoured brainstorming and found text-generation strategies useful to learn; c) A1 students found it difficult to generate texts in L2, to organize their texts, to find vocabulary and "necessary" grammar to express their intended meaning; d) A2 students liked brainstorming, learning new knowledge and techniques during the L2 Writing Strategy Instruction; e) A2 level students were more interested in the pragmatic techniques. They found it difficult to find "appropriate" words and "impressive" sentences and linking words to express their intended meaning. These results suggest that L2 writing strategy instruction might help teaching L2 learners how to improve their writing performance at the middle-school level.

Flower (1980) has written extensively about the "perfect-draft" problem in L1 writing. Producing a "perfect draft" is a cognitively-demanding – and probably unrealistic –process. Flower suggests writing without revision, saving this for a subsequent and separate step. Brainstorming may contribute to a successful "imperfect-draft" strategy (Flower 1981). The writer jots down the ideas that come to her mind in any order, which is also a way for creative thinking to emerge. Free-writing activities might enable students to write down what come to their minds about a particular topic or picture. In these activities, they are told to write down their ideas without thinking about possible mistakes, encouraging writers to focus on idea-generation, rather than grammatical and pragmatic concerns – it may help prevent writer's block (Rose, 1984).

***Keystroke loggings as an instructional tool***

Research suggests that keystroke logging can be used as an instructional tool in teaching L1, L2, and L3 writing, since its replay function enables student writers to watch their writing

unfold. Our stimulated recall interviews with seven focus-group learners showed that watching recorded *Inputlog* files enable learners to express their awareness of writing processes, especially the revision process through which they recognize and correct spelling, lexical, grammatical, and errors, and improve the pragmatic aspects of their writing. This result aligns with previous research that suggests keystroke logging allows student writers to reflect on their actions and thoughts while writing on a computer, increasing their awareness of their writing processes (Lindgren, 2004; Lindgren & Sullivan, 2003, 2006; Sullivan & Lindgren, 2002) and improving their self-regulation while writing not only in L1 but also in L2 or L3.

Keystroke logging can also be used in writing instruction as a method for teacher or peer feedback. Students can watch the log files with their teachers, who provide feedback. This technique can be used not only by teachers in schools and universities but also by tutors in writing centers to give feedback and advice on how to develop L1 or L2 writing skills. Teachers could also use keystroke logging to see if a certain type of learning program (language-focused, strategy-focused) was having a positive effect on learners' writing. Researchers could pair this with eye-tracking techniques (Ranalli et al. 2019). Peers can also provide feedback to each other by watching the log files in pairs and focusing on revisions (additions and deletions) during the writing process. Lindgren (2004) has found that this method of peer instruction and feedback improves writers' text quality.

In one possible teaching/learning situation, the teacher could also present writing students with log files from a skilled and unskilled writer, as examples of expert and novice composition processes, and ask students to identify the differences. This may help raise awareness of the processes used in effective writing, and constitutes an interesting example of learning from one's peers (Braaksma et al., 2004).

To conclude, these various instructional techniques and methods can be adapted and used for teaching writing not only in the L1 but also in the second or foreign languages, depending on the needs and levels of the writers.

***Directions for future research***

The findings of this research project highlight possible areas for further research. While some behaviour differs in L1 and L2 writing, there are also similarities. Strömqvist and colleagues (2006, p. 73) suggest that a "searchable, web-based archive of online writing data from writers of different languages, age-groups and abilities, would present a rich source not only

for researchers, but also for teachers and students." We plan to extend our research to first, second and third languages, with age-matched groups to gain further insights into text production in multilingual writing. We would like to collect data from native Turkish teenagers in Turkey who are learning French as a school language, and English as a foreign language to investigate whether there are differences in writing processes in L1 Turkish, L2 French and L3 English.

Previous research on bilinguals' language learning suggests that:

> […] bilingualism can be a valued precursor of general as well as lingual flexibility. A second, more general, implication is that second language experience can change structural and functional properties of mind. (Ransdell, Arecco & Levy, 2001, p.127)

To have a better understanding of differences we measured in bilingual and monolingual writing, we will need to organize data collection for a more fine-grained analysis of text features (Rinnert & Kobayashi, 2016; Rinnert et al., 2015; Valdés, 2005), and cognitive and cultural processes involved in text production. We would like to perform close linguistic analysis of our keystroke logging data. The linguistic analysis function of *Inputlog*[17] could be used to look for more evidence on linguistic processing among bilinguals and monolinguals (Leijten et al., 2019). These analyses highlight how writers use different linguistic units (like nouns, adjectives, verbs, or prepositions) during writing process, and may help us understand how the use of these linguistic units influences text quality in L1, L2 or L3 writing.

Although we have tried here, to a certain extent, to unravel the writing processes that underlie linguistic and cognitive processing in L1 and L2 writing, there are many cognitive, linguistic and pragmatic activities that take place during text production. A more fine-grained consideration of pause location and revision type is something to be carried out following our doctoral defence. Our research looks at two kinds of pause locations: within- and between-words. We will now look more closely at different types of boundary pauses: sentence boundaries, clause boundaries, paragraph boundaries. We can also look more qualitatively at the types of revisions the students made while writing: linguistic or pragmatically-focused revisions. We can look more carefully at revision-type differences between monolingual and bilingual writers, or across languages and tasks. Some further future research includes the following: What kinds of revisions do the learners make in their different languages? Do their hesitations at various pause locations underlie different types of linguistic processing in L1,

[17] The linguistic analysis function of *Inputlog* is a new feature of the program unavailable to use for data analysis publicly and processed only by the *Inputlog* developers when requested for research purposes.

L2 and L3 writing? How do the writers transfer their writing skills/processes from one language to another? What are the underlying mechanisms that seem to trigger language transfer?

***Implications for educational policies***

Our Turkish-French bilingual students' limited experience with writing (and typing) in Turkish suggests that the heritage language curriculum should include focused work on written language production. Although heritage speakers are orally proficient, they need systematic work on their writing skills in that language: lexical orthography, syntax, pragmatic text structures, etc. (Tiryakioglu, 2008; 2011; Tiryakioglu & Hilton, 2019). Our teaching suggestions align with those of Cummins (1980; 1982), who suggests that the development of literacy skills in a native/heritage language will enhance bilingual learners' "executive skill" (metacognitive knowledge of language and its functions), and enhance their acquisition of the second – and any other foreign - languages.

We therefore suggest that more action should be taken at the "macro" level in France and European schools. Systematic learning of heritage languages – including their written components – should be targeted in European countries. Although the European Union Council has developed policies for the teaching and learning of heritage languages in European countries (De Bot & Gorter, 2005), it seems that the application of these educational policies largely depends on educational policies in each country.

The data obtained in this study with a mixed-methods approach illustrate the dynamic processes involved in multilingual writing. We hope that our research provides some insights for educationalists, program developers and teachers, and that keystroke logging will be considered among the instructional methods teachers can use to develop effective writing techniques in French, Turkish and English as well as in other languages.

# REFERENCES


Adrian, H., Dowling, C., Manescau, G., Renou, R., & Sandra, S. (2013). *Join the theme 3e*. Paris:Nathan

*Agence National de la Recherche* (https://anr.fr/fr/lanr-et-la-recherche/engagements-et-valeurs/lintegrite-scientifique/).

Ailhaud, E. (2016). *Etude des processus rédactionnels d'un texte : les données temporelles comme indices de la gestion des unités de production*. Thèse de doctorat, Sciences du Langage, Université Lyon 2

Akinci, M.A. (2006). Du bilinguisme à la bilittéracie. Comparaison entre élèves bilingues turc-français et élèves monolingues français. *Langage et Société*, *116,* 93-110.

Akinci, M. (2007). *Fransa'da Türkçe Ana Dili Eğitimi ve İki Dilli Türk Çocuklarının Dil Becerileri*. II. Avrupa Türk Dili Bilgi Şöleni, 5-6 mayıs, TOBB Ekonomi ve Teknoloji Üniversitesi, Ankara,

Akinci, M.A. (2010). Des pratiques langagières aux activités bilittéraciques : le cas des jeunes bilingues issus de l'immigration turque en France. In C. Corblin, C. & J. Sauvage (Eds.), *L'enseignement des Langues vivantes étrangères à l'école* (pp. 115-144). Paris : L'Harmattan, collection Enfances-Langages.

Akinci, M.A. (2016). Le bilinguisme des enfants turcophones issus de familles immigrées. In C. Hélot & J. Erfurt (Eds*), L'éducation bilingue en France: Politiques linguistiques, modèles et pratiques* (pp. 473-486). Limoges: Lambert Lucas.

Akinci, M.A., & Decool-Mercier,N. (2010). Aspects of language acquisition and disorders in Turkish-French bilingual children. In S. Topbas, & M.Yavas (Eds.), *Communication Disorders in Turkish in monolingual and multilingual setting* (pp. 314-353). Clevedon: Multilingual Matters

Akinci, M.A., Pfaff, C., & Dollnick, M., (2009). Orthographic and morphological aspects of written Turkish in France, Germany and Turkey. In I. Ergenc (Ed.), *Essays on Turkish Linguistics* (pp. 363-372). Wiesbaden: Otto Harrassowitz Verlag.

Akyel, A. (1994). First language use in EFL writing: Planning in Turkish vs. planning in English. *International Journal of Applied Linguistics, 4*(2), 169-184.

Akyel, A., & Kamisli, S. (1997). *Composing in first and second languages: Possible effects of EFL writing instruction.* Odense Working Papers in Language and Communication: Still More on Writing, *14*, 69-95.

Alamargot, D., & Chanquoy, L. (2001). *Through the models of writing*. Dordrecht: Kluwer Academic Publishers.

Alamargot, D., Lambert, E., Thebault, C., & Dansac, C. (2007). Text composition by deaf and hearing middle-school students: The role of working memory. *Reading and Writing, 20*, 333–360. https://doi.org/10.1007/s11145-006-9033-y

Aldridge, M., & Fontaine, L. (2019). Using keystroke logging to capture the ımpact of cognitive complexity and typing fluency on written language production. In E. Lindgren & K.P.H. Sullivan (Eds.), *Observing writing: Insights from keystroke logging and handwriting* (pp. 285-305). Leiden, the Netherlands: Brill.

Alves, R. A., Castro, S. L., de Sousa, L., & Strömqvist, S. (2007). Typing skill and pause–execution cycles in written composition. In M.Torrance, L.Van Waes, & D. Galbraith (Eds.), *Writing and cognition: Research and applications* (pp. 55-65). Amsterdam: Elsevier.

Alves, R. A., Castro, S. L., & Olive, T. (2008), Execution and pauses in writing narratives: Processing time, cognitive effort and typing skill. *International Journal of Psychology, 43* (6), 969–979. doi:10.1080/00207590701398951

Archibald, A. , & Jeffrey, G. (2000). Second Language Acquisition and writing: a multidisciplinary approach. *Learning and Instruction, 10*(1), 1–11.

Arndt, V. (1987). Six writers in search of texts: A protocol-based study of L1 and L2 writing. *ELT journal*, *41*(4), 257-267.

Baaijen, V., Galbraith, D., & de Glopper, K. (2012). Keystroke analysis: Reflections on procedures and measures. *Written Communication, 29*(3), 246–277.

Baba, K. (2009). Aspects of lexical proficiency in writing summaries in a foreign language. *Journal of second language writing*, *18*(3), 191-208.

Babayiğit, S. (2014). Contributions of word-level and verbal skills to written expression: Comparison of learners who speak English as a first (L1) and second language (L2). *Reading and Writing*, *27*(7), 1207-1229.

Baddeley, A. D. (2000). The episodic buffer: A new component of working memory. *Trends in Cognitive Sciences*, *4*(11), 417-423.

Baddeley, A. (2012). Working memory: Theories, models, and controversies. *Annual Review of Psychology, 63*, 1–29.

Baddeley, A., Gathercole, S., & Papagno, C. (1998). The phonological loop as a language learning device. *Psychological Review, 105*(1), 158–173. https://doi.org/10.1037/0033-295X.105.1.158

Baddeley, A. D., & Hitch, G. (1974). Working memory. In G.H. Bower (Ed.), *The psychology of learning and motivation: Advances in research and theory* (pp. 47–89). New York: Academic Press.

Barbier, M.L. (1998). Written production in first and second language: Activation of writing processes and cognitive resources. *Proceedings of the EARLI Special Interest Group on Writing* (pp. 369-374), University of Poitiers.

Barbier, M. L., Piolat, A., Roussey, J. Y., & Raby, F. (2008). Notetaking and writing from hypertexts in L1 and L2: cognitive effort and language procedures. *International Journal of Applied Linguistics, 156*, 31-50.

Barkaoui, K. (2007). Rating scale impact on EFL essay marking: A mixed-method study. *Assessing writing*, *12*(2), 86-107.

Barkaoui, K. (2014). Examining the impact of L2 proficiency and keyboarding skills on scores on TOEFL-IBT writing tasks. *Language Testing, 31*(2), 241– 259.

Barkaoui, K. (2015). Test takers' writing activities during the TOEFL iBT® writing tasks: A Stimulated recall study. *ETS Research Report Series*, *2015*(1), 1-42.

Bartolotti J, & Marian V. (2012). Language learning and control in monolinguals and bilinguals. *Cognitive Science, 36*(6), 1129-1147.doi: 10.1111/j.1551-6709.2012.01243

Beare, S., & Bourdages, J. S. (2007). Skilled writers' generating strategies in L1 and L2; An exploratory study. In Rijlaarsdam, G. (Series Ed.) & M. Torrance, L. Van Waes & D. Galbraith (Volume Eds.), *Studies in writing: Vol. 18. Writing and cognition: Research and applications* (pp. 151-161). Amsterdam: Elsevier

Beauvais, C., Olive, T., & Passerault, J.M. (2011). Why are some texts good and others not? Relationship between text quality and management of the writing processes. *Journal of Educational Psychology, 103*, 415–428. http://dx.doi.org/10.1037/a0022545.

Bereiter, C., & Scardamalia, M. (1987). *The psychology of written composition.* Hillsdale, NJ: Erlbaum.

Berman, R. (1994). Learners' transfer of writing skills between languages. *TESL Canada Journal, 12* (1), 29-46.

Berninger, V. W. (1999). Coordinating transcription and text generation in working memory during composing: Automatic and constructive processes. *Learning Disability Quarterly*, *22*(2), 99-112.

Bialystok, E. (2009). Bilingualism: The good, the bad, and the indifferent. *Bilingualism: Language and Cognition, 12* (1), 3–11.

Bosredon, C. (2014). Représentations de l'écriture au cycle 3 : une enquête croisée auprès d'enseignants et d'élèves. *Pratiques* [Online], 161-162, retrieved on 21/June/2016 from http://pratiques.revues.org/2200

Braaksma, M.A.H., Rijlaarsdam, G., & Van den Bergh, H. (2004). Observational learning and its effects on the orchestration of writing processes. *Cognition and Instruction, 22*(1), 1-36.

Breetvelt, I., Van den Bergh, H., & Rijlaarsdam, G. (1994). Relations between writing processes and text quality: when & how? *Cognition and Instruction, 12*(2), 103-123.

Breuer, E. O. (2014). *First Language versus Foreign Language Fluency, Errors and Revision Processes in Foreign Language Academic Writing.* Unpublished PhD Dissertation. University of Bonn.

Breuer, E.O. (2019). Fluency in L1 and FL writing: An analysis of planning, essay writing and final revision. In E. Lindgren & K.P.H. Sullivan (Eds.), *Observing writing: Insights from keystroke logging and handwriting*. (pp. 189–210). Leiden, the Netherlands: Brill.

Chenoweth, N. A., & Hayes, J. R. (2001). Fluency in writing. Generating in L1 and L2. *Written Communication*, *18*(1), 80-98.

Chenoweth, N. A., & Hayes, J. R. (2003). The inner voice in writing. *Written Communication*, *20*(1), 99-118.

Chesnet, D., & Alamargot, D. (2005). Analyse en temps réel des activités occulaires et graphomotrices du scripteur: intérêt du dispositifs "Eye and Pen". L*'Année Psychologique, 105*(3), 477-520.

Connelly, V., Dockrell, J. E., & Barnett, J. (2005). The slow handwriting of undergraduate students constrains overall performance in exam essays. *Educational Psychology*, *25*(1), 99-107.

Connelly, V., Dockrell, J. E., & Barnett, A. (2011). Children challenged by writing due to language and motor difficulties. In V. Berninger (Ed.), *Cognitive psychology of writing handbook: Past, present, and future contributions of cognitive writing research to cognitive psychology* (pp. 217-245). East Sussex, UK: Psychology Press.

Connelly, V., Dockrell, J. E., Walter, K., & Critten, S. (2012). Predicting the quality of composition and written language bursts from oral language, spelling, and handwriting skills in children with and without specific language impairment. *Written Communication*, *29*, 278–302.

Chenu, F., Pellegrino F, Jisa, H., & Fayol, M. (2014). Interword and intraword pause threshold in writing. *Frontiers in Psychology*,5:182. doi: 10.3389/fpsyg.2014.00182

Cho, Y. (2003). Assessing writing: Are we bound by only one method? *Assessing writing*, *8*(3), 165-191.

Choi, Y. H. (2016). Writing strategies in the process of L2 computer-mode academic writing with the use of multiple resources. *English Teaching, 71*, 3-28.

Crossley, S. A., & McNamara, D. S. (2009). Computational assessment of lexical differences in L1 and L2 writing. *Journal of Second Language Writing*, *18*(2), 119-135.

Cumming, A. (1989). Writing expertise and second language proficiency. *Language Learning, 39,* 81-141.

Cumming, A. (2001). Learning to write in a second language: Two decades of research. *International journal of English studies*, *1*(2), 1-23.

Cummins, J. (1980). The cross-lingual dimensions of language proficiency: Implications for bilingual education and the optimal age issue. *TESOL Quarterly, 14*(2), 175-187. doi:10.2307/3586312

Cummins, J. (1982). *Interdependence and bicultural ambivalence: Regarding the pedagogical rationale for bilingual education.* Rosslyn, VA: National Clearinghouse for Bilingual Education.

De Bot, K., & Gorter, D. (2005). A European perspective on heritage languages. *The Modern Language Journal, 89*(4), 612-616.

De Milliano, I., Van Gelderen, A., & Sleegers, P. (2012). Patterns of cognitive self-regulation of adolescent struggling writers. *Written Communication*, *29*(3), 303-325.

Deane, P., & Zhang, M. (2015). *Exploring the feasibility of using writing process features to assess text production skills* (ETS Research Report No. RR-15-26). Princeton, NJ: Educational Testing Service. http://dx.doi.org/10.1002/ets2.12071

DeSilva, R., & Graham, S. (2015). The effects of strategy instruction on writing strategy use for students of different proficiency levels. *System, 53,* 47–59.

Dörnyei, Z. (2001). New themes and approaches in second language motivation research. *Annual review of applied linguistics*, *21*(1), 43-59.

Duncan, L. G., Casalis, S., & Colé, P. (2009). Early metalinguistic awareness of derivational morphology: Observations from a comparison of English and French. *Applied Psycholinguistics*, *30*(3), 405-440.

Eckstein, G. (2013). Implementing and evaluating a writing conference program for international L2 writers across language proficiency levels. *Journal of Second Language Writing, 22*, 231-239.

Edelsky, C. (1982). Writing in a bilingual program: The relation of L1 and L2 texts. *TESOL quarterly*, *16*(2), 211-228.

Ellis, R., & Yuan, F. (2004). The effects of planning on fluency, complexity, and accuracy in second language narrative writing. *Studies in Second Language Acquisition*, *26*(1), 59–84.

ELCO Project, Ministry of National Education, retrieved on 15/12/2017 from http://eduscol.education.fr/cid52131/enseignements-de-langue-et-de-culture-d-origine elco.html#lien3

Engber, C.A. (1995). The relationship of lexical proficiency to the quality of ESL compositions. *Journal of Second Language Writing, 4*(2), 139-155.

Ericsson, K. A., & Simon, H. A. (1993). *Protocol analysis: Verbal reports as data* (Rev. ed.). London: The MIT Press.

Council of Europe. Council for Cultural Co-operation. Education Committee. Modern Languages Division. (2001). *Common European Framework of Reference for Languages: learning, teaching, assessment*. Cambridge University Press.

Fayol, M. (1991). From sentence production to text production: Investigating fundamental processes. *European Journal of Psychology of Education, 6* (2), 101-119.

Fidalgo, R., Harris, K. R., & Braaksma, M. (2017). Design principles for teaching effective writing: An introduction. In *Design principles for teaching effective writing* (pp. 3-12). Leiden, the Netherlands: Brill.

Fidalgo, R., & García, J. N. (2012). Comparative Studies of Strategy and Self-Regulated Interventions in Students With Learning Disabilities. In M. Torrance, D. Alamargot, M. Castelló, F. Ganier, O. Kruse, A. Mangen, L. Tolchinsky & L. Van Waes (Eds.), *Learning to Write Effectively: Current Trends in European Research* (pp. 99-102). Leiden, the Netherlands: Brill.

Flower, L. (1980). *Problem-solving strategies for writing*. New York: Harcourt Brace Jovanovich Inc.

Flower, L., & Hayes, J. R. (1980). The dynamics of composing: Making plans and juggling constraints. In L. W. Gregg, & E. R. Steinberg (Eds.), *Cognitive processes in writing* (pp. 31-50). Hillsdale, NJ: Erlbaum.

Flower, L., & Hayes, J.R. (1981). A cognitive process theory of writing. *College Composition and Communication, 32*(4), 365-387.

Galbraith, D., & Baaijen, V.M. (2019). Aligning keystrokes with cognitive processes in writing. In E. Lindgren & K.P.H. Sullivan (Eds), *Observing writing: Insights from keystroke logging and handwriting*. (pp. 305–324). Leiden, the Netherlands: Brill.

Gathercole, S. E., & Baddeley, A. D. (1993). *Essays in cognitive psychology.Working memory and language.* Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Grabe, W., & Kaplan, R.B. (1996). *Theory and practice of writing: An applied linguistic perspective.* London: Longman.

Grabowski, J., Becker-Mrotzek, M., Knopp, M., Jost, J., & Weinzierl, C. (2014). Comparing and combining different approaches to the assessment of text quality. *Methods in writing process research*, 147-165.

Graham, S., Harris, K.R., & Mason, L. (2005). Improving the writing performance, knowledge, and self-efficacy of struggling young writers: The effects of self-regulated strategy development. *Contemporary Educational Psychology, 30*, 207–241.

Graham, S., & Harris, K.R. (2013). Designing an Effective Writing Program. In S. Graham, C. A. MacArthur, & J. Fitzgerald (Eds.*), Best Practices in Writing Instruction* (pp. 3-9). New York: The Guilford Press

Graham, S., & Perin, D. (2007). *Writing next: Effective strategies to improve writing of adolescents in middle and high schools—A report to Carnegie Corporation of New York.* Washington, DC: Alliance for Excellent Education.

Harklau, L. (2007). The adolescent English language learner: identities lost and found. In J. Cummins, & C. Davison (Eds.), International handbook of English language teaching (pp. 559–573). Norwell, MA: Springer

Harris, K. R., & Graham, S. (1996). *Making the writing process work: Strategies for composition and self-regulation*. Cambridge, MA: Brookline.

Hayes, J.R. (1996). A new framework for understanding cognition and affect in writing. In C.M. Levy & S. Ransdell (Eds.), *The science of writing: Theories, methods, individual differences and applications* (pp.1-27). Mahwah, NJ: Erlbaum.

Hayes, J. R. (2012). Modeling and remodeling. *Written Communication, 29*(3), 369-388.

Hayes, J. R., & Chenoweth, N. A. (2007). Working memory in an editing task. *Written Communication*, *24*, 283–294.

Hayes, J. R., & Flower, L. S. (1980). Identifying the organization of the writing process. In L. W. Gregg, & E. R. Steinberg (Eds.), *Cognitive processes in writing* (pp. 3-30). Hillsdale, NJ: Erlbaum.

Hilton, H.E. (2008). The link between vocabulary knowledge and spoken L2 fluency. *Language Learning Journal, 36*(2), 153-166.

Hilton, H. E. (2011a). What is implicit and what is explicit in L2 speech? Findings from an oral corpus. In C. Sanz & R. P. Leow (Eds), *Implicit and Explicit Language Learning: Conditions, Processes, and Knowledge in SLA and Bilingualism* (pp.145-158).Washington DC: Georgetown University Press.

Hilton, H. E. (2011b). Psycholinguistique de la production orale, aisance et disfluence en L2. Dans D. Chini, & P. Goutéraux (dir.) *Intégration de l'altérité dans l'apprentissage des langues : formes didactique et procédures psycholinguistiques* (75-96). Paris : L'Harmattan.

Hilton, H.E. (2014). Oral fluency and spoken proficiency: ideas for testing and research.In P. Leclercq, A. Edmonds & H. Hilton (Eds.), *Measuring L2 Proficiency: perspectives from SLA* (27-53). Bristol: Multilingual Matters.

Hilton, H. E., Lenart, E., & Zoghlami, N. (2016). Compréhension et production en anglais L2 à l'école primaire. *Revue française de linguistique appliquée, XX1*(2), 65-80.

Hirose, K., & Sasaki, M. (1994). Explanatory variables for Japanese students' expository writing in English: An exploratory study. *Journal of Second Language Writing, 3*, 203–229.

Hulstijn, J.H. (2011). Language proficiency in native and nonnative speakers: An agenda for research and suggestions for second-language assessment. *Language Assessment Quarterly, 8*(3), 229-249.

Hyland, K. (2003). *Second Language Writing* (Cambridge Language Education). Cambridge: Cambridge University Press. doi:10.1017/CBO9780511667251

Hyland, K. (2016). Methods and methodologies in second language writing research. *System, 59*, 116-125.

Jacobs, H.L., Zinkgraf, S.A., Wormuth, D.R., Hartfiel, V.E., & Hughey, J.B. (1981). *Testing ESL composition: A practical approach.* Rowley. MA: Newbury House.

Janssen, D., Van Waes, L., & Van den Bergh, H. (1996). Effects of thinking aloud on writing processes. In C. M. Levy & S. Ransdell (Eds.), *The science of writing: Theories, methods, individual differences & applications: The science of uniting* (pp. 233–250). Mahwah, NJ: Lawrence Erlbaum.

Jones, S., & Tetroe, J. (1987). Composing in a second language. In A. Matsuhashi (Ed.), *Writing in real time: Modelling production processes* (pp. 34–57). Norwood, NJ: Ablex.

Kaufer, D., Hayes, J.R., & Flower, L.S. (1986). Composing written sentences. *Research in the Teaching of English, 20*, 121-140.

Kellogg, R.T. (1996). A model of working memory in writing. In G. Rijlaarsdam, H. Van den Bergh, & M. Couzijn (Eds.), *Theories, models and methodology in writing research* (pp. 57-71). Amsterdam: Amsterdam University Press.

Kellogg, R.T. (1999). Components of working memory in text production. In M. Torrance & G.C. Jeffery (Eds.), The *cognitive demands of writing: Processing capacity and working memory in text production* (pp.43-62). Amsterdam: Amsterdam University Press.

Kellogg, R.T. (2008). Training writing skills: A cognitive developmental perspective. *Journal of writing research, 1*(1), 1-26

Knospe, Y., Sullivan, K. P., Malmqvist, A., & Valfridsson, I. (2019). Observing writing and website browsing: swedish students write L3 German. In E. Lindgren & K.P.H. Sullivan (Eds.), *Observing writing: Insights from keystroke logging and handwriting* (pp. 258-284). Leiden, the Netherlands: Brill.

Kobayashi, H., & Rinnert, C. (2012). Understanding L2 writing development from a multicompetence perspective: Dynamic repertoires of knowledge and text construction. In R. M. Manchón (Ed.), *L2 writing development: Multiple perspectives* (pp. 101–134). Berlin: De Gruyter Mouton.

Kobayashi, H., & Rinnert, C. (2013). L1/L2/L3 writing development: Longitudinal case study of a Japanese multicompetent writer. *Journal of Second Language Writing, 22*, 4–33

Kollberg P., & Eklundh K.S. (2002) Studying writers' revising patterns with S-Notation analysis. In T. Olive & C.M. Levy (Eds.), *Contemporary tools and techniques for studying writing* (pp. 89–104). Dordrecht, the Netherlands: Kluwer Academic Publishers.

Kormos, J. (2006). *Speech production and second language acquisition*. Lawrence Erlbaum Associates Publishers.
Kowal, I. (2014). Fluency in second language writing: A developmental perspective. *Studia Linguistica Universitatis Iagellonicae Cracoviensis, 131,* 229-246.

Krapels, A. R. (1990). An overview of second language writing process research. In B. Kroll (Ed.), *Second language writing: Research insights for the classroom* (pp. 37–56). Cambridge: Cambridge University Press.

Kroll, B. (1990). *Second language writing. Research insights for the classroom.* Cambridge: Cambridge University Press.

Kroll, B. (Ed.). (2003). *Exploring the Dynamics of Second Language Writing* (Cambridge Applied Linguistics). Cambridge: Cambridge University Press. doi:10.1017/CBO9781139524810

Kubota, R. (1998). An investigation of Japanese and English L1 essay organization: Differences and similarities. *Canadian modern language review*, *54*(4), 475-508.

Latif, A. M.M. (2008). A state-of-the-art review of the real-time computer-aided study of the writing process. *International Journal of English Studies,* *8*(1), 29–50. Retrieved from http://revistas.um.es/ijes/article/view/49081

Latif, A. M. M. (2013). What do we mean by writing fluency and how can it be validly measured? *Applied linguistics*, *34*(1), 99-105.

Leijten, M., Van Horenbeeck, E., & Van Waes, L. (2019). Analysing keystroke logging data from a linguistic perspective. In E. Lindgren & K.P.H. Sullivan (Eds.). *Observing writing: Insights from keystroke logging and handwriting* (pp. 71–96). Leiden, the Netherlands: Brill. doi:10.1163/9789004392526_005

Leijten, M., & Van Waes, L. (2006). Inputlog: New perspectives on the logging of on-line writing. In K.P.H. Sullivan & E. Lindgren (Eds.), *Studies in Writing: Vol. 18. Computer key-stroke logging and writing: Methods and applications* (pp.73-94). Oxford: Elsevier.

Leijten, M., & Van Waes, L. (2013). Keystroke logging in writing research: Using Inputlog to analyze and visualize writing processes. *Written Communication*, *30*(3), 358-392.

Levelt, W. J. (1999). Language production: A blueprint of the speaker. *Neurocognition of language*, 83-122.
Levy, M.C. & Ransdell, S. (1996). Writing signatures. In C. M. Levy & S. Ransdell (Eds.), *The Science of Writing: Theories, methods, individual differences, and applications* (pp.149-161). New York (N. J.): Lawrence Erlbaum Ass.

Limpo, T., & Alves, R. A. (2013). Teaching planning or sentence-combining strategies: Effective SRSD interventions at different levels of written composition. *Contemporary Educational Psychology*, *38*(4), 328-341.

Lindgren, E. (2004). The uptake of peer-based intervention in the writing classroom. In G. Rijlaarsdam, H. Van den Bergh, & M. Couzijn (Eds.), *Studies in writing: Volume 14. Effective learning and teaching of writing* (pp. 259-274). Dordrecht: Kluwer Academic Publishers.

Lindgren, E. (2005). *Writing and revising: didactic and methodological implications of keystroke logging*. PhD thesis, Umeå University, Sweden.

Lindgren, E., & Sullivan K.P.H. (2002). The LS graph: A methodology for visualising writing revision. *Language and Learning, 52*(3), 565-595.

Lindgren, E., & Sullivan, K. P. H. (2003). Stimulated recall as a trigger for increasing noticing and language awareness in the L2 writing classroom: A case study of two young female writers. *Language Awareness*, *12*, 172-186.

Lindgren, E., & Sullivan, K. P. H. (2006). Analysing online revision. In Sullivan, K., & Lindgren, E. (Eds.), *Computer Keystroke Logging and Writing: Methods and Applications* (pp. 157–188). Oxford: Elsevier.

Lindgren, E., Sullivan, K. P. H., & Spelman Miller, K. (2008). Development of fluency and revision in L1 and L2 writing in Swedish high school years 8 and 9. *International Journal of Applied Linguistics, 156*, 133-151.

Lindgren, E., Sullivan, K.P.H., Lindgren, U., & Spelman Miller, K. (2007). GIS for writing: Applying geographic information system techniques to data-mine writing's cognitive processes. In G. Rijlaarsdam (Series Ed.) & M. Torrance, L. Van Waes & D. Galbraith (Vol. Eds), *Writing and cognition: Research and applications* (pp. 83-96). Amsterdam: Elsevier.

Lindgren, E., Westum, A., Outakoski, H., & Sullivan, K. P. (2017). Meaning-making across languages: a case study of three multilingual writers in Sápmi. *International Journal of Multilingualism*, *14*(2), 124-143.

Lindgren, E., Westum, A., Outakoski, H., & Sullivan, K.P.H. (2019). Revising at the leading edge: Shaping ideas or clearing up noise. In E. Lindgren & K.P.H. Sullivan (Eds.), *Observing writing: Insights from keystroke logging and handwriting* (pp. 345–364). Leiden, the Netherlands: Brill.

Linnemann, M. (2019). Anticipation of audience during writing. In E. Lindgren & K.P.H. Sullivan (Eds.), *Observing writing: Insights from keystroke logging and handwriting* (pp. 325–344). Leiden, the Netherlands: Brill.

Maggio, S., Lété, B., Chenu, F., Jisa, H., & Fayol, M. (2012). Tracking the mind during writing: Immediacy, delayed, and anticipatory effects on pauses and writing rate. *Reading and Writing, 25*(9), 2131–2151. https://doi.org/10.1007/s11145-011-9348-1

Manchón, R. M. (2016). Language and L2 writing: Learning to write and writing to learn in academic contexts. In K. Hyland & P. Shaw (Eds.), *Handbook of English for academic purposes* (pp.139-152). New York: Routledge

Manchón, R.M., & de Haan, P. (2008). Writing in foreign language contexts: An introduction. *Journal of Second Language Writing, 17*(1), 1-6.

Manchón, R. M., Murphy, L., & Roca de Larios, J. (2005). Using concurrent protocols to explore L2 writing processes: Methodological issues in the collection and analysis of data. In P. K. Matsuda & T. Silva (Eds.*), Second language writing research: Perspectives on the process of knowledge construction* (pp. 191–205). Mahwah, NJ: Lawrence Erlbaum.

Manchón, R., & Roca de Larios, J. (2007). On the temporal nature of planning in L1 and L2 composing. *Language Learning, 57*(4)*,* 549-593.

Matsuda, P.K. & Silva, T. (Eds.) (2005). *Second Language Writing Research: Perspectives on the process of knowledge construction.* New Jersey: Lawrence Erlbaum Associates, Publishers.

Matsuhashi, A. (Ed.) (1987). *Writing in real time: Modeling production processes.* New Jersey: Ablex Publishing Corporation.

Matsuhashi, A. (1987). Revising the plan and altering the text. In A. Matsuhashi (Ed.), *Writing in real time: Modelling production processes* (pp. 224-253). Norwood, NJ: Ablex.

Matsumoto, K. (1995). Research paper writing strategies of professional Japanese EFL writers. *TESL Canada journal*, *13*(1), 17-27.

McCutchen, D. (1986). Domain Knowledge and Linguistic Knowledge in the Development of Writing Ability. *Journal of Memory and Language, 25*, 431-444.

McCutchen, D. (2000). Knowledge, processing, and working memory: Implications for a theory of writing. *Educational Psychologist, 35*(1), 13–23.

McNamara, D.S., Crossley, S.A., & McCarthy, P.M. (2010). Linguistic features of writing quality. *Written Communication, 27*(1), 57-86.

Ministre de l'Education Nationale (Ministry of National Education) (2018, March 01). Programmes. http://www.education.gouv.fr/cid81/les-programmes.html

Ministre de l'Education Nationale (Ministry of National Education) (2018, April 01). Newsletter. http://www.education.gouv.fr/bo/2002/hs1/default.htm

Muncie, J. (2002). Finding a place for grammar in EFL composition classes. *ELT journal*, *56*(2), 180-186.

Murphy, L., & Roca de Larios, J. (2010). Searching for words: One strategic use of the mother tongue by advanced spanish EFL writers. *Journal of second language writing, 19*(2), 61-81.

Olive, T. (2010). Methods, tools and techniques for the on-line study of the writing process. In N. L. Mertens (Ed.), *Writing: Processes, Tools and Techniques* (pp. 1-18). New York: Nova Publishers.

Olive, T. (2011). L'analyse du décours temporel de la production écrite. In T. Ponchon & I. Laborde-Milaa (Eds.), *Sciences du langage et nouvelles technologies* (pp. 61-68). Limoges: Lambert-Lucas

Olive, T., Favart, M., Beauvais, C., & Beauvais, L. (2009). Children's cognitive effort and fluency in writing: Effects of genre and of handwriting automatisation. *Learning and Instruction, 19*, 299-308.

Olive, T., Kellogg, R.T., & Piolat, A. (2002). The triple task technique for studying the process of writing. In T. Olive, & C.M. Levy (Eds.), *Contemporary tools and techniques for studying writing* (pp. 31–59). Springer Netherlands. https://doi.org/10.1007/978-94-010-0468-8-3

Ong, J. (2013). Discovery of ideas in second language writing task environment. *System, 41*(3), 529-542.

Ong, J., & Zhang, L.J. (2013). Effects of the manipulation of cognitive processes on EFL writers' text quality.*TESOL Quarterly, 47*(2), 375-398.

Palviainen, Å., Kalaja, P., & Mäntylä, K. (2012). Development of L2 writing: fluency and proficiency. *AFinLA-E: Soveltavan Kielitieteen Tutkimuksia*, *0*(4), 47-59.

Park, J. (2006). The study on the rater reliability of three scoring methods in assessing argumentative essays: holistic, analytic, and multiple-trait scoring methods. Retrieved from http://s-space.snu.ac.kr/handle/10371/95933

Pascual y Cabo, D., & Prada, J. (2015). Understanding the Spanish heritage language speaker/learner. *EuroAmerican Journal of Applied Linguistics and Languages Special Issue, 2*(2), 1-10.

Pennington, M. C., Brock, M. N., & Yue, F. (1996). Explaining Hong Kong students' response to process writing: An exploration of causes and outcomes. *Journal of second language writing*, *5*(3), 227-252.

Pennington, M., & So, S. (1993). Comparing writing process and product across two languages: A study of 6 Singaporian university student writers. *Journal of Second Language Writing, 2*(1), 41-63.

Peters, E., & Pauwels, P. (2015). Learning academic formulaic sequences. *Journal of English for academic purposes*, *20*, 28-39.

Polio, C., & Park, J. H. (2016). Language development in second language writing. In R. M. Manchón & P. Matsuda (Eds.), *Handbook of second and foreign language writing* (pp. 287–306). New York: Routledge.

Rahmanpanah, H., & Tajeddin, Z. (2015). Investigating a systematic approach to the promotion of EFL learners' autonomy. *Journal of Language and Translation, 1*(9), 17–31.

Raimes, A. (1985). What unskilled ESL students do as they write: A classroom study of composing. *TESOL Quarterly*, *19*(2), 229-258.

Raimes, A. (1987). Language proficiency, writing ability, and composing strategies: A study of ESL college student writers. *Language Learning, 37*(3), 439-468.

Ranalli, J. R., Feng, H. H., & Chukharev-Khudilaynen, E. (2018). The affordances of process-tracing technologies for supporting L2 writing instruction. *Language Learning & Technology*, *23*(2), 1-11.

Ransdell, S., Arecco, M. R., & Levy, C. M. (2001). Bilingual long-term working memory: The effects of working memory loads on writing quality and fluency. *Applied Psycholinguistics*, *22*(1), 113-128.

Ransdell, S., & Levy, C.M. (1996). Working memory constraints on writing quality and fluency. In C. M. Levy & S. Ransdell (Eds.), *The Science of Writing: Theories, methods, individual differences, and applications* (93-105). New York (N. J.): Lawrence Erlbaum Ass.

Rast, R., Watorek, M., Hilton, H., & Shoemaker, E. (2014). Initial processing and use of inflectional markers: Evidence from French adult learners of Polish. In Z. Han & R. Rast (Eds.), *First Exposure to a Second Language: Learners' Initial Input Processing* (64-106). Cambridge: Cambridge University Press

Révész, A., Kourtali, N. E., & Mazgutova, D. (2017). Effects of task complexity on L2 writing behaviors and linguistic complexity. *Language Learning, 67*(1), 208-241.

Révész, A., Michel, M., & Lee, M. (2019). Exploring second language writers' pausing and revision behaviors: a mixed-methods study. *Studies in Second Language Acquisition, 41*(3), 605-631. doi:10.1017/S027226311900024X

Rinnert, C., Kobayashi, H., & Katayama, A. (2015). Argumentation text construction by Japanese as a foreign language writers: A dynamic view of transfer. *The Modern Language Journal*, *99*(2), 213-245.

Rinnert, C., & Kobayashi, H. (2016). Multicompetence and multilingual writing. In R.M. Manchón, & P.K. Matsuda (Eds.), *Handbook of second and foreign language writing* (pp. 365–385). Berlin:Walter de Gruyter.

Rijlaarsdam, G., & Van den Bergh, H. (1996). The dynamics of composing-An agenda for research into an interactive Compensatory Model of writing: Many questions, some answers. In C. M. Levy & S. Ransdell

(Eds.), *The Science of writing: Theories, methods, individual differences, and applications* (pp.107-125). New York (N. J.): Lawrence Erlbaum Ass.

Roca de Larios, J., Manchón, R., & Murphy, L. (2006). Generating text in native and foreign language writing: A temporal analysis of problem solving formulation processes. *The Modern Language Journal, 90*(1), 100-114.

Roca de Larios, J., Manchón, R.M., Murphy, L., & Marin, J. (2008). The foreign language writer's strategic behaviour in the allocation of time to writing processes. *Journal of Second Language Writing, 17*(1), 30-47.

Roca de Larios, J., Marin, J., & Murphy, L. (2001). A temporal analysis of formulation processes in L1 and L2 writing. *Language Learning, 51*(3), 497-538.

Roca de Larios, J., Murphy, L., & Manchón, R. M. (1999). The use of restructuring strategies in EFL writing: A study of Spanish learners of English as a foreign language. *Journal of Second Language Writing, 8*(1)*,* 13-44.

Roca de Larios, J. R., Murphy, L., & Marín, J. (2002). A critical examination of L2 writing process research. In S. Ransdell, & M.L. Barbier (Eds.), *New directions for research in L2 writing* (pp. 11-47). Springer, Dordrecht.

Rose, M. (1984). *Writer's Block. Cognitive Dimension.* Carbondale: Southern Illinois University Press.

Sasaki, M. (2000). Toward an empirical model of EFL writing processes: An exploratory study. *Journal of Second Language Writing, 9*(3)*,* 259-291.

Sasaki, M. (2002). Building an empirically-based model of EFL learners' writing processes. In S. Ransdell & M.-L. Barbier (Eds.), *New directions for research in L2 writing* (pp. 49–80). Dordrecht: Kluwer Academic.

Sasaki, M. (2004). A multiple-data analysis of 3.5-year development of EFL student writers. *Language Learning, 54*(3), 525-582.

Sasaki, M. (2011). Effects of varying lengths of study-abroad experiences on Japanese EFL students' L2 writing ability and motivation: A Longitudinal Study. *TESOL quarterly*, *45*(1), 81-105.

Sasaki, M., & Hirose, K. (1996). Explanatory variables for EFL students' expository writing. *Language Learning, 46*(1)*,* 137-174.

Schilperoord, J. (1996). *It's about time: Temporal aspects of cognitive processes in text production*. Amsterdam/Atlanta:Rodopi.

Schneider,P., Dube, R.V., & Hayward, D. (2003). *The Edmonton Narrative Norms Instrument: Description of the Normative Study.* Retrieved from http://www.rehabmed.ualberta.ca/spa/enni/pdf/Description%20of%20Study.pdf

Schoonen, R., Snellings, P., Stevenson, M., & Van Gelderen, A. (2009). Towards a blueprint of the foreign language writer: The linguistic and cognitive demands of foreign language writing. In R. M. Manchón (Ed.), *Writing in foreign language contexts. Learning, teaching and research,* (pp. 77-101). Bristol, UK: Multilingual Matters

Schoonen, R., Van Gelderen, A., Glopper, K. D., Hulstijn, J., Simis, A., Snellings, P., & Stevenson, M. (2003). First language and second language writing: The role of linguistic knowledge, speed of processing, and metacognitive knowledge. *Language Learning, 53*(1), 165-202.

Schoonen, R., Van Gelderen, A., Stoel, R. D., Hulstijn, J. H., & De Glopper, K. (2011). Modeling the development of L1 and EFL writing proficiency of secondary school students. *Language Learning*, *61*(1), 31-79.

Sengupta, S. (2000). An investigation into the effects of revision strategy instruction on L2 secondary school learners. *System*, *28*(1), 97-113.

Severinson Eklundh, K., & Kollberg, P. (1996). Computer tools for tracing the writing process: from keystroke records to S-notation. In G. Rijlaarsdam, M. Couzijn & H. Van den Bergh (Eds.), *Theories, Models and Methodology in Writing Research* (pp. 526–541). Amsterdam: Amsterdam University Press.

Shehadeh, A. (2011). Effects and student perceptions of collaborative writing in L2. *Journal of Second Language Writing*, *20*(4), 286-305.

Shi, L. (2001). Native-and nonnative-speaking EFL teachers' evaluation of Chinese students' English writing. *Language Testing*, *18*(3), 303-325.

Silva, T. (1993). Toward an understanding of the distinct nature of L2 writing: The ESL research and its implications. *TESOL Quarterly*, *27*(4), 657-677.

Snellings, P., Van Gelderen, A., & De Glopper, K. (2004). The effect of enhanced lexical retrieval on L2 writing: A classroom experiment. *Applied Psycholinguistics, 55,* 175-200.

Søvik, N., & Flem, A. (1999). The effects of different tasks on children's process and product variables in writing. *Learning and instruction, 9*, 167-188.

Spelman Miller, K. (2000). Academic writers on-line: investigating pausing in the production of text. *Language Teaching Research,4*(2), 123-148.

Spelman Miller, K., & Sullivan, K. P. H. (2006). Keystroke logging: an introduction. In G. Rijlaarsdam (Series Ed.) and K. P. H. Sullivan, & E. Lindgren. (Vol. Eds.), *Studies in Writing, Vol. 18, Computer Keystroke Logging: Methods and Applications* (1–9). Amsterdam: Elsevier.

Spelman Miller, K. (2006). The pausology study of written language composition. In G. Rijlaarsdam (Series Ed.), and K.P.H. Sullivan, & E. Lindgren (Eds.), *Studies in Writing, Vol. 18. Computer Keystroke Logging and Writing: Methods and Applications* (pp. 11-30). Amsterdam: Elsevier.

Spelman Miller, K., Lindgren, E., & Sullivan, K.P.H. (2008). The psycholinguistic dimension in second language writing: opportunities for research and pedagogy. *TESOL Quarterly Special edition on psycholinguistics and second language learning*, 433-54.

Stevenson, M., Schoonen, R., & De Glopper, K. (2006). Revising in two languages: A multi-dimensional comparison of online writing revisions in L1 and FL. *Journal of Second Language Writing, 15*(3)*,* 201-233.

Sengupta, S. (2000). An investigation into the effects of revision strategy instruction on L2 secondary school learners. *System*, *28*(1), 97-113.

Shehadeh, A. (2011). Effects and student perceptions of collaborative writing in L2. *Journal of Second Language Writing*, *20*(4), 286-305.

Sullivan K.P.H., & Lindgren, E. (2002). Self-assessment in autonomous computer-aided L2 writing. *ELT Journal, 56*(3), 258–266.

Sullivan, K. P. H., & Lindgren, E. (Eds.) (2006). *Computer keystroke logging and writing*. Oxford and Amsterdam: Elsevier.

Thorson, H. (2000). Using the computer to compare foreign and native language writing processes: A statistical and case study approach. *Modern Language Journal, 84*(2), 155-170.

Tillema, M. (2012). *Writing in first and second language: Empirical studies on text quality and writing processes.* Utrecht: LOT.

Tillema, M., Van den Bergh, H., Rijlaarsdam, G., & Sanders, T. (2013). Quantifying the quality difference between L1 and L2 essays. A rating procedure with bilingual raters and L1 and L2 benchmark essays. *Language Testing, 30* (1), 71-97.

Tiryakioglu, G. (2008). Teaching Turkish as a second language to children in belgium: methods, techniques and materials. In I. Aydoğan, & A.F. Yaylacı (Eds.), *Proceedings of the 1st International Congress of European Turks in the Contex of Education and Culture (I.Uluslararası Eğitim ve Kültür Bağlamında Avrupalı Türkler Kongresi)* (pp 114-131). Kayseri: Erciyes Üniversitesi ISBN-ISSN 9789756478479(Tk.)

Tiryakioglu, G. (2011). Teaching Turkish as a foreign language to children: the case in belgium. In V.D. Günay, Ö. Fidan, B. Çetin, & F. Yıldız (Eds), *Proceedings of the 3rd International Congress of Teaching Turkish ( 3. Uluslararası Türkçenin Eğitimi-Öğretimi Kurultay Bildirileri)* (pp 323-332). İzmir: Dokuz Eylül Universitesi ISBN 978-975-441-333-5

Tiryakioglu, G., & Hilton, H. (2018a). *The relationship between typing skill and writing processes in multilingual writing.* Paper presented in symposium "Typing in a foreign language - how does it affect your writing? "at the EARLI Special Interest Group International Conference on Writing, Antwerpen- Belgium, 29th - 31st August, 2018.

Tiryakioglu, G., & Hilton, H. (2018b). *The relationship between writing processes and text quality in L1 and L2 writing.* Paper presented at the EARLI Special Interest Group International Conference on Writing, Antwerpen-Belgium, 29th -31st August, 2018.

Tiryakioglu, G., & Hilton, H. (2019). *Multilingual writing processes and text quality.* Paper presented at EUROSLA Conference, 28th-31st August, Lund-Sweden.

Tiryakioglu, G., Peters, E., & Verschaffel, L. (2019). The effect of L2 proficiency level on composing processes of EFL learners: Data from keystroke loggings, think alouds and questionnaires. In E. Lindgren & K.P.H. Sullivan (Eds.), *Observing writing: Insights from keystroke logging and handwriting* (pp. 212–235). Leiden, the Netherlands: Brill.

Tiryakioglu, G., Sercu, L., & Verschaffel, L. (2010). *The effect of L2 proficiency level on composing processes of foreign language student writers.* 12th International Conference of the EARLI Special Interest Group on Writing, Heidelbergh- Germany, 8th-10th September, Poster Presentation

Tiryakioglu, G., Sercu, L., & Verschaffel, L. (2014). *How Beneficial is L2 Writing Strategy Instruction for EFL Learners at Different Proficiency Levels.* EARLI Special Interest Group International Conference on Writing, Amsterdam- The Netherlands, 27th -29th August, Research Meeting Session.

Torrance, M., Fidalgo, R., & García, J. N. (2007). The teachability and effectiveness of cognitive self-regulation in sixth grade writers. *Learning & Instruction*, *17*, 265-285.

Torrance, M., & Galbraith, D. (2006). The processing demands of writing. In C. MacArthur, S. Graham, and J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 67–89). New York, NY: The Guilford Press.

Torrance, M., & Jeffery, G. (1999). Writing processes and cognitive demands. In M. Torrance & G. Jeffery (Eds.), *The cognitive demands of writing: Processing capacity and working memory in text production* (pp. 1-11). Amsterdam: Amsterdam University Press.

Torrance, M., Thomas, G.V., & Robinson, E.J. (2000). Individual differences in undergraduate essay-writing strategies: A longitudinal study. *Higher Education, 39,* 181-200.

Uzawa, K. (1994). *Translating and writing processes of adult second language learners* . Doctoral dissertation, University of British Columbia.

Uzawa, K. (1996). Second language learners' processes of L1 writing, L2 writing and translation from L1 into L2. *Journal of Second Language Writing, 5*(3), 271-294.

Valdés, G. (2005). Bilingualism, heritage language learners, and SLA research: Opportunities lost or seized? *Modern Language Journal*, *89*, 410-426. doi:10.1111/j.1540-4781.2005.00314.x

Valdés, G., Haro, P., & Arriarza, M.P.E. (1992).The development of writing abilities in a foreign language: Contributions toward a general theory of L2 writing. *The Modern Language Journal*, *76*(3), 333-352.

Van den Bergh, H., & Rijlaarsdam, G. (1996). The dynamics of composing: Modelling writing process data. In C. M. Levy & S. Ransdell (Eds.), *The Science of Writing: Theories, methods, individual differences, and applications* (pp. 207-232). New York (N. J.): Lawrence Erlbaum Ass.

Van den Bergh, H., & Rijlaarsdam, G. (2001). Changes in cognitive activities during the writing process and relationships with text quality. *Educational Psychology, 21*(4), 373-385.

Van Gelderen, A., Oostdam, R., & Van Schooten, E. (2011). Does foreign language writing benefit from increased lexical fluency? Evidence from a classroom experiment. *Language Learning, 61*(1), 281–321.

Van Waes, L. (2016). *Pausing behaviours in writing processes.* Paper presented at the Keystroke Research School, 24th March 2016, University of Antwerpen, Belgium.

Van Waes, L., & Leijten, M. (2011). *Observing and analysing digital writing processes with Inputlog*. Paper presented at the Antwerp summer school on writing process research: Keystroke logging and eyetracking, Antwerp, Belgium.

Van Waes, L., Leijten, M., Pauwaert, T., & Van Horenbeeck, E. (2020). A multilingual copy task: measuring typing and motor skills in writing with inputlog. *Journal of open research software.-2013, currens*, *7*(30), 1-8.

Van Waes, L., Leijten, M., Wengelin, A., & Lindgren, E. (2012). Logging tools to study digital writing processes. In V. W. Berninger (Ed.), *Past, present, and future contributions of cognitive writing research to cognitive psychology* (pp. 507-533). New York, NY: Psychology Press

Van Waes, L., & Leijten, M. (2015). Fluency in writing: A multidimensional perspective on writing fluency applied to L1 and L2. *Computers and Composition, 38,* 79-95.

Van Waes, L., Leijten, M., Mariën, P., & Engelborghs, S. (2017). Typing competencies in Alzheimer's disease: An exploration of copy tasks. *Computers in Human Behavior, 73*, 311-319 |doi: 10.1016/j.chb.2017.03.050.

Van Waes, L., Leijten, M., & Van Weijen, D. (2009). Keystroke logging in writing research: Observing writing processes with Inputlog. *GFL Journal, 2*(3), 42-64.

Van Steendam, E., Rijlaarsdam, G., Sercu, L., & Van den Bergh, H. (2010). The effect of instruction type and dyadic or individual emulation on the quality of higher-order peer feedback in EFL. *Learning and Instruction, 20*(4), 316–327.https://doi.org/10.1016/j.learninstruc.2009.08.009

Van Steendam, E., Rijlaarsdam, G., Van den Bergh, H., & Sercu, L. (2014). The mediating effect of instruction on pair composition in L2 revision and writing. *Instructional Science, 42*(6), 905-927. doi: 10.1007/s11251-014-9318-5.

Van Weijen, D. (2009). *Writing processes, text quality, and task effects.* Utrecht: LOT.

Van Weijen, D., Van den Bergh, H., Rijlaarsdam, G., & Sanders, T. (2008). Differences in process and process-product relations in L2 writing. *ITL:International Journal of Applied Linguistics, 156,* 203–226.

Van Weijen, D., Van den Bergh, H., Rijlaarsdam, G., & Sanders, T. (2009). L1 use during L2 writing: An empirical study of a complex phenomena. *Journal of Second Language Writing, 18*(4), 235-250.

Verheyden, L., Van den Branden, K., Rijlaarsdam, G., Van den Bergh, H., & De Maeyer, S. (2010).Written narrations by 8- to 10-year-old Turkish pupils in Flemish primary education: A follow-up of seven text features. *Journal of Research in Reading, 33*, 20–38. doi:10.1111/j.1467-9817.2009.01430.x

Wang, W., & Wen, Q. (2002). L1 use in the L2 writing process: An exploratory of 16 Chinese EFL Learners. *Journal of Second Language Writing, 11*, 225-246.

Weigle, S. C. (2002). *Assessing writing*. Cambridge, UK: Cambridge University Press

Wengelin, A. (2006). Examining Pauses in Writing: Theory, Methods and Empirical Data. In K.P.H. Sullivan, & E. Lindgren (Eds.), *Computer key-stroke logging and writing*. (pp. 107–130). Amsterdam, the Netherlands: Elsevier.

Wengelin, A. Frid, J., Johansson, R., & Johansson, V. (2019). Combining keystroke logging with other methods. Towards an experimental environment for writing process research. In E. Lindgren and K.P.H. Sullivan (Eds.), *Observing writing: Insights from keystroke logging and handwriting* (pp. 30-50). Leiden, the Netherlands: Brill.

Whalen, K., & Ménard, N. (1995). L1 and L2 writers' strategic and linguistic knowledge: A model of multiple-level discourse processing. *Language Learning, 45*(3), 381-418.

Wolfersberger, M. (2003). L1 to L2 Writing process and strategy transfer: A look at lower proficiency writers. *TESL-EJ,7*(2). Retrieved from http://www.tesl-ej.org/wordpress/ issues/volume7/ej26/ej26a6/

Woodall, B. R. (2002). Language-switching: Using the first language while writing in a second language. *Journal of Second Language Writing*, *11*(1), 7-28.

Xu, C., & Ding, Y. (2014). An exploratory study of pauses in computer-assisted EFL writing. *Language Learning & Technology, 18*(3), 80–96. Retrieved from http://llt.msu.edu/issues/october2014/xuding.pdf

Yang, W., & Sun,Y. (2015). Dynamic development of complexity, accuracy and fluency in multilingual learners' L1, L2 and L3 Writing. *Theory and Practice in Language Studies, 5* (2), 298-308.

Zamel, V. (1982). Writing: the process of discovering the meaning. *TESOL Quarterly*, *16(2),* 195-210.

Zamel, V. (1983). The composing processes of advanced ESL students: Six case studies. *TESOL Quarterly*, *17*(2), 165-187.

Zamel, V. (1984). In search of the key: reesarch and practice in composition. In J. Handscombe, R. Orem, & B.P. Taylor (Eds.), *on TESOL'83: The question of control* (pp. 195-202). Washington, DC: TESOL.

ZARGAN, Lexical database for Turkish, retrieved from
http://st2.zargan.com/duyuru/Zargan_Linguistic_Resources_for_Turkish.html

Zhang, L. J. (2013). Second language writing as and for second language learning. *Journal of Second Language Writing*, *22*(4), 446-447.

# APPENDICES (A-T)

## A. Parental consent form

### Formulaire de consentement, pour parents de mineur

TITRE DE L'ETUDE : *L'écriture en anglais langue étrangère*

*responsables* **:** Gulay Tiryakioglu (doctorante, Université Lyon 2)

Pr. Heather Hilton (directrice de la thèse)

**Résumé des objectifs de la recherche :** L'objectif de cette recherche doctorale est de comparer des processus à l'œuvre quand des élèves français écrivent en français (langue maternelle ou langue principale de scolarisation) et en anglais (langue étrangère). Notre thèse s'intéresse aux rapports entre les connaissances en anglais, les processus de rédaction et la « qualité du texte ». Les participants à cette étude, des élèves français en 3$^{eme}$, vont réaliser deux tâches d'écriture en anglais et en français ; toutes les touches tapées au clavier de l'ordinateur seront enregistrées lors de ces rédactions, grâce à un logiciel spécial (*Inputlog*, développé à l'Université d'Anvers, Belgique). Gulay Tiryakioglu reste à votre disposition pour toute précision concernant cette étude, ses objectives, et les retombées didactiques de cette étude (elle nous aidera à mieux comprendre les difficultés de l'écriture en langue étrangère, et fournira des pistes pour l'enseignement de cette compétence).

Je soussigné(e), ……..,

parent de …….,

déclare avoir lu le document d'information décrivant l'étude de Mme Gulay Tiryakioglu, la nature du projet, son but, la durée de l'étude; j'ai été informé de ce que l'on attend de la part de mon enfant.

Je comprends que je suis libre de permettre à mon enfant de participer à cette étude ou non, sans qu'il soit nécessaire de justifier cette décision et sans qu'elle n'entraîne le moindre désavantage pour lui.

☐ **J'accepte que mon enfant participe au projet.**
> merci de lire le reste du document et signer en bas de la page

☐ **Je n'accepte pas que mon enfant participe au projet.**
> merci de signer ici :

Les informations que mon enfant fournira dans le cadre du projet sont
- les réponses données aux questionnaires de l'enquête ;
- les réponses données lors des tâches proposées en anglais et en français.

J'accepte que ces informations fassent l'objet d'analyses scientifiques, en relation directe avec les objectifs de la recherche précisés ci-dessus, dans plus strict respect de la vie privée. J'ai compris que les informations fournies par mon enfant seront anonymées, et utilisées exclusivement à des fins scientifiques.

J'accepte que les résultats de cette étude (toujours sous forme anonymes), soient diffusés à des fins scientifiques, selon les règles déontologiques de la communauté scientifique.

Je peux à tout moment demander la consultation des données collectées sans frais. Ces données seront conservées durant le temps nécessaire à leur analyse, et pour un maximum de dix années. Je pourrais contacter la responsable du traitement de ces données, Gulay Tiryakioglu, à l'adresse suivante :

Gulay Tiryakioglu
Adresse: Tel: email:

_____

*signature des 2 parents responsables de l'enfant,* ***précédée par la mention « lu et approuvé »***

_____

*date (jour/mois/année)*

## B. Language Profile Questionnaire (for parents)

**Chers parents,**

**Vous avez donné à votre enfant l'autorisation de participer à notre projet de recherche et nous vous en remercions chaleureusement. Pour mieux comprendre l'utilisation de l'anglais par les enfants participants au projet, nous avons besoin de quelques informations. Pourriez-vous renseigner le questionnaire qui suit, et le remettre à votre enfant (pour une remise à l'école) ? Toutes ces informations seront utilisées exclusivement à des fins de recherche. Nous vous demandons de mettre le prénom de votre enfant ci-dessous, mais l'utilisation de ces informations par la suite sera strictement anonyme.**

**Merci encore de votre aide!** Gulay Tiryakioglu, Heather Hilton

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| prénom de votre enfant et initiale du nom de famille : |
|---|

1. **Quel est votre pays d'origine? Mère: ______________________________**
   **Père: ________________________________**
2. **Quelle langue parlez-vous le plus souvent à la maison?**
3. **Utilisez-vous d'autres langues *avec* votre enfant? Laquelle/ Lesquelles ?**
4. **Quelle(s) autre(s) langue(s) utilisez-vous *en présence de* votre enfant?**
5. **A quelle occasion l'/les utilisez-vous?**
6. **Dans votre entourage familial et amical, y a-t-il des/d'autres locuteurs de l'anglais?**
7. **Comment évaluez-vous votre niveau en anglais?**
   **Mère: O débutant (ou moins) O intermédiare O avancé O natif O bilingue**
   **Père: O débutant (ou moins) O intermédiare O avancé O natif O bilingue**
8. **Pensez-vous que votre niveau en anglais est une aide/ un handicap dans votre vie professionnelle?**
9. **Est-ce que vous/votre entourage aidez votre enfant à apprendre l'anglais? O Non O Oui**
10. **Merci de cocher, ci-dessous (le cas échéant) par quels supports votre enfant est exposé à l'anglais *en dehors de l'école*:**
    - ◯ **Dessins animés ou programmes pour la jeunesse et/ou films**
    - ◯ **Livres pour enfants ou magazines**
    - ◯ **Jeux vidéos**
    - ◯ **Programmes de télévision ou films (pour plus grands)**
    - ◯ **Internet**
    - ◯ **Cours particuliers**
    - ◯ **Publicités, affiches**
    - ◯ **Autres: ________________________________**

*Encore merci de votre aide précieuse! Vous pouvez remettre cette fiche à votre enfant, qui la rapportera au collège.*

## C. Writing Profile Questionnaire

# Questionnaire 1

Dans ce questionnaire, tu verras différentes phrases. Lis chaque phrase attentivement. Quelle est ta réaction à cette phrase ? Dans la colonne à droite, donne une réponse honnête. Ni tes enseignants ni tes parents ne verront tes réponses, tu pourras donc dire ce que tu penses, vraiment.

| | | |
|---|---|---|
| 1 | En général (à l'école et en dehors de l'école), j'aime écrire. | **O Non O Oui O Un peu**<br>Si tu n'aimes pas écrire, pourrais-tu me dire *pourquoi ?*<br>---------- |
| 2 | En dehors de l'école, j'écris… | ○ jamais<br>○ très rarement<br>○ de temps en temps (1-2 fois par mois)<br>○ souvent (une fois par semaine)<br>○ beaucoup (plus d'une fois par semaine)<br>○ tous les jours |
| 3 | Si oui, qu'est-ce que tu écris en déhors de l'école? | ---------- |
| 4 | Quand tu écris (en dehors d'école), avec quoi écris-tu? | ○ crayon<br>○ stylo ou feutre<br>○ clavier/ ordinateur/ tablette<br>○ telephone<br>○ autre?_____ |
| 6 | Je pense que j'écris : | ○ très bien<br>○ bien<br>○ pas mal<br>○ pas très bien<br>○ mal |
| 7 | Est-ce que tu as déjà écrit une histoire/ un récit ? | ○ oui, à l'école<br>○ oui, chez moi<br>○ non |
| 8 | Est-ce que tu aimes lire (pour l'école, pour le plaisir)? | **O Non O Oui O Un peu** |
| 9 | Combien de livres lis-tu par mois ? | ○ moins d'un<br>○ un<br>○ deux<br>○ plus de deux (pourrais-tu préciser le nombre ? _____) |

As-tu d'autres choses à me dire ? _____

**Merci pour tes réponses honnêtes !**

## D. Motivation for Learning English Questionnaire

**Questionnaire 3**

Dans le tableau ci-dessous, il y a des phrases, et des réactions. Lis chaque phrase attentivement. Coche l'une des 3 réactions possibles. Il n'y a pas de réponse juste ou de réponse fausse. C'est ton opinion honnête qui nous intéresse.

**Exemple:**

| | ***pas d'accord*** | ***d'accord*** | ***tout à fait d'accord*** |
|---|---|---|---|
| J'aime le chocolat. | | | |

| | ***pas d'accord*** | ***d'accord*** | ***tout à fait d'accord*** |
|---|---|---|---|
| 1. L'anglais est une langue qui me plaît. | | | |
| 2. Je n'aime pas l'anglais. | | | |
| 3. J'aime apprendre l'anglais mieux que d'autres langues. | | | |
| 4. J'aime/ j'aimerais pouvoir communiquer avec d'autres personnes en anglais. | | | |
| 5. Je pense que c'est facile d'apprendre l'anglais. | | | |
| 6. Je pense que c'est utile d'apprendre l'anglais.. | | | |
| 7. Mes parents sont contents que j'apprenne l'anglais. | | | |
| 8. J'aimerais savoir plus des mots d'anglais. | | | |
| 9. J'ai peur de faire des fautes quand je parle en anglais. | | | |
| 10. Le cours d'anglais est ennuyeux. | | | |
| 11. J'aime les sons de l'anglais | | | |
| 12. Le cours d'anglais est difficile. | | | |
| 13. Je n'aime pas parler en anglais. | | | |
| 14. J'aimerais avoir des amis anglais/ anglaises. | | | |
| 15. J'espère apprendre différentes langues dans ma vie. | | | |
| 16. J'aimerais avoir plus de leçons d'anglais chaque semaine. | | | |

Autres choses à me dire, à propos de l'anglais ? _____

## E. Motivation for Learning Turkish Questionnaire

### Questionnaire 5

Dans le tableau ci-dessous, il y a des phrases, et des réactions. Lis chaque phrase attentivement. Coche l'une des 3 réactions possibles. Il n'y a pas de réponse juste ou de réponse fausse. C'est ton opinion honnête qui nous intéresse.

**Exemple:**

| | *pas d'accord* | *d'accord* | *tout à fait d'accord* |
|---|---|---|---|
| J'aime le chocolat. | | | |

| | *pas d'accord* | *d'accord* | *tout à fait d'accord* |
|---|---|---|---|
| 1. Le turc est une langue qui me plaît. | | | |
| 2. Je n'aime pas la langue turque. | | | |
| 3. J'aime apprendre le turc mieux que d'autres langues. | | | |
| 4. J'aime/ j'aimerais pouvoir communiquer avec d'autres personnes en turc. | | | |
| 5. Je pense que c'est facile d'apprendre le turc. | | | |
| 6. Je pense que c'est utile d'apprendre le turc. | | | |
| 7. Mes parents sont contents que j'apprenne le turc. | | | |
| 8. J'aimerais savoir plus des mots de langue turque. | | | |
| 9. J'ai peur de faire des fautes quand je parle en turc. | | | |
| 10. Le cours de turc est ennuyeux. | | | |
| 11. J'aime les sons du turc. | | | |
| 12. Le cours de turc est difficile. | | | |
| 13. Je n'aime pas parler en turc. | | | |
| 14. J'aimerais avoir des amis turcs. | | | |
| 15. J'espère apprendre différentes langues dans ma vie. | | | |
| 16. J'aimerais avoir plus de leçons de turc chaque semaine. | | | |

Autres choses à me dire, à propos de la langue turque ? _____

## F. Post-writing Questionnaire for French Writing Task

# Questionnaire 2

Dans le tableau, il y a des phrases. Lis chaque phrase attentivement. Coche l'une des trois réactions possibles. Il n'y a pas de réponse juste ou de réponse fausse. C'est ton opinion honnête qui m'intéresse.

**Exemple:**

| | ***pas d'accord*** | ***d'accord*** | ***tout à fait d'accord*** |
|---|---|---|---|
| J'aime le chocolat. | | | |

| | | ***pas du tout d'accord*** | ***d'accord*** | ***tout à fait d'accord*** |
|---|---|---|---|---|
| 1 | J'ai aimé cet exercice. | | | |
| 2 | Cet exercice était difficile. | | | |
| 3 | Cet exercice était stressant. | | | |
| 4 | Cet exercice m'a plu. | | | |
| 5 | C'est la première fois que j'écris un récit en français. | | | |
| 6 | J'aime écrire en français. | | | |
| 7 | J'écris très bien en français. | | | |
| 8 | Je n'aime pas écrire en français. | | | |
| 9 | Je n'écris pas très bien en français. | | | |

Autres choses à me dire ? _____

## G. Post-writing Questionnaire for English Writing Task

## Questionnaire 4

Dans le tableau, il y a des phrases. Lis chaque phrase attentivement. Coche l'une des 3 réactions possibles. Il n'y a pas de réponse juste ou de réponse fausse. C'est ton opinion honnête qui m'intéresse.

**Exemple:**

| | ***pas du tout d'accord*** | ***d'accord*** | ***tout à fait d'accord*** |
|---|---|---|---|
| J'aime le chocolat. | | | |

| | | ***pas du tout d'accord*** | ***d'accord*** | ***tout à fait d'accord*** |
|---|---|---|---|---|
| 1 | J'ai aimé cet exercice. | | | |
| 2 | Cet exercice était difficile. | | | |
| 3 | Cet exercice était stressant. | | | |
| 4 | Cet exercice m'a plu. | | | |
| 5 | C'est la première fois que j'écris un récit en anglais. | | | |
| 6 | J'aime écrire en anglais. | | | |
| 7 | J'écris très bien en anglais. | | | |
| 8 | Je n'aime pas écrire en anglais. | | | |
| 9 | Je n'écris pas très bien en anglais. | | | |

Autres choses à me dire ? _____

## H. Post-writing Questionnaire for Turkish Writing Task

## Questionnaire 6

Dans le tableau, il y a des phrases. Lis chaque phrase attentivement. Coche l'une des trois réactions possibles. Il n'y a pas de réponse juste ou de réponse fausse. C'est ton opinion, en toute honnêteté, qui m'intéresse.

**Exemple:**

| | ***pas du tout d'accord*** | ***d'accord*** | ***tout à fait d'accord*** |
|---|---|---|---|
| J'aime le chocolat. | | | |

| | | ***pas du tout d'accord*** | ***d'accord*** | ***tout à fait d'accord*** |
|---|---|---|---|---|
| 1 | J'ai aimé cet exercice. | | | |
| 2 | Cet exercice était difficile. | | | |
| 3 | Cet exercice était stressant. | | | |
| 4 | Cet exercice m'a plu. | | | |
| 5 | C'est la première fois que j'écris un récit en turc. | | | |
| 6 | J'aime écrire en turc. | | | |
| 7 | J'écris très bien en turc. | | | |
| 8 | Je n'aime pas écrire en turc. | | | |
| 9 | Je n'écris pas très bien en turc. | | | |

Autres choses à me dire ? _____

## İ. Instructions for the data collection session

Bonjour. Je m'appelle Gulay. Je suis prof d'anglais et de turc. Je viens de l'Université Lyon 2. Je fais ma recherche sur l'écriture en anglais, en français et en turc. Comment les élèves écrivent un texte en deux ou trois langues? Quelles sont les différences? C'est une recherche scientifique. Nous allons développer un logiciel et une technique pour mieux enseigner l'écriture en anglais. C'est une recherche de doctorat. Merci beaucoup pour votre participation.

Pour cette recherche, vous allez effectuer trois tâches sur un ordinateur. Il y a deux questionnaires : un au début, l'autre à la fin. Je vais vous donner des instructions et vous allez tous faire l'activité ensemble avec le logiciel *Inputlog*. C'est un logiciel qui enregistre vos touches. Qu'est-ce que tu vas faire? Dans la tâche « Copie », vous allez copier des mots et des phrases. Dans la tâche descriptive, vous allez décrire une image en 4 minutes. Dans la tâche narrative, vous allez raconter une histoire (à partir de cinq images) en 10 minutes. Je voulais aussi faire un entretien avec deux participants volontaires à la fin de cette session. Ça prend 4-5 minutes. Qui veut participer à cet entretien?

Maintenant, nous allons commencer avec le questionnaire :

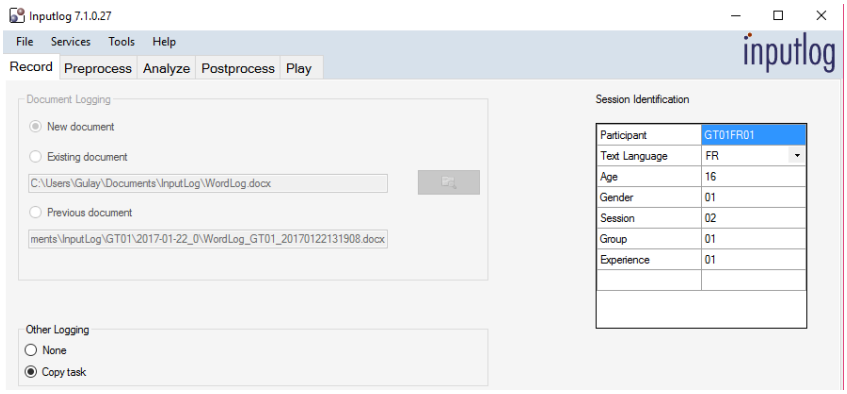
> Remplissez ce questionnaire sur l'écriture en général. C'est dans votre dossier. Votre identifiant, c'est votre initiale de nom et prénom, et un numéro que nous vous avons donné pour le projet (il est écrit sur votre dossier). Par exemple, moi, je mets: « GT01 ». Lorsque vous avez terminé de remplir le questionnaire, mettez-le dans ton dossier. Ensuite, nous ferons la première tâche sur l'ordinateur.

## J. How to use Inputlog (Comment utiliser Inputlog)

**1ère Session: Tâche de copie**

1. Ouvrez *Inputlog*. Remplissez les details dans **"session identification"** (les initiales des ton prénom et nom, 01 (numero de participant), FR01).

Choisissez "**Copy task".** Et cliquer sur "**recording**".



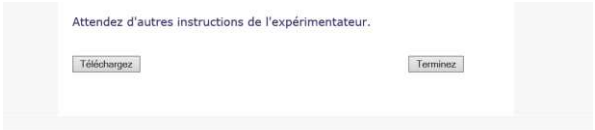

Cliquer sur >>>>>>> Recording

2. Choisissez **"French"** et dans la page suivante **remplissez les "donnes des participants".**

Vous allez copier quelques mots et des phrases. Cela prend 7 ou 8 minutes.

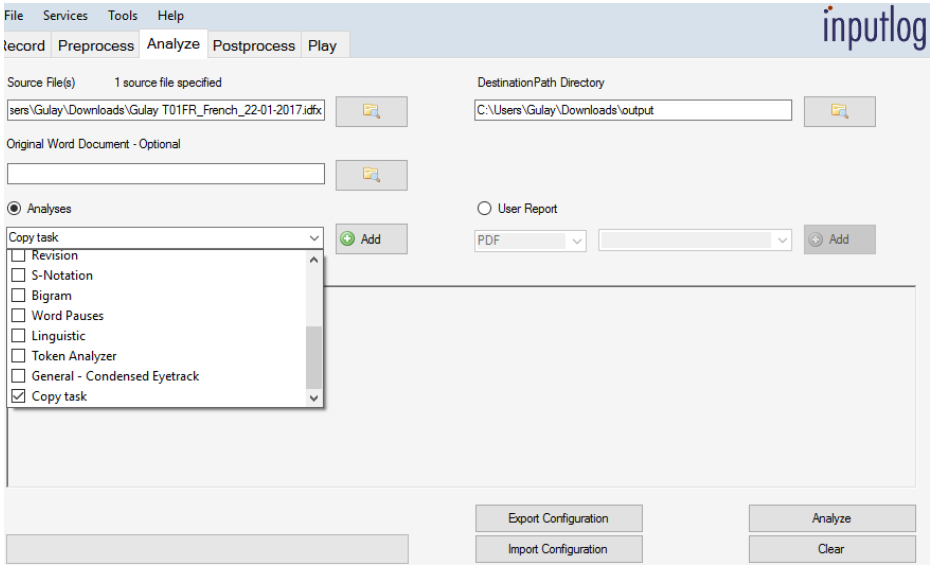
3. Dès que vous avez fini de copier les consonnes, dans la page suivante cliquer sur >>>>>>

**Téléchargez**



4. Tapez **"sauvegarder"** dans la barre de *Windows* après votre sauvegarde.

5. Tapez "**ouvrir**" et le fichier s'ouvre avec *Inputlog*. Dans le section, **"analyses", cochez "copy task", "add" et cliquez sur >>>>** **Analyze**




**2ème session: Tâche descriptive**

1. Ouvrez *Inputlog*.
2. Cochez "New document" et "none".
3. Vérifiez l'identifiant de la session : "session identification"
4. **Cliquez sur >>> Recording.**
5. Décrivez le dessin en Français en 4 minutes.
6. Dès que vous avez fini de rédiger le texte, **tapez l'icône caché** d'*Inputlog* dans la barre des tâches.
7. A la page d'*Inputlog*, **cliquez sur "stop recording".**

**3ème session: Tâche narrative**

1. Ouvrez *Inputlog*.
2. Vérifiez que les cases suivantes sont cochés : **"New document"** et **"none"**.
3. Changez juste l'identifiant de la ("session identification"), en mettant **FR02**.
4**. Cliquez sur >>> Recording.**
5. Décrivez l'histoire dans le dessin en français en 8 minutes.
5. Dès que vous aurez terminé, **tapez l'icône caché** d'*Inputlog* dans la barre de *Windows*.
6. Cliquez sur "**stop recording".**

7. A la fin, merci de remplir le questionnaire sur cette tâche.

## K. Writing tasks

**French descriptive task**

**UN PETIT PARAGRAPHE EN FRANCAIS**

**Regarde la photo. Que voies-tu ? Qu'est-ce qui s'y passe ?**

**Ecris une petite description.**

**Essaie d'écrire au moins CINQ PHRASES. Tu as QUATRE minutes.**

**Turkish descriptive task**

**TÜRKÇE PARAGRAF YAZMA**

**Fotoğrafa bakınız. Neler görüyorsunuz? Neler oluyor?**
**Lütfen fotoğrafı Türkçe anlatın.**
**En az BEŞ CÜMLE yazmaya çalışın. DÖRT dakikanız var.**

**English descriptive task**

**WRITE AN ENGLISH PARAGRAPH**

**Look at the picture. What do you see? What is happening?**

**Please write a little description.**

**Try to write at least FIVE SENTENCES. You have got FOUR minutes.**

**French narrative task**

Tâche narrative en français

-1-

-2-

-3-

-4-

**Turkish narrative task**

TÂCHE NARRATIVE EN TURC

-1-

-2-

-3-

-4-

## English narrative task

ENGLISH NARRATIVE TASK

-1-

-2-

-3-

-4-

-5-

## L. Retrospective Questions: Stimulated Recall Questions

**Questions related to the Planning Process:**

1. How did you start writing?
2. Did you plan anything?
3. You stopped here for a long time. What were you thinking?

**Questions related to the Formulation Process:**

1. Can you tell me how you formed the sentences?
2. How did you organize your ideas?
3. What did you do when you could not remember the word?
4. Why did you pause a lot before writing that word?
5. Why did you stop after writing that word?
6. Can you remember what you were thinking here?
7. Why did you pause here?

**Questions related to the Revision Process:**

1. What did you do after writing?
2. Why did you pause after you finished writing?
3. Why did you erase that word/sentence?
4. Why did you subsitute this word with that word?

**Translation in French (Questions de Rétrospectif)**

Après la rédaction en anglais, en français et en turc, les élèves vont répondre à des questions que la chercheuse pose après avoir regardé leurs processus d'écriture sur l'ordinateur. Voici les questions possibles :

Questions concernant la planification du texte :

1. Qu'est-ce que tu as fait avant de commencer à écrire ton texte?
2. As-tu fait un plan avant d'écrire ton texte?
3. Tu t'es arrêté ici longtemps. Tu te souviens pourquoi?
4. A quoi étais-tu en train de penser?
5. Comment as-tu organisé tes idées?

Questions concernant le processus de formulation :

6. Pourquoi as-tu hésité avant d'écrire ce mot?
7. Pourquoi t'es-tu arrêté après avoir écrit ce mot?
8. Peux-tu te rappeler à quoi tu pensais ici?
9. Pourquoi t'es-tu arrêté / as-tu hésité ici?

Questions concernant le processus de relecture :

1. Pourquoi as-tu effacé cette lettre/ ce mot / phrase?
2. Pourquoi as-tu remplacé ce mot à ce mot?

Questions générales :

1. Qu'est-ce qui était le plus difficile pour toi dans cet exercice d'écriture?
2. As-tu aimé cette activité ? Pourquoi (pas)?

## M. Three samples of transcriptions of stimulated recall interviews in French, English and Turkish

Below, as an illustration of our transcription and coding conventions, are two sample transcriptions from the stimulated recall protocol for a monolingual French student (Subject C) in L1 French and L2 English. Further below, Turkish transcriptions of a Turkish-French bilingual student (Subject E) can be found. In the transcriptions, underlined segments between quotation marks are the words that the subject used in her final written text. We did not make any corrections in students' original texts. Segments that are crossed out were the words that were erased during writing. The segments that are not in quotation marks are her explanation of reasons for pause and revision behaviour.

### 1. Learner C (monolingual), French narrative task: interview duration 7' 19"

Inv: Tu peux lire et en meme temps tu peux me dire pourquoi tu as effacé un mot, pourquoi tu t'es arretée et pourquoi tu as changé quelque chose. D'accord, okay ? Tu peux commencer s'il te plaît.

Learner C: "Sur cette image on", là j'ai effacé parce que j'avais écris 'pon' et je me suis trompée. "on voit un éléphant et une giraffe au bord de la piscine qui parlent…" La j'ai effacé parce que j'ai interverti les lettres. "... en souriant. Sur cette image ". Là j'ai effacé. Ça n'est fait pas vraiment exprimé. "on peut voir l'éléphante qui glisse". Là j'ai effacé parce que je me suis rendu compte qu'il n'est pas vraiment sur l'image. Il n'etait pas en train de glisser et qu'il etait seulement en train de courir. Qui court autour de la piscine," Là j'ai effacé, j'ai interverti les lettres, "et qui glisse"

Inv: Ah, tu as ajouté quelque chose ici.

C: suivi de la giraffe. parce que la giraffe va suivre en dernier. Je me suis dit que c'etait mieux de mettre là, qu'après.

Inv: D'accord.

C: Là j'avais oublié une majuscule. "Puis l'éléphant glisse". La j'ai mis un "s" j'avais oublié en 's'. "à cause de l'eau autour"

Inv: Ah, tu l'as effacé.

C: Oui, parce que j'avais collé 'autour et de' et du coup j'ai oublié un espace "autour de la piscine.".

Inv: Ah, ici en fait juste avant l'image 3 tu t'es arrêtée beaucoup, qu'est-ce que tu as pensé ici juste avant l'image 3.

C: Je suis en train de regarder comment formuler les phrases pour que ça fasse un beau récit."L'éléphante tombe à côté de la piscine et se fait mal au genou. La giraffe accourut à l'éléphant pour lui venir en aide."

"4 : (Pendant que) l'éléphante pleurait" j'avais oublié le 'e'. "pleurant de douleur". Et voila J'ai rajouté 'de douleur' pcq il n'est pas vraiment de douleur. Pleurant, ça veut dire ça n'est pas forcement de douleur, du coup j'ai ajouté ça pour plus de precision. "et (que) la giraffe" rassurant, là rassurant parce qu' elle a rassuré l'éléphant.

Inv: Ici, qu'est-ce que tu as fait là?

C: J'ai rajouté un 'e' à l'éléphant parceque ça signifie l'éléphante J'ai rajouté un 'e' à tous les 'éléphantes.

Inv: D'accord.

C: C'est une éléphante. Je crois qu'on dit comme ça.

Inv: Ici tu as ajouté quelque chose.

C: Parce que en fait la phrase je voulais faire après, ça n'allait pas avec le debout de ma phrase donc je rajoute 'pendant' , çà fasse une phrase correcte française.

Inv: Ah, ici tu t'es arrêtée beaucoup juste avant l'image 5, pourquoi?

C: Parce que, pourquoi j'ai arreté ? Pour formuler correctement, pour regarder bien à l'image ce qui s'est passé.

"5 : Celui-ci appliqua un pansement sur la plaie de l'éléphante pendant qu'elle se tordait de douleur" Là j'ai effacé pcq j'ai enversé des lettres encore. "et la giraffe". La j'ai effacé pcq'il y a un seul 'r' " resta auprès d'eux." J'avais oublié une majuscule. Et du coup j'ai rajouté un 'é'. et là, parce que, là il n'assure pas vraiment.

Inv: Tu as ajouté une phrase pour l'image 4. Pourquoi tu as decidé d'ajouter une phrase?

C: Je me suis rendu compte parce qu'il ne rassure pas vraiment, mais qu'il voulait appeler l'éléphante qui avait mal et il voulait trouver un moyen de la soigner mais il ne rassure pas vraiment "essayer de trouver un moyen de la soigner, un autre éléphant arriva en courant à l'aide de la victime."

Inv: Qu'est-ce qui est difficile pour toi dans l'écriture en français?

C: De faire des phrases correctement formulées avec le sujet, verb et COD et de ne pas faire des phrases trop longues et pas trop courtes, non plus.

Inv: Okay, merci beaucoup.

**2. Learner C (monolingual), English narrative task: interview duration 6' 59"**

Inv: C'est la session en anglais. Tu peux parler en français ou en anglais. Comme tu veux.

C: En anglais

Inv: Okay. On va faire la même chose. Tu peux me dire pourquoi tu as effacé, ce que tu pensais. Voilà je commence. Voilà. You thought a lot at the beginning of the task. Why did you think a lot?

C: I have... Hmm. Moi je parle en français.

Inv: OK that's better.

C: En fait j'avais effacé là 'scene'. Moi j'avais mis un point virgule, mais en fait il fallait mettre un point tout court.

Aprés j'ai effacé le 'r', parce que le 'r' est à côté du 't', et donc je me suis trompée.

"1. The scene takes place in a swimming-pool. There are an elephant and a giraffe. The elphant cast a ball. "is playing with a ball."

Inv: Ah, ici juste avant 'cast', tu as arrêtée, tu as pensé beaucoup, pourquoi?

C: Parce que en fait j'ai cherché comment dire 'jeter'. "cast a ball in the swimming-pool". Je l'avais effacé parce que, j'ai mis un 'x' au lieu de 'w'. "The elephant..."

Inv: Tu as ajouté une phrase?

C: Parce que, c'est l'éléphant qui jouait avec la balle. Je me suis dit, c'est important de la mettre et je l'avais écrit deux fois.

Inv: Ah, tu as effacé.

C: C'était pour la deuxième. La balle était tombé dans la piscine et j'avais oublié de la mettre. Là j'avais mis 'plays', sauf que l'action est en train de se passer, du coup c'était 'is playing' V+ing. j'ai changé

"2. But the ball falls in the swimming-pool."

Là, j'ai rajouté 'but', je me suis dit que c'est un mot important à mettre, pcq il faut rajouter des vocabulaire qu'on connait.

Inv: 'So', tu as ajouté 'so' et tu as effacé 'so'.

C: Parce que j'ai mis un point virgule, du coup il fallait que je mette un point.

"3. So the giraffe jump in the swimming-pool to catch the ball." Ensuite la giraffe..

Inv: Et ensuite moi je trouve que tu as pensé beaucoup avant l'image 3?

C: Je ne sais pas comment dire que la giraffe allait chercher la balle. je ne sais pas exactement comment dire en anglais. J'ai reflechi, je me suis dit de mettre 'attraper' (catch).

Inv: Ah oui, tu as effacé.

"4. The giraffe give the ball to the elephant."

J'ai mis un point d'interrogation sauf que c'est point tout court.

"5. The giraffe is happy to have catch the ball. And The elephant's "

Inv: Ah tu as effacé 'and'.

C: Parce que après la phrase est trop longue. Là, " The elephant 's crazy about the giraffe and the giraffe loves also the elephant." C'était pour dire que l'elephant était amoureux de giraffe et la giraffe est amoureuse de l'éléphante. Il ne faut pas répéter la même chose. Je ne savais pas trop comment dire.

Inv: Très bien. Qu’est-ce qui est le plus difficile pour toi dans l'écriture en anglais?

C: Le vocabulaire, la conjugaison des verbes par exemple au passé ou alors trouver les verbes approprie aux images aux scenes qu'se passe.

Inv: Est-ce que cet exercice est intéressant pour toi?

C: Oui, ça m'a permis de m'entrainer d'écrire des phrases en anglais et d'analyser des images pour transcrire exactement ce qui s'est passé. Et après, ce qui est dur pour moi en anglais et en français souvent sur l'ordinateur, j'inverse des lettres si j'écris plus vite que ce que je pense. Du coup j'inverse des letters dans que j'écris, je dois les effacer et recommencer.

**3. Learner E (Turkish-French bilingual), Turkish narrative task: interview duration 3'02''**

Inv: Tu peux me dire pourquoi tu t'es arrêté longtemps, pourquoi tu as effacé un mot et pourquoi tu as pensé longtemps? Ou bien pourquoi tu as remplacé un mot? Tu peux lire ce que tu as écrit?

E: "Bu hikayede bir kopek vede bir tavsan var. Bunlar yuruse cikmak icin"

Inv: Tu t'es arrêté longtemps just avant 'yürüyüşe'.

E: Ee kafamda biraz düşündüm ne yazayım diye. Hikayeyi nasıl yazayım diye. Cümleyi nasıl kurayım diye. " telefonlastilar ve parkta bulusmaya karar verdiler. Tavsan uzaktan arkadasini gorunce cok sevindi ve heycanlandi cunku bir ballonla"

Inv: Orada bir şey sildin.

E: Evet burada kelimeyi yanlış yazdım, unuttum. "gelmisti."

Inv: Burada da bir şey sildin?

E: Tavşan yazmak istiyordum, köpek yazdım. Karıştırdım iki hayvanı. "Tavsan ve kopek birbilerine sarilip konustlar ve sonrada oynamaya karar aldilar ama on dakika"

Inv: Burada da sildin.

E: Harf unuttum, sildim, geri yazdım. "on dakika sonra ballonu alan tavsan onu havaya ucurup kaybomus. Buna kopekcik cok sinirlenms".

Inv: Neden burada durdun?

E: Bir harf unuttum. "ve tavsan arkadasina kizmis."

Inv: Burada neyi düzelttin?

E: Geriye dönüp okudum, bir harf unuttum. Onu düzelttim. "Kopek bir kara almis"

Inv: Burada da durdun. Neden?

E: 'kara' mı 'karar' mı yazmalıyım. Onu düşündüm. "o karda"

Inv: Burada kelimeleri sildin. Neden?

E: Daha iyi ifade etmek istedim. " kendidine "

Inv: Burada da sildin. Neden?

E: Çünkü kelime ekledim, daha iyi anlatmak için. "yeniden bir ballon almasiydi cunku o annesinin bir hediyesiymis.Buna cok uzuldu tavsan e bu karari kabul etmis. ama ikisi hala arkadaslar tabikide."

Inv: Neden durdun genelde?

E: Kelimeleri yanlış yazdım.

Inv: Türkçe yazmada nerede zorluk çekiyorsun?

E: Kelimeleri doğru yazıp yazmadığımı bilmiyorum. Kelimeleri hatırlamaya çalışıyorum. Nasıl daha iyi ifade edebilirim başka bir şekilde onun için düşünüyorum. Büyük harfleri düzelttim. Kelimeyi doğru yazmadan önce düşündüm; doğrusu nedir diye 'kara' mı 'karar' mı.

Inv: Süper. Çok teşekkürler.

## N. Text Quality Rating Scale: Jacobs et al.'s (1981) ESL Composition Profile Score criteria

**Content: 30 points**

**27–30** Excellent to very good: knowledgeable; substantive, thorough development of thesis; relevant to topic assigned

**22–26** Good to average: some knowledge of subject; adequate range; limited thematic development; mostly relevant to topic, but lacks detail

**17–21** Fair to poor: limited knowledge of subject; minimal substance; poor thematic development

**13–16** Very poor: shows little or no knowledge of subject; inadequate quantity; not relevant, or not enough to rate

**Organization: 20 points**

**18–20** Excellent to very good: fluent expression; clear statement of ideas; solid support; clear organization; logical and cohesive sequencing

**14–17** Good to average: adequate fluency; main ideas clear but loosely organized; supporting material limited; sequencing logical but incomplete

**10–13** Fair to poor: low fluency; ideas not well connected; logical sequencing and development lacking

**7–9** Very poor: ideas not communicated; organization lacking, or not enough to rate

**Vocabulary : 20 points**

**18–20** Excellent to very good: complex range; accurate word/idiom choice; mastery of word forms; appropriate register

**14–17** Good to average: adequate range; errors of word/idiom choice; effective transmission of meaning

**10–13** Fair to poor: limited range; frequent word/idiom errors; inappropriate choice, usage; meaning not effectively communicated

**7–9** Very poor: translation-based errors; little knowledge of target language vocabulary, or not enough to rate

**Language Use (Grammar): 25 points**

**22–25** Excellent to very good: accurate use of relatively complex structures; few errors in agreement, number, tense,word order, articles, pronouns, prepositions

**18–21** Good to average: simple constructions used effectively; some problems in use of complex constructions; errors in agreement, number, tense, word order, articles, pronouns, prepositions

**11–17** Fair to poor: significant defects in use of complex constructions; frequent errors in agreement, number, tense, negation, word order, articles, pronouns, prepositions; fragments and deletions; lack of accuracy interferes with meaning

**5–10** Very poor: no mastery of simple sentence construction; text dominated by errors; does not communicate, or not enough to rate

**Mechanics: 5 points**

**5** Excellent to very good: masters conventions of spelling, punctuation, capitalization, paragraph indentation, etc

**4** Good to average: occasional errors in spelling, punctuation, capitalization, paragraph indentation, etc.,which do not interfere with meaning

**3** Fair to poor: frequent spelling, punctuation, capitalization, paragraphing errors; meaning disrupted by formal problems

**2** Very poor: no mastery of conventions due to frequency of mechanical errors, or not enough to rate

## O. Text quality rating criteria

**4-point scale based on ESL Composition Profile of Jacobs et al. (1981)**

| Category | Score | Writing descriptors |
|---|---|---|
| excellent to very good | (4) | Content: knowledgeable; substantive, thorough development of thesis; relevant to topic assigned<br>Organization: fluent expression; clear statement of ideas; solid support; clear organization; logical and cohesive sequencing<br>Vocabulary: complex range; accurate word/idiom choice; mastery of word forms; appropriate register<br>Language use: accurate use of relatively complex structures; few errors in agreement, number, tense, word order, articles, pronouns, prepositions<br>Mechanics: masters conventions of spelling, punctuation, capitalization, paragraph indentation, etc |
| good to average | 3 | Content: some knowledge of subject; adequate range; limited thematic development; mostly relevant to topic, but lacks detail<br>Organization: adequate fluency; main ideas clear but loosely organized; supporting material limited; sequencing logical but incomplete<br>Vocabulary: adequate range; errors of word/idiom choice; effective transmission of meaning<br>Language use: simple constructions used effectively; some problems in use of complex constructions; errors in agreement, number, tense, word order, articles, pronouns, prepositions<br>Mechanics:occasional errors in spelling, punctuation, capitalization, paragraph indentation, etc.,which do not interfere with meaning |
| fair to poor | 2 | Content: limited knowledge of subject; minimal substance; poor thematic development<br>Organization: low fluency; ideas not well connected; logical sequencing and development lacking<br>Vocabulary: limited range; frequent word/idiom errors; inappropriate choice, usage; meaning not effectively communicated<br>Language use: significant defects in use of complex constructions; frequent errors in agreement, number, tense, negation, word order, articles, pronouns, prepositions; fragments and deletions; lack of accuracy interferes with meaning<br>Mechanics: frequent spelling, punctuation, capitalization, paragraphing errors; meaning disrupted by formal problems |
| very poor text quality | 1 | Content: shows little or no knowledge of subject; inadequate quantity; not relevant, or not enough to rate<br>Organization: ideas not communicated; organization lacking, or not enough to rate<br>Vocabulary: translation-based errors; little knowledge of target language vocabulary, or not enough to rate<br>Language use: no mastery of simple sentence construction; text dominated by errors; does not communicate, or not enough to rate<br>Mechanics: no mastery of conventions due to frequency of mechanical errors, or not enough to rate |

## P. Booklet for raters on text quality rating procedure

### LA PROCÉDURE D'ÉVALUATION DES TEXTES [anglais-français-turc]

Chère collègue, cher collègue,

Merci beaucoup d'avoir accepté de nous aider dans ce projet de recherche. Nous apprécions vivement le temps précieux que vous consacrez à cette tâche.

Vous trouverez dans les fiches ci-jointes un ensemble de petits textes qui ont été rédigés (à l'ordinateur) par des élèves d'anglais langue étrangère ("LV1") de troisième. Ils avaient deux tâches à accomplir, en utilisant un traitement de texte dans une salle informatique:

**Une tâche narrative:** On a distribué à chaque élève la courte bande dessinée ci-jointe. Ils avaient 8 minutes pour composer un petit texte qui raconte l'histoire de la BD.

**Une tâche descriptive:** A partir de la photo (ci-jointe), les élèves avaient 4 minutes pour écrire au moins 5 phrases.

Ce que nous vous demandons de faire:

Vous n'allez pas effectuer la *correction* de ces petits textes, mais seulement une appréciation de leur qualité. Pour vous guider, deux petits barèmes sont fournis avec chaque texte. Merci de lire attentivement et de suivre les consignes qui suivent.

**Première évaluation : classement des textes (selon leur qualité générale)**

Lire chaque texte rapidement, pour évaluer sa qualité générale, selon l'une des quatre catégories figurant dans le tableau en haut du texte :

| **qualité du texte...** | | | |
|---|---|---|---|
| **4**<br>**supérieure** | **3**<br>**moyenne +** | **2**<br>**moyenne -** | **1**<br>**inférieure** |
| | | | |

Mettre une croix dans la case qui correspond à votre choix : le texte est de qualité supérieure (4) ; de qualité « moyenne plus » (moitié supérieure des textes moyens ; 3) ; de qualité « moyenne moins » (moitié inférieure des textes moyens ; 2) ; ou de qualité inférieure (1).

Avant de passer à la deuxième évaluation, il est utile (pour la fiabilité de votre appréciation) de regrouper les textes d'un même niveau de qualité, selon la case cochée pour chacun. Faites quatre « piles », en entassant tous les textes ayant obtenu le même score à l'étape 1. Profiter de ce tri pour ajuster vos appréciations, si nécessaire.

**Deuxième évaluation : évaluation des textes**

Evaluer les textes de chaque pile de façon plus détaillée, en utilisant le tableau qui figure en bas du texte : entourer votre choix.

***plus précisément...***

| | 4 | 3 | 2 | 1 |
|---|---|---|---|---|
| **Contenu...** | **très bon** | **suffisant** | **limité** | **insuffisant** |
| **Organisation des idées...** | **claire** | **suffisante** | **limitée** | **insuffisante** |
| **Utilisation du lexique, de la grammaire, de l'orthographe** | **efficace** | **suffisante** | **limitée** | **dominée par erreurs** |

Nous restons à votre disposition pour toute précision, aide, ou autre. Encore merci pour votre collaboration indispensable.

## Q. Histograms for the copy task measures

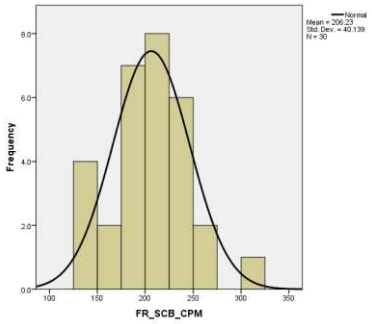



Figure 6.1 Selected Component Bigrams in L1 (French)

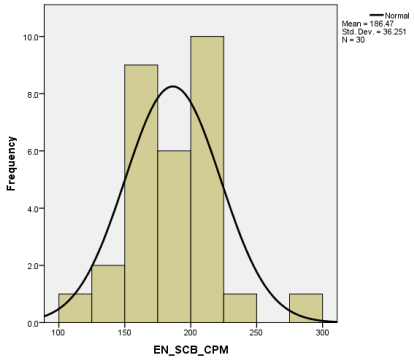



Figure 6.2 Selected Component Bigrams in L2 (English)

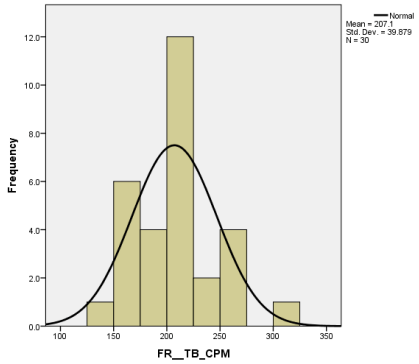



Figure 6.3 Targeted Bigrams in L1 (French)

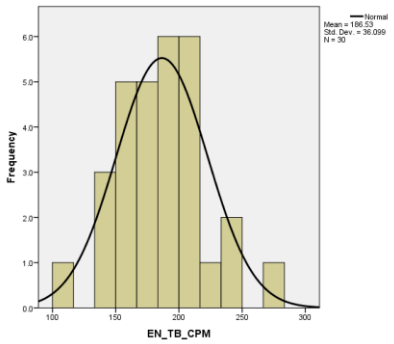



Figure 6.4 Targeted Bigrams in L2 (English)

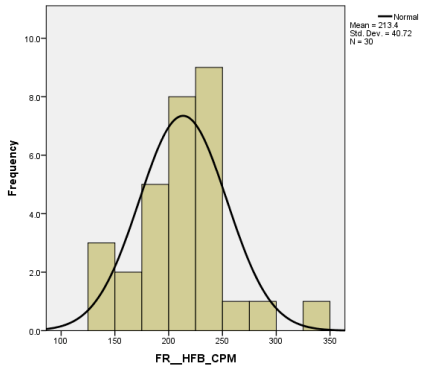



Figure 6.5 High Frequency Bigrams in L1 (French)

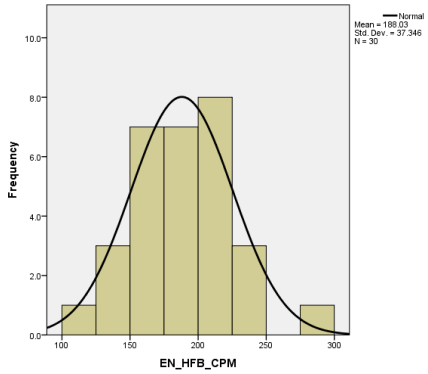



Figure 6.6 High Frequency Bigrams in L2 (English)

## R. Tests of normality for the writing process measures (keystroke loggings) for the descriptive and narrative tasks of both L1/dominant (French) and L2 (English) writing.

Tests of Normality for the descriptive task of L1/dominant (French) writing

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| FR_DESC_PROTIME | .174 | 30 | .020 | .881 | 30 | .003 |
| FR_DESC_PAUSETIME | .181 | 30 | .013 | .898 | 30 | .007 |
| FR_DESC_TOTALWORDS | .170 | 30 | .026 | .921 | 30 | .028 |
| FR_DESC_CPM | .056 | 30 | .200* | .983 | 30 | .888 |
| FR_DESC_WPM | .080 | 30 | .200* | .988 | 30 | .975 |
| FR_DESC_P-Bursts | .150 | 30 | .082 | .910 | 30 | .015 |
| FR_DESC_Pauses | .135 | 30 | .171 | .922 | 30 | .030 |
| FR_DESC_PWW | .145 | 30 | .110 | .955 | 30 | .225 |
| FR_DESC_PBetW | .124 | 30 | .200* | .952 | 30 | .188 |
| FR_DESC_REVISONS | .133 | 30 | .186 | .955 | 30 | .234 |
| FR_DESC_R-Bursts | .194 | 30 | .005 | .881 | 30 | .003 |
| FR_DESC_RATIO | .166 | 30 | .034 | .831 | 30 | .000 |

Tests of Normality for the narrative task of L1/dominant (French) writing

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| FR_NAR_PROTIME | .176 | 30 | .019 | .926 | 30 | .038 |
| FR_NAR_PAUSETIME | .163 | 30 | .041 | .920 | 30 | .027 |
| FR_NAR_TOTALWORDS | .155 | 30 | .063 | .925 | 30 | .037 |
| FR_NAR_CPM | .118 | 30 | .200* | .930 | 30 | .048 |
| FR_NAR_WPM | .166 | 30 | .035 | .880 | 30 | .003 |
| FR_NAR_RATIO | .204 | 30 | .003 | .774 | 30 | .000 |
| FR_NAR_P-Bursts | .154 | 30 | .068 | .926 | 30 | .039 |
| FR_NAR_Pauses | .169 | 30 | .029 | .948 | 30 | .147 |
| FR_NAR_PWW | .094 | 30 | .200* | .970 | 30 | .547 |
| FR_NAR_PBETW | .134 | 30 | .179 | .943 | 30 | .111 |
| FR_NAR_REVISIONS | .085 | 30 | .200* | .988 | 30 | .979 |
| FR_NAR_R-Bursts | .234 | 30 | .000 | .803 | 30 | .000 |

Tests of Normality for the descriptive task of L2/L3 (English) writing

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| EN_DESC_PROTIME | .102 | 30 | .200* | .966 | 30 | .432 |
| EN_DESC_PAUSETIME | .207 | 30 | .002 | .918 | 30 | .023 |
| EN_DESC_TOTALWORDS | .109 | 30 | .200* | .968 | 30 | .480 |
| EN_DESC_CPM | .157 | 30 | .057 | .966 | 30 | .425 |
| EN_DESC_WPM | .104 | 30 | .200* | .971 | 30 | .570 |
| EN_DESC_RATIO | .119 | 30 | .200* | .942 | 30 | .100 |
| EN_DESC_P-Bursts | .210 | 30 | .002 | .912 | 30 | .017 |
| EN_DESC_Pauses | .086 | 30 | .200* | .963 | 30 | .363 |
| EN_DESC_PWW | .167 | 30 | .033 | .953 | 30 | .209 |
| EN_DESC_PBETW | .101 | 30 | .200* | .947 | 30 | .137 |
| EN_DESC_REVISIONS | .082 | 30 | .200* | .983 | 30 | .894 |
| EN_DESC_R-Bursts | .160 | 30 | .047 | .892 | 30 | .005 |

Tests of Normality for the narrative task of L2/L3 (English) writing

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | df | Sig. |
| EN_NAR_PROTIME | .189 | 30 | .008 | .895 | 30 | .006 |
| EN_NAR_PAUSETIME | .122 | 30 | .200* | .963 | 30 | .364 |
| EN_NAR_TOTALWORDS | .147 | 30 | .097 | .950 | 30 | .174 |
| EN_NAR_CPM | .081 | 30 | .200* | .974 | 30 | .657 |
| EN_NAR_WPM | .079 | 30 | .200* | .965 | 30 | .413 |
| EN_NAR_RATIO | .167 | 30 | .032 | .929 | 30 | .046 |
| EN_NAR_P_Bursts | .107 | 30 | .200* | .968 | 30 | .491 |
| EN_NAR_Pauses | .108 | 30 | .200* | .977 | 30 | .730 |
| EN_NAR_PWW | .126 | 30 | .200* | .947 | 30 | .143 |
| EN_NAR_PBETW | .097 | 30 | .200* | .977 | 30 | .751 |
| EN_NAR_REVISIONS | .179 | 30 | .015 | .882 | 30 | .003 |
| EN_NAR_R_Bursts | .143 | 30 | .119 | .959 | 30 | .298 |

In light grey, the measures where the distribution is apparently non-normal; in dark grey where the statistic is marginal – measures that should be tested with nonparametric statistics to be safe.

## S. Friedman Test results in study 2

Table of Friedman Test results for comparisons for writing process measures for L1 French, L2 Turkish and L3 English (combined tasks); significant differences are in **bold type**, with line highlighted in grey

| | measure | French | | Turkish | | English | | $\chi^2$ | p value |
|---|---|---|---|---|---|---|---|---|---|
| | | mean | SD | mean | SD | mean | SD | | |
| 1 | process time | 6.11 | 1.14 | 6.24 | 1.28 | 5.52 | .814 | 3.60 | .165 |
| 2 | number of total words | 95.60 | 22.64 | 58.16 | 18.71 | 56.10 | 19.63 | **19.73** | **.000*** ** |
| 3 | characters per minute | 82.45 | 17.59 | 62.78 | 18.22 | 49.51 | 16.19 | **21.73** | **.000*** ** |
| 4 | words per minute | 15.18 | 8.63 | 9.04 | 2.74 | 9.90 | 3.27 | **22.80** | **.000*** ** |
| 5 | P-burst length | 24.33 | 8.44 | 16.59 | 6.40 | 11.37 | 3.39 | **24.40** | **.000*** ** |
| 6 | pause time in min | 1.85 | .602 | 2.45 | .747 | 2.70 | .918 | **6.53** | **.038(m)** |
| 7 | number of pauses | 23 | 5.51 | 25 | 6.82 | 25.50 | 6.26 | 3.13 | .208 |
| 8 | number of within-word pauses | 225 | 71.33 | 220 | 77.99 | 125 | 49.99 | **22.80** | **.000** ** |
| 9 | number of between-word pauses | 99 | 23.37 | 60 | 18.01 | 59 | 20.07 | **19.73** | **.000** ** |
| 10 | number of revisions | 56.73 | 21.58 | 42.93 | 16.73 | 36.90 | 14.17 | **6.40** | **.042m** |
| 11 | R-burst length | 18.89 | 7.90 | 22.31 | 8.99 | 13.35 | 3.93 | **11.20** | **.004** ** |
| 12 | ratio | .862 | .062 | .838 | .103 | .856 | .055 | .133 | .936 |
| 13 | overall text quality | 8.53 | 3.72 | 13.27 | 2.61 | 8.60 | 3.54 | **17.37** | **.000*** ** |

*$p < .01$. **$p < .001$. ***p<.0001, marginal effect $p<.05$.

## T. Tables of study 3

**Table a: Comparisons for writing process measures for the descriptive task in L1 French writing** (medians, minima, maxima, and Mann Whitney U test) **between monolinguals and bilinguals**

| | monolingual (n=13) | | | bilingual (n=17) | | | Mann-Whitney U | Z value | P value |
|---|---|---|---|---|---|---|---|---|---|
| | Median | Min | Max | Median | Min | Max | | | |
| typing speed | 214 | 135 | 312 | 198 | 136 | 257 | 88.000 | -.942 | .346 |
| process time | 4.54 | 4.21 | 6.12 | 4.59 | 2.41 | 5.52 | 105.500 | -.209 | .834 |
| Number of words | 105 | 59 | 124 | 83 | 47 | 116 | 77.000 | -1.403 | .161 |
| Characters per minute | 99.17 | 61.50 | 141.04 | 92.82 | 35.43 | 123.25 | 89.000 | -.900 | .368 |
| Words per minute | 19.07 | 11.06 | 27.63 | 17.64 | 5.85 | 21.42 | 84.000 | -1.109 | .267 |
| P-burst length | 25.51 | 14.89 | 56.00 | 29.73 | 8.92 | 57.70 | 105.000 | -.230 | .818 |
| pause time in minutes | 1.28 | .36 | 2.00 | 1.25 | .37 | 2.21 | 95.500 | -.628 | .530 |
| Number of pauses | 16 | 11 | 28 | 18 | 10 | 26 | 107.500 | -.126 | .900 |
| Number of within-word pauses | 177 | 129 | 285 | 198 | 78 | 313 | 98.000 | -.523 | .601 |
| Number of between-word pauses | 102 | 63 | 125 | 82 | 48 | 129 | 80.000 | -1.277 | .202 |
| number of revisions | 49 | 26 | 74 | 43 | 19 | 67 | 77.000 | -1.404 | .160 |
| R-burst length | 16.22 | 8.34 | 37.63 | 16.04 | 6.50 | 32.80 | 92.000 | -.774 | .439 |
| ratio | .909 | .760 | .967 | .890 | .578 | .974 | 96.500 | -.586 | .558 |

**Table b: Comparisons for writing process measures for the narrative task in L1 French writing (medians, minima, maxima, and Mann Whitney U test) between monolinguals and bilinguals**

| | monolingual (n=13) | | | bilingual (n=17) | | | Mann-Whitney U | Z value | P value |
|---|---|---|---|---|---|---|---|---|---|
| | Median | Min | Max | Median | Min | Max | | | |
| process time | 8.28 | 6.48 | 9.44 | 8.17 | 4.56 | 9.58 | 97.500 | -.544 | .586 |
| Number of words | 120 | 78 | 229 | 107 | 63 | 184 | 84.500 | -1.089 | .276 |
| Characters per minute | 85.62 | 57.92 | 129.81 | 75.09 | 56.45 | 116.26 | 88.000 | -.942 | .346 |
| Words per minute | 15.48 | 10.71 | 27.02 | 13.57 | 10.98 | 20.70 | 96.000 | -.607 | .544 |
| P-burst length | 28.57 | 14.35 | 51.09 | 22.81 | 12.97 | 39.73 | 84.000 | -1.109 | .267 |
| pause time in minutes | 1.57 | 1.12 | 3.35 | 2.34 | 1.27 | 4.10 | 77.500 | -1.381 | .167 |
| Number of pauses | 26 | 21 | 38 | 27 | 18 | 41 | 93.000 | -.735 | .462 |
| Number of within-word pauses | 290 | 140 | 378 | 241 | 194 | 441 | 82.000 | -1.193 | .233 |
| Number of between-word pauses | 140 | 82 | 234 | 113 | 63 | 190 | 82.500 | -1.172 | .241 |
| number of revisions | 82 | 38 | 121 | 71 | 18 | 138 | 88.500 | -.921 | .357 |
| R-burst length | 13.81 | 8.68 | 41.00 | 16.71 | 8.26 | 41.08 | 91.000 | -.816 | .414 |
| ratio | .888 | .469 | .965 | .859 | .763 | .943 | 100.000 | -.440 | .660 |

# SOMMAIRE

## Introduction

L'écriture est un processus complexe et exigeant, qui implique des composants en interaction. L'écriture est difficile, car les écrivains doivent mener simultanément des activités cognitives, métacognitives, pragmatiques, affectives et linguistiques (Bereiter & Scardamalia, 1987; Flower & Hayes, 1980; 1981; Hayes, 1996; Hayes & Flower, 1980; Kellogg, 1996, 1999; Schoonen et al., 2011; Torrance & Galbraith, 1996). Écrire dans une langue étrangère[18] (L2) est encore plus difficile que d'écrire dans la première langue (L1), car les écrivains de L2 maîtrisent en général moins bien la L2 que leur langue maternelle (Grabe & Kaplan, 1996; Schoonen et al., 2003; 2011). Pour les apprenants débutants en L2 dont les connaissances en L2 sont limitées et ne sont pas disponibles automatiquement, la rédaction d'un texte peut être un processus beaucoup plus difficile, car l'attention sera dirigée vers ces connaissances « d'ordre inférieur » telles que le vocabulaire, l'orthographe et la grammaire. La capacité de la mémoire de travail n'est pas libre pour les activités sémantiques et pragmatiques de « plus haut niveau » telles que la planification ou le contenu et l'organisation du texte (par exemple, Chenoweth et Hayes, 2001; Lindgren, 2004; McCutchen, 2000; Whalen & Ménard, 1995).

Ma préoccupation avec la production écrite a commencé avec ma carrière de professeur d'anglais, après l'obtentions de mon diplôme du département d'enseignement de l'anglais comme langue étrangère (ALE) de l'Université Hacettepe en Turquie en 1991. Depuis, j'ai enseigné l'anglais à des étudiants de différents niveaux de l'école primaire à l'université. J'ai été témoin de la difficulté de mes apprenants d'ALE dans la production écrite à tous les niveaux. Alors que les apprenants d'ALE les plus compétents écrivent leurs textes couramment et avec une meilleure qualité de texte, les apprenants moins compétents avaient du mal, me disant que cela était dû à un vocabulaire et à des connaissances grammaticales limités. Ces difficultés les conduisaient souvent à perdre leur motivation et à arrêter simplement d'écrire, ce qui se traduit par des textes de mauvaise qualité. Rechercher les raisons de la facilité ou de la difficulté de mes apprenants d'ALE dans la production de leurs textes en anglais est devenu l'un de mes objectifs professionnels.

[18] Une deuxième langue est une langue présente dans l'environnement social immédiat de l'apprenant; une langue étrangère, comme son nom l'indique, est parlée par des groupes sociaux plus éloignés. Nous utiliserons l'abréviation «L2» pour désigner les deux et spécifierons la distinction le cas échéant.

Je m'intéresse également aux processus d'écriture des apprenants bilingues. Lorsque j'ai travaillé comme professeur de turc pour les Consulats Général de Turquie en Belgique et en France pendant dix ans, j'ai eu l'expérience d'enseigner la langue d'origine turque dans les écoles primaires et secondaires où il y a des apprenants bilingues turco-belge ou turco-français. J'ai observé les difficultés des apprenants bilingues turc-français dans la production écrite dans leur langue d'origine turque pendant mes cours, bien qu'ils parlent le turc (avec un mélange de français) comme langue à la maison, avec leurs parents et amis (Akinci, 2006; 2010). Ces étudiants bilingues apprennent également l'anglais comme langue étrangère. Dans cette optique, je me suis toujours demandé si les bilingues turc-français produisent des textes en turc (leur L1), en français (langue scolaire dominante, surtout pour l'écriture), et en anglais (langue étrangère) de la même manière. Je me suis également demandé si les bilingues turc-français composent leurs textes français et anglais de la même manière que leurs pairs monolingues français. Bien qu'il y ait un grand nombre de recherches sur la production écrite des bilingues (à la fois en L1 et L2) utilisant des données textuelles (le « produit » des processus d'écriture) - en particulier dans l'écriture académique - il y a moins de recherches comparant les *processus* d'écriture en trois langues.

A cette époque de développement technologique, l'ordinateur devient un outil puissant et important pour comprendre comment les apprenants écrivent dans leurs différentes langues. Un outil innovant de recherche sur les processus d'écriture, *Inputlog*, qui enregistre les touches tapées au clavier (*keystroke loggings*), m'a été présenté lors de mes études de master en Sciences de l'éducation à l'Université de Louvain en Belgique. J'ai été fasciné par l'efficacité de cet outil. Les enregistrements de frappe capturent les comportements dactylographiques temporels, les pauses, les révisions (en nombre de suppressions et d'ajouts) et les mouvements de la souris pendant l'écriture, calculant de façon précise le temps entre la pression d'une touche et sa libération (Van Waes & Leijten, 2015). Le logiciel *Inputlog* fournit également un ensemble impressionnant de programmes d'analyse de données. En raison de ces nombreuses fonctions utiles, j'étais ravie d'utiliser un logiciel d'enregistrement des frappes dans mes recherches pour comparer les processus d'écriture dans trois langues différentes.

Dans cette étude doctorale, alors que notre principal ensemble de données proviendra des enregistrements de frappe, nous combinerons également ces données avec des méthodes plus qualitatives, comme des questionnaires pré- et post-rédaction, et des entretiens de rappel stimulé. Nous espérons que nos analyses des relations entre les apprenants et leurs attitudes

envers l'écriture, les mesures du processus d'écriture (fluidité, les hésitations et les révisions), et les produits (les textes qu'ils produisent) fourniront des informations pour développer des méthodes ou des outils pour améliorer les performances d'écriture dans les différentes langues d'un apprenant.

## 1. Cadre théorique

Les premières études sur l'écriture en langue seconde s'appuyaient sur des recherches sur l'écriture en L1 et ont adopté les théories, les modèles, les méthodes de recherche et les pratiques pédagogiques de cette recherche en L1 (Grabe & Kaplan, 1996; Krapels, 1990), qui prévalent aujourd'hui. La recherche sur l'écriture en L2 a commencé à la fin des années 1960 et au début des années 1970 aux États-Unis et au Royaume-Uni, avec l'arrivée de plus d'étudiants étrangers ou bilingues dans leurs établissements d'enseignement supérieur et une prise de conscience accrue de leurs besoins (Grabe & Kaplan, 1996). Les premières recherches sur l'écriture en L2 se sont concentrées sur les produits d'écriture - les caractéristiques des textes produits par ces apprenants - ainsi que sur les techniques d'enseignement des compétences en écriture (Grabe & Kaplan, 1996). Dans les années 1980, les études d'écriture en L2 ont commencé à prospérer, avec un nouvel accent sur les processus, sur le comportement d'écriture des écrivains L2 qualifiés et non qualifiés, et sur la production efficace de textes L2. Le développement de techniques de réflexion à voix haute, pour étudier ce à quoi les écrivains pensaient en écrivant, a aidé à focaliser l'attention scientifique sur les processus d'écriture en L1 et L2. Les chercheurs en écriture se sont davantage intéressés aux « opérations mentales utilisées par les écrivains lorsqu'ils tentent de générer, d'exprimer et d'affiner des idées afin de produire un texte » (Roca de Larios, Murphy et Marin, 2002, p.12).

De plus en plus de recherches sur l'écriture en langue seconde portent sur les similarités et les différences inter-linguistiques dans les processus d'écriture en L1 et L2 (par exemple Akyel, 1994; Akyel & Kamisli, 1997; Beare & Bourdages, 2007; Chenoweth & Hayes , 2001; Cumming, 1989; Grabe & Kaplan, 1996; Hirose & Sasaki, 1994; Jones & Tetroe, 1987; Manchón & Haan, 2008; Manchón et al., 2005; Pennington & So, 1993; Raimes, 1987; Roca de Larios, Manchón & Murphy, 2006; Sasaki, 2002, 2004; Sasaki & Hirose, 1996; Skibniewski, 1987; Tillema, 2012; Tiryakioglu et al., 2019; Whalen & Ménard, 1995; Zamel, 1983). Les recherches sur les processus d'écriture en L1 et L2 suggèrent que, bien que les écrivains utilisent des stratégies et des comportements de rédaction similaires lorsqu'ils

écrivent dans leur langue première et deuxième langue (par exemple, Akyel & Kamisli, 1997; Beare & Bourdages, 2007; Zamel, 1983), il existe également des différences entre écriture en L1 et L2 (Grabe & Kaplan, 1996; Raimes, 1985; 1987; Silva, 1993; Tillema, 2012). Dans sa méta-analyse de 73 études empiriques sur l'écriture de L1 et L2, Silva (1993) a montré que les écrivains de L2, par rapport aux écrivains de L1, faisaient moins de planification, et éprouvaient des difficultés à atteindre leurs objectifs et à organiser les idées générées en écriture en L2. Les textes produits en L2 sont généralement plus courts, impliquent des mots plus fréquents et des phrases moins complexes et contiennent plus d'erreurs (voir Silva, 1993 pour une revue).

La maîtrise de la langue est un facteur important contribuant à la maîtrise de l'écriture dans sa langue maternelle (Bereiter & Scardamalia, 1987; Hayes & Flower, 1980; Kellogg, 1996; McCutchen, 1986; 2000; Schoonen et al., 2003; Snellings, Van Gelderen, & De Glopper, 2004). En écriture en L2, les connaissances linguistiques sont susceptibles de jouer un rôle majeur dans le processus d'écriture, puisque l'écriture en L2 présente plus de défis pour l'encodage linguistique (Schoonen et al., 2003). Les processus impliqués dans la formulation - la transposition du contenu propositionnel dans une forme verbale - est probablement celui qui diffère le plus de l'écriture en L1, et que les écrivains trouvent le plus difficile (Chenoweth & Hayes, 2001; Schoonen et al., 2003) -- dépend fortement de la connaissance de la langue. Avoir de riches ressources linguistiques - « connaissances lexicales, morphosyntaxiques et orthographiques » - facilitera le processus de formulation (Schoonen et al., 2011, p.33), et permettra aux rédacteurs de L2 de détourner leur attention d'activités de niveau inférieur (comme l'orthographe, le vocabulaire et la grammaire), pour l'investir dans des activités de niveau supérieur (les aspects pragmatiques de la communication écrite; Chenoweth & Hayes, 2001; Schoonen et al., 2003; Whalen & Ménard, 1995).

La recherche à ce jour a produit des résultats contradictoires concernant la relation entre les différents niveaux de la connaissance de la langue, les processus de rédaction et leurs produits. Un certain nombre d'études en L2 concluent que la maîtrise de la L2 joue un rôle majeur dans l'explication des performances d'écriture[19] en L2 (par exemple, Cumming, 1989; Hirose & Sasaki, 1994; Manchón & Roca de Larios, 2007; Pennington & So, 1993; Roca de Larios, Manchón & Murphy, 2006; Roca de Larios, Manchón, Murphy & Marín, 2008; Roca

[19] Dans la recherche d'écriture, la performance d'écriture a été utilisée pour faire référence à la fois au processus d'écriture et au produit (rédaction des partitions ou qualité du texte). Par exemple, dans leur étude portant sur la fluidité d'écriture en L1 et L2, Chenoweth et Hayes (2001) ont utilisé le terme «performance d'écriture» pour désigner le processus d'écriture. Cumming (1989), pour sa part, utilise ce terme pour désigner le texte écrit.

de Larios, Murphy & Manchón, 1999; Sasaki, 2000, 2002, 2004; Sasaki & Hirose, 1996; Whalen & Ménard, 1995). La majorité des études ont montré qu'à mesure que les compétences augmentent, les performances en écriture de L2 augmentent (Chenoweth & Hayes, 2001; Cumming, 1989; Hirose & Sasaki, 1994; Roca de Larios et al., 1999; Sasaki, 2000; 2004; Sasaki & Hirose , 1996; Whalen & Ménard, 1995). Dans certaines études plus anciennes, il a été constaté que les performances d'écriture en L2 n'étaient pas nécessairement associées à la compétence en L2 (Raimes, 1985, 1987; Zamel, 1982, 1983, 1984).

Dans une série d'études, Roca de Larios et ses collègues ont étudié la relation entre le niveau de compétence L2 (faible, moyen ou élevé) et différents aspects des processus d'écriture en L2 des apprenants d'ALE en espagnol, tels que la planification (Manchón & Roca de Larios, 2007), les processus de formulation (Roca de Larios, Manchón, & Murphy, 2006), et la répartition des activités cognitives sur l'ensemble du processus d'écriture en L2 (Roca de Larios, Manchón, Murphy & Marin, 2008). Ils ont trouvé les résultats suivants dans ces études. Les rédacteurs de haut niveau ont consacré plus de temps à la planification de la tâche de L2 et aucun signe de perte de performance n'a été observé chez ces élèves (Manchón & Roca de Larios, 2007). Avec une maîtrise accrue, il pourrait y avoir moins de temps consacré à la recherche lexicale, donc l'expression du sens voulu ; les étudiants consacraient moins de temps à compenser le manque de ressources linguistiques (Roca de Larios et al., 2006). Les élèves à haut niveau de compétence consacraient leur temps aux activités d'écriture de manière plus équilibrée avec plus de planification et d'évaluation et moins de méta-commentaires que les élèves de plus faible niveau (Roca de Larios et al., 2008).

Bien qu'il existe une quantité importante de recherches sur le développement de l'écriture des élèves bilingues, il y a moins de recherches sur le développement de l'écriture des apprenants d'une langue seconde qui acquièrent une langue majoritaire (Babayigit, 2014). Par exemple, dans une étude comparant des apprenants néerlandais bilingues et monolingues, Verheyden et ses collègues (2010) ont constaté que les textes des apprenants bilingues turco-néerlandais en néerlandais étaient plus faibles que leurs homologues néerlandais de L1. Il a été conclu que cela pouvait être lié à un niveau inférieur de maîtrise du néerlandais pour les apprenants bilingues. Dans une autre étude, Stevenson et ses collègues (2006) ont comparé les enregistrements de frappe des élèves monolingues et bilingues en néerlandais L1 ou L2 et L2 ou L3 anglais, et ont constaté une moindre variabilité dans les textes anglais (par rapport aux textes néerlandais). Les textes monolingues étaient nettement plus longs que ceux des

bilingues dans les deux langues. Les bilingues avaient également des scores de qualité de texte inférieurs à ceux des monolingues dans les deux langues.

Les recherches sur le développement du langage chez les enfants bilingues turc-français en France sont relativement rares, même si elles ont récemment commencé à se développer (Akinci, 2006; 2010; Akinci & Decool-Mercier, 2010; Akinci, Pfaff & Dollnick, 2009; Ertek, 2017). Akinci (2006) a étudié le développement oral narratif de 94 enfants turco-français (âgés de 5 à 11 ans) en L1 turc et L2 français. Les enfants turcs utilisaient moins de connecteurs à des âges inférieurs et ne connaissaient pas la signification de certains mots français utilisés dans la vie quotidienne. Selon Akinci (2010), cependant, par rapport à leurs pairs monolingues français, les bilingues turc-français ne sont pas en retard sur leurs pairs en matière de maîtrise orale du français à l'âge de sept ans. Par rapport aux pairs monolingues en Turquie, les bilingues turc-français atteignent le même niveau en turc à l'âge de 14-15 ans.

Des recherches sur la comparaison des processus d'écriture en L1, L2 et L3 ont commencé à se développer récemment. Le multilinguisme est aujourd'hui une préoccupation de nombreux chercheurs, car de plus en plus de personnes deviennent multilingues à notre époque de grande activité migratoire. Selon la théorie des multi-compétences, un écrivain multicompétent peut être décrit comme un écrivain dont les diverses compétences liées au langage et à l'écriture interagissent les unes avec les autres (Kobayashi & Rinnert, 2013; Rinnert & Kobayashi, 2016; Rinnert, Kobayashi & Katayama, 2015). Dans une étude de cas, Kobayashi & Rinnert (2013) ont examiné le développement longitudinal d'un écrivain multilingue en trois langues : L1 (japonais), L2 (anglais) et L3 (chinois), pendant deux ans et demi. Des similitudes et des différences ont été observées entre l'écriture en trois langues, avec une relation entre la maîtrise de la langue et la maîtrise de l'écriture. Cependant, les frontières entre les aspects textuels et linguistiques dans trois langues sont imprécises et se chevauchent (Kobayashi & Rinnert, 2013, p.6).

***Enregistrements des frappes dans la recherche d'écriture L2***

Les études susmentionnées sur le processus d'écriture en L2 ont généralement utilisé des protocoles de réflexion à voix haute ; seules quelques études ont utilisé l'enregistrement des frappes comme méthode en temps réel pour étudier les activités cognitives en écriture L2. Dans une première étude, Thorson (2000) a comparé les processus d'écriture en L1 (anglais) et L2 (allemand) de 18 étudiants universitaires américains à deux niveaux de cours (avancé ou intermédiaire) tout en effectuant deux tâches (écrire une lettre ou un article) dans les deux

langues en utilisant *Trace-It* et *J-Edit* comme programmes d'enregistrement des frappes. Il a été constaté que les élèves de L2 révisaient davantage en L2. Une analyse plus approfondie de deux étudiants a montré que les étudiants semblent transférer leurs stratégies d'écriture de L1 en L2 et qu'ils utilisent différentes stratégies lors de la rédaction des textes. Stevenson, Schoonen et De Glopper (2006) ont utilisé la réflexion à haute voix ainsi que les enregistrements de frappe pour analyser deux textes argumentatifs en L1 (néerlandais) et L2 (anglais) par 22 élèves de 4ème du secondaire. Les résultats ont montré que les rédacteurs révisent plus en L2 qu'en L1. De plus, les révisions des rédacteurs de L2 étaient davantage liées aux révisions linguistiques liées à l'orthographe, au vocabulaire et à la grammaire. Dans une autre étude, Spelman Miller, Lindgren et Sullivan (2008) ont utilisé des enregistrements de frappe pour examiner l'effet de l'expérience de l'écriture sur les processus de rédaction de 14 jeunes écrivains suédois en L2 (anglais). Ils se sont concentrés sur les hésitations, la fluidité et les révisions en tant que données d'enregistrement des touches et la qualité du texte. Ils ont constaté qu'à mesure que l'expérience des élèves en écriture augmentait, le nombre des hésitations  et le temps consacré aux tâches diminuaient. Dans une étude plus récente, Van Waes et Leijten (2015) ont comparé la maîtrise de l'écriture de 68 étudiants universitaires en L1 (néerlandais) et L2 (anglais) en utilisant *Inputlog* comme programme d'enregistrement des touches tapées au clavier. L'objectif principal de Van Waes et Leijten était de définir les mesures de fluidité dans la recherche sur les processus d'écriture. Ils ont proposé un nouveau modèle multidimensionnel pour mesurer la fluidité pendant le processus d'écriture, qui se concentre sur quatre dimensions des caractéristiques liées au processus: la production, la variance du processus, la révision et le comportement de pause.

J'ai réalisé une étude pilote[20], avec *Inputlog 4.0*, dont le but était de déterminer s'il existe des différences entre les processus de rédaction en L1 et L2 de lycéens turcs qui apprennent l'anglais langue étrangère, et si le niveau de la connaissance de l'anglais affecte leurs processus de rédaction en L2. Les participants étaient huit lycéens turcs en Turquie (six femmes et deux hommes) âgés de 16 à 18 ans, à deux niveaux de compétence différents en anglais : compétence de haut niveau (n = 4), et compétence de bas niveau (n = 4). Trois types de données ont été collectés : les enregistrements de frappe, les protocoles verbaux et les réponses aux questionnaires post-écriture. Nous avons constaté qu'il existe des différences

[20] L'étude pilote a été publiée sous forme de chapitre de livre:Tiryakioglu, G., Peters, E., & Verschaffel, L. (2019). The effect of L2 proficiency level on composing processes of ALE learners: Data from keystroke loggings, think alouds and questionnaires. In E. Lindgren & K.P.H. Sullivan (Eds.). *Observing writing: Insights from keystroke logging and handwriting* (pp. 212–235). Leiden, the Netherlands: Brill.

significatives entre les processus de rédaction en L1 et L2 de ces deux petits groupes de lycéens. Les apprenants composent un texte en L2 moins couramment qu'un texte en L1. C'est-à-dire qu'ils produisent moins de mots par minute (Breuer, 2019; Chenoweth & Hayes, 2001; Lindgren, Sullivan, & Spelman Miller, 2008; Sasaki & Hirose, 1996; Schoonen et al., 2009; Silva, 1993; Van Waes & Leijten, 2015). Les apprenants s'arrêtent plus fréquemment en écriture L2, pour évaluer les idées proposées, les traduire en unités linguistiques et transcrire les mots dans le texte écrit. Leurs révisions (suppressions et insertions) ont lieu plus souvent en L2 qu'en L1 (Stevenson, Schoonen & De Glopper, 2006; Thorson, 2000). Nous avons également constaté qu'il existe des différences importantes dans les mesures de processus entre les rédacteurs à compétence élevée et faible en L2 en écriture en L2. Les lycéens à faible niveau de L2 ont consacré plus de temps à la rédaction du texte de L2 que les lycéens de niveau élevé. Les protocoles verbaux des élèves à haut niveau en L2 ont montré qu'ils étaient plus préoccupés par les problèmes pragmatiques liés à l'expression du sens, tandis que les élèves à faible niveau en L2 étaient plus préoccupés par les opérations linguistiques en L2. Les résultats du questionnaire post-écriture ont montré qu'en L2, les élèves étaient confrontés à des difficultés liées au vocabulaire, à l'orthographe des mots et à la précision grammaticale des phrases produites.

***Notre modèle d'écriture multilingue***

Sur la base de notre revue de la littérature sur l'écriture en L1 et en L2, ainsi que de notre étude pilote, nous avons tenté de développer un modèle d'écriture qui pourrait décrire le processus d'écriture dans une écriture multilingue. Nous l'avons adapté du schéma de production orale de Hilton (2008, p. 77) qui décrit le processus de production du langage oral basé sur les modèles de Levelt (1999) et Kormos (2006). Nous nous sommes inspirés du modèle de production orale de Levelt car il a déjà été utilisé dans la description de la production orale en L2. Notre modèle d'écriture multilingue met en évidence la manière dont les différents composants interagissent les uns avec les autres pendant la production d'un texte. Dans ce modèle, lorsque l'écrivain se voit confier une tâche d'écriture en L2 / L3, il utilise ses connaissances sociales / pragmatiques existantes pour décider des dimensions pragmatiques du texte qu'il va écrire. Une fois que l'écrivain a formulé un concept (ou un ensemble de concepts) à exprimer, un ensemble d'opérations linguistiques sont déclenchées dans la mémoire de travail : activation de mots, de connaissances grammaticales et orthographiques. Il existe deux chemins différents pour la génération d'un texte en L2 (L3, etc.): direct et indirect. La génération directe de texte se produit lorsque l'écrivain a les

connaissances linguistiques nécessaires en L2 pour organiser et encoder ses idées dans cette langue. La génération indirecte du texte est plus caractéristique de l'écriture lorsque les connaissances linguistiques de la L2 / L3 sont faibles: la nouvelle idée est d'abord générée dans la L1, puis l'écrivain cherche activement le mots et les formes grammaticales qui traduisent ces phrases en L2 / L3. Dans les deux cas, une interaction peut se produire entre les langues, souvent appelé « interférence linguistique » ou « transfert ». Les interactions entre les langues de l'écrivain dépendent de divers facteurs, aussi bien linguistiques que pragmatiques. Alors que la langue dominante ou L1 pourrait influencer et interférer avec la production de texte en L2, une autre langue moins dominante (L3) pourrait également déclencher des transferts linguistiques de diverses sortes. Il ressort clairement de nos résultats que les langues des élèves multilingues ne sont pas isolées les unes des autres. Ils interagissent lors de la production écrite, qui est un processus non linéaire, complexe et dynamique (Yang & Sun, 2015).

En résumé, bien qu'il existe des recherches sur la comparaison des processus d'écriture en L1 et L2 via des enregistrements de touches, il y a peu de recherches sur les comparaisons multilingues, à l'exception de la recherche de Lindgren et ses collègues (2016) avec des bilingues de 14 à 15 ans en L1, L2 et en L3. Ils ont constaté que les apprenants multilingues appliquent un processus de création de sens similaire et utilisent des dispositifs pragmatiques lorsqu'ils écrivent dans plusieurs langues (Lindgren, 2008). Des recherches supplémentaires peuvent nous aider à comprendre les similarités et les différences entre l'écriture dans les langues différentes.

## 2. But de la recherche et des questions

Dans une tentative de faire progresser la recherche sur les processus d'écriture en L2 et L3, ce projet de doctorat tente de fournir des informations supplémentaires sur le rôle joué par les connaissances linguistiques et les compétences en dactylographie dans les processus de rédaction L1, L2 et L3 et la qualité du texte. La question de recherche plus générale est; Y a-t-il des différences dans la production de texte (processus de rédaction et qualité du texte) entre les tâches (écriture descriptive et narrative) et les langues (français, turc et anglais)?

Les questions générales de recherche peuvent être formulées ci-dessous;

1. Existe-t-il des différences entre les processus de rédaction (mesurés par la fluidité d'écriture, les hésitations et les révisions) en L1 / français dominant et L2 / L3 anglais?

2. Existe-t-il des différences entre l'écriture descriptive et narrative en L1 et L2?

3. Y a-t-il des différences entre les scores de qualité du texte en L1 / français dominant et L2 / L3 anglais?

4. Y a-t-il des différences dans les compétences en dactylographie de ces collégiens français dans leur L1 / français dominant et L2 / L3 anglais?

5. Quelle relation peut-on trouver entre les caractéristiques de l'apprenant, les processus de rédaction et la qualité du texte en L1 / français dominant et L2 / L3 anglais?

Nous avons cherché à répondre à ces questions de recherche générales dans trois études, organisées autour des caractéristiques linguistiques de nos participants. L'étude 1 examine les relations entre certaines caractéristiques de l'apprenant d'ALE (compétence de dactylographie et connaissances linguistiques), les processus d'écriture (maîtrise de l'écriture, les hésitations et révisions) et la qualité du texte (scores globaux du texte) dans la première langue (L1 / français dominant) et une langue étrangère (L2/ L3 Anglais) dans les travaux d'écriture réalisés par des adolescents de collège français. L'étude 2 examine ces relations dans l'écriture multilingue (L1-turc, L2-français et L3-anglais) par des collégiens bilingues turc-français. L'étude 3 compare ces écrivains de collège français monolingues et bilingues en L1 / langue dominante de l'école (français) et étrangers L2 / L3 (anglais). Nous examinerons différents facteurs susceptibles d'influencer les processus d'écriture et la qualité du texte.

## 3. Méthodologie

***Les participants***

Les participants à notre première étude (étude 1) étaient 30 collégiens de 3ème (âgés de 14 à 15 ans) qui apprennent l'anglais comme langue étrangère en France. Dans ce pool total d'élèves(n = 30), nous avons identifié trois sous-groupes : 13 apprenants français monolingues ayant l'anglais comme une première langue étrangère (L2), 15 apprenants bilingues turc-français ayant l'anglais comme une première langue étrangère (L3), et deux autres apprenants bilingues (arabe-français), également apprenant l'anglais au collège. Le profil linguistique des 15 élèves bilingues turc-français est le suivant: leur L1 est le turc (utilisé à la maison, principalement oralement), leur deuxième langue est le français (et probablement leur langue dominante, puisqu'ils ont appris à le lire et à l'écrire, et l'utilisent toute la journée à l'école, avec leurs enseignants et leurs amis). Leur L3 est l'anglais comme langue étrangère enseignée à l'école.

***Les instruments***

Les enregistrements de frappe et les mouvements de souris des collégiens ont été enregistrés à l'aide d'*Inputlog* 7.1, le logiciel de recherche développé par Leijten et Van Waes (2006) à l'Université d'Anvers / Belgique (Leijten & Van Waes, 2006; 2013). Nous voulions utiliser trois tâches de copie différentes dans *Inputlog* afin de mesurer la vitesse de frappe dans les trois langues du projet. Des tâches de copie en français et en anglais étaient disponibles, mais la tâche de copie en turc ne l'était pas au début de la collecte des données. Par conséquent, j'ai contribué au développement de la version turque de la tâche de copie, qui est maintenant disponible pour d'autres chercheurs.

Une série de questionnaires pré- et post-écriture ont été utilisés pour obtenir des informations relatives aux profils linguistiques de nos élèves, à leur pratique générale de l'écriture, à leur motivation pour l'apprentissage des langues du projet, et à leurs réactions par rapport aux tâches qu'ils ont réalisées pour nous. Tous les questionnaires ont été rédigés en français afin que tous puissent comprendre et répondre aux questions. Les informations relatives aux langues parlées à la maison ont été obtenues grâce au questionnaire sur le profil linguistique. Il a été adapté du projet Seine & Marne Primaire (Hilton et al., 2016), et se compose de dix questions à remplir par les parents des apprenants. Le Questionnaire sur le profil d'écriture des élèves a été adapté de Bosredon (2014) et du projet de Hilton, Seine & Marne Primaire (Hilton et al., 2016), pour obtenir des informations relatives aux attitudes et comportements des élèves 'liés à l'écriture en français uniquement. Le questionnaire se compose de neuf questions pourtant sur leurs habitudes d'écriture, les types de textes écrits, leurs outils préférés. Le questionnaire sur la motivation des étudiants pour l'anglais a été adapté du projet VILLA (Rast et al., 2014; adapté de Gardner, 1982) et utilisé pour refléter la motivation des étudiants à apprendre l'anglais comme langue étrangère. Le questionnaire sur la motivation des étudiants pour le turc est essentiellement le même instrument, adapté pour le turc comme langue d'origine. Il a été utilisé pour sonder la motivation des étudiants bilingues à en savoir plus sur leur langue d'origine, le turc. Le Questionnaire Post-écriture se compose de neuf questions liées aux perceptions de nos élèves tout de suite après la tâche d'écriture narrative en français, anglais et turc.Le rappel stimulé est une analyse rétrospective à haute voix. Après la tâche de production écrite, nous avons regardé le fichier *Inputlog* individuellement avec un petit sous-groupe d'élèves, leur demandant de tenter d'exprimer ce qu'ils pensaient pendant les hésitations et les révisions enregistrées (Barkaoui, 2015; Lindgren, 2004; Révész et al., 2019; Sasaki, 2000; 2002). Sept étudiants se sont portés volontaires pour participer à ces

entretiens individuels. Nous avons posé à chacun(e) des questions pour les aider à se souvenir de ce qu'ils ont fait et pensé pendant les pauses longues et les révisions (DeSilva & Graham, 2015; Sasaki, 2000; 2002). La fonction *Replay* dans *Inputlog* permet de voir les frappes se dérouler exactement comme lors de la saisie initiale. À chaque pause de plus de 2000 ms, nous avons arrêté le fichier et leur avons demandé pourquoi ils hésitaient à ce stade. Nous avons enregistré les entretiens pour l'analyse structurée de ces protocols.

***Procédure de collecte des données***

La collecte des données a été réalisée dans deux collèges de Mâcon (France) entre novembre 2016 et mars 2017. Suite à la candidature d'élèves volontaires au projet (en novembre 2016), avec l'aide du directeur de leur école et de l'enseignant principal des classes contactées, nous avons pu distribuer et recueillir un formulaire d'autorisation parentale. *Inputlog* et les logiciels nécessaires à la réalisation des tâches écrites ont été installés sur les ordinateurs des laboratoires des deux écoles par les techniciens des écoles.

Nous avons organisé une session pour chaque langue dans les laboratoires de nos deux collèges. La première session se déroulait en langue française, pour les textes en L1/ langue dominante français. Les participants ont d'abord reçu des instructions sur la façon d'effectuer les tâches et sur la façon d'utiliser *Inputlog*, car il s'agissait d'un nouveau logiciel pour eux. Ensuite, les élèves ont rempli (stylo et papier) le Questionnaire sur leur profil d'écriture ; cela a pris environ 5 minutes. Ils ont ensuite effectué la tâche de copie en français dans *Inputlog* (7-8 minutes, sur ordinateur). Après cela, tuojours dans *Inputlog*, ils ont effectué la tâche descriptive en français (4 minutes) suivie de la tâche narrative en français (8 minutes). Pour la tâche descriptive, les élèves ont décrit une image statique (photo couleur). Dans la tâche narrative, ils ont raconté l'histoire illustrée par une série de dessins, adopté de ENNI (*The Edmonton Narrative Norms Instrument*, développé par Schneider et ses collègues en 2003). Après avoir terminé ces tâches de production écrite en langue L1 / langue d'école, ils ont rempli le Questionnaire post-écriture (5 minutes, stylo et papier) conçu pour recueillir leurs réactions à la tâche narrative. Une session de rappel stimulé en entretien individuel a suivi la tâche narrative avec les élèves du sous-groupe, pour une durée d'environ 10 minutes par élève. Les sessions en turc et en anglais suivaient la même structure que cette première session en français, avec, pour chaque langue, un questionnaire de motivation à la place du questionnaire sur le profil d'écriture.

Pour chaque langue, donc, la collecte de données a pris une heure de classe (50 minutes + 10 minutes pour chaque entretien de rappel stimulé) par langue, pour un total de deux leçons consacrées au processus pour le sous-groupe monolingue, et trois leçons pour les élèves bilingues turc-français. Les enseignants d'anglais, de français et de turc ont accueilli le projet avec un certain enthousiasme, très intéressés de connaître nos résultats, et de découvrir le logiciel *Inputlog*.

***L'analyse des données***

Avant d'effectuer des analyses sur les données brutes enregistrées par *Inputlog*, nous les avons mise en forme à l'aide de divers filtres dans le module *Pré-Procès* d'Inputlog : un filtrage temporel servant à supprimer les longues pauses inutiles au début et à la fin des tâches. Ensuite, nous avons effectué une analyse générale, une analyse récapitulative, une analyse des pauses, une analyse des révisions, et une analyse de la tâche de copie, toutes déjà programmées dans *Inputlog*. Le logiciel génère automatiquement les variables de sortie basées sur le fichier nettoyé .idfx (voir Leijten & Van Waes, 2006; Van Waes & Leijten, 2015 pour plus d'informations). Pour nos analyses, nous avons choisi les mesures de fluidité suivantes, calculées automatiquement dans *Inputlog* : caractères par minute, mots par minute, durée des « rafales » entre deux pauses. La fonction « analyse des pauses » fournit les variables de pause suivantes sont : le temps de pause, le nombre de pauses, ainsi que l'emplacement de chaque pause (à l'intérieur ou entre les mots).

Nous avons également extrait le « temps total de rédaction », le « nombre total de mots » dans le document principal, et « le nombre de mots par minute », ainsi que le « nombre de caractères par minute » (voir Leijten & Van Waes, 2006; Van Waes & Leijten, 2015 pour des informations plus détaillées). Pour les révisions, nous avons choisi d'analyser : le nombre de révisions, la longueur moyenne du texte produit entre deux révisions. Le « rapport produit / processus » mesure le « nombre total de caractères dans le texte final, divisé par le nombre total de caractères produits pendant le processus d'écriture » (Leijten & Van Waes, 2013, p. 364). Nous avons effectué une analyse des tâches de copie sur *Inputlog* donnant des résultats automatiquement liés aux mesures de vitesse de frappe : la vitesse et la précision de la saisie de bigrammes à haute et basse fréquence dans des tâches de formation de mots et de phrases.

Les réponses des élèves aux protocoles de rappel stimulé obtenus auprès de sept sujets volontaires (16 protocoles d'entretien au total, car chaque élève a commenté sa production en deux ou trois langues) ont été transcrites (sur ordinateur) et segmentées, selon des thèmes

mentionnés par les élèves. Un schéma de codage comportant cinq catégories a été développé à partir des raisons évoquées par les apprenants (pour expliquer leurs hésitations et leurs révisions) : le vocabulaire, l'orthographe, la grammaire, des éléments pragmatiques (liés à l'organisation du discours, la prise en compte du lecteur), et des raisons codées « référentiels » (liées aux rapports entre les images et le texte, ou à leur interprétation de la tâche).

Des mesures du niveau de compétence générale de nos participants dans la langue de rédaction - L1, L2 et L3 - ont été obtenues, en utilisant leur moyenne scolaire au premier trimestre pour les cours de français, d'anglais et de turc. Ces notes trimestrielles sont basées sur des contrôles, des devoirs, la participation en classe, des examens écrits et oraux. Le nombre de notes contribuant à cette moyenne peut différer d'une langue à l'autre.

Afin de comparer la qualité des textes produits par nos élèves en L1, L2 et L3, nous avons utilisé le *Profil de composition ESL* de Jacobs et al. (1981), car il s'agit de l'une des instruments d'évaluation des textes les plus utilisées en L2. Nous avons adapté l'échelle de critères en 4 points de Jacobs et ses collègues (1981) et Uzawa (1996) ; elle fut tuilisée pour évaluer les textes des élèves en deux étapes, une évaluation holistique, suivi d'une évaluation plus analytique. L'échelle « holistique » est conçue pour refléter la qualité globale d'un texte : haute (4 points), moyenne-haute (3 points), moyenne-basse (2 points) et basse (1 point). L'évaluateur doit d'abord trier tous les textes d'un même groupe, dans ces quatre catégories. Ensuite, pour chaque texte, l'évaluateur effectue une analyse de trois critères d'écriture plus spécifiques : le contenu, l'organisation des idées et l'utilisation de la langue (« grammaire, vocabulaire et orthographe », pris ensemble). Pour déterminer la qualité des textes produits par nos élèves, nous avons recruté deux juges français, deux juges anglais et deux juges turcs. La fiabilité s'est avérée plus élevée pour les évaluations en anglais que pour les évaluations en français et en turc. Toutes les données ont été importées dans SPSS pour des analyses statistiques, dont les résultats seront présentés ci-dessous.

## 4. Résultats et discussion

### Etude 1

Cette étude présente les résultats des données collectées auprès de nos 30 collégiens français pour comparer leurs processus d'écriture en L1 et L2 et L3. Dans la première étude, nous analyserons les données des participants bilingues et monolingues ensemble, en opposant

l'écriture en français (première ou langue seconde dominante de chaque enfant) et l'écriture en anglais comme langue étrangère (L2 ou L3). Nous avons utilisé le test non paramétrique de Wilcoxon, et les tests du khi carré pour effectuer ces comparaisons, car notre échantillon est trop petit (n = 30) pour effectuer des ANOVA et parce qu'une grande partie des données n'est pas normalement distribuée.Nous avons également examiné les taux de pause et de révision. Nous avons considéré la production de pauses et de révisions pour chaque apprenant par 100 mots produits.

***Effets de tâche***

Nous avons trouvé les différences suivantes entre les tâches descriptives et narratives en français pour nos mesures automatiques dans *Inputlog* : le temps passé à écrire, le nombre total de mots, la fluidité d'écriture (caractères par minute, mots par minute, longueur des « rafales » de pause), les hésitations pendant l'écrite (temps total de pause, nombre de pauses, emplacement des pauses) et le nombre de révisions. Les autres mesures (longueur du texte entre révisions, et du rapport produit / processus) étaient statistiquement équivalentes pour ces deux tâches en français.

Nous avons trouvé les différences suivantes entre les tâches descriptives et narratives dans l'écriture en anglais L2 / L3: le temps passé à écrire, le nombre total de mots (longueur des textes), une partie des mesures d'hésitation (le nombre total de pauses et le nombre de pauses à l'intérieur d'un mot). Toutes les autres mesures étaient statistiquement équivalentes ou marginales pour ces deux tâches en anglais; les mesures donnant des différences marginales étaient le temps de pause en minutes, le nombre de pauses entre les mots et le nombre de révisions.

***Effets de langage: comparaison des processus de rédaction français et anglais L2 / L3***

Nous avons trouvé des différences entre la vitesse de frappe, les processus de rédaction en français et en anglais L2 / L3, à l'exception du nombre de pauses et du rapport produit / processus. Nos résultats corroborent les conclusions précédentes selon lesquelles les auteurs de L2 / L3 composent moins aisément un en L2 / L3 qu'en L1 (Breuer, 2019; Chenoweth & Hayes, 2001; Knospe et al., 2019; Lindgren et al., 2008; Ong & Zhang, 2010 ; Sasaki & Hirose, 1996; Silva, 1993; Tiryakioglu et al., 2019; Van Waes & Leijten, 2015). C'est-à-dire qu'ils produisent moins de mots par minute (Chenoweth & Hayes, 2001; Sasaki & Hirose, 1996; Silva, 1993; Tiryakioglu et al., 2019); ils s'arrêtent également plus fréquemment en écriture L2 / L3. (Breuer, 2014; 2019; Chenoweth & Hayes, 2001; McCutchen, 1986; Sasaki

& Hirose, 1996; Spelman Miller 2000; Tiryakioglu et al., 2019). Les taux de pause montrent que nos apprenants ont fait une pause pendant l'écriture en français avec une moyenne de 23% comparé à un taux de pause moyen de 49% en écriture en anglais L2 / L3 lorsque les deux tâches sont combinées. On a émis l'hypothèse que plus de temps était consacré à l'évaluation des idées, et notamment à leur « traduction » (ou encodage) en unités linguistiques (Breuer, 2019; Chenoweth & Hayes, 2001; McCutchen, 1986; Sasaki & Hirose, 1996; Spelman Miller, 2000; Tiryakioglu et al., 2019 ).

Les rafales de texte entre deux pauses sont une indication importante de la fluidité d'écriture. Elles reflètent la productivité de la production de texte entre deux longues pauses (Chenoweth & Hayes, 2001). L'écriture en L1 est caractérisée par des rafale de texte plus longs entre pauses, et des rafales de pause plus courts en L2 / L3. Cela pourrait indiquer que nos apprenants ALE n'ont pas développé et automatisé leur production de texte L2 / L3 autant qu'en langue L1 / dominante (Chenoweth & Hayes, 2001; Leijten, Van Horenbeeck & Van Waes, 2019).

Nous avons constaté que nos apprenants révisaient leurs textes plus en écriture L2 / L3 qu'en L1 / écriture française dominante (Chenoweth & Hayes, 2001; Lindgren et al., 2019; Silva, 1993; Stevenson et al., 2006; Tiryakioglu et al., 2019; Thorson, 2000) lorsque l'on considère les taux de révision, ce qui est conforme aux précédents résultats de recherche de Thorson (2000) qui ont trouvé des différences significatives entre les processus de révision en écriture L1 (anglais) et L2 (allemand). Les taux de révision montrent que nos apprenants ont révisé leurs textes en français avec une moyenne de 59% de révisions par rapport à une moyenne de 76% de taux de révision en langue anglaise L2 / L3. Nos résultats confirment que les révisions de nos apprenants sont au niveau des mots en écriture L2 / L3 puisque leur connaissance du vocabulaire est moins développée en L2 / L3. Ceci s'explique par le plus grand effort cognitif et linguistique nécessaire pour encoder des idées dans une langue moins connue (Sasaki, 2000; Schoonen et al., 2003, 2011; Silva, 1993).

Nous avons également constaté que les comportements dactylographiques en L1 / français dominant et L2 / L3 anglais sont différents pour nos sujets. Il est intéressant de noter que nous avons observé plus de variance dans la vitesse de frappe en français qu'en L2 / L3 anglais, pour toutes les variables de vitesse de frappe, ce qui est un résultat important.

Bien que nous n'ayons pas trouvé de différences entre la qualité du texte L1 / français dominant et L2 / L3 anglais, nous avons trouvé des corrélations entre la qualité des textes

français et anglais. Nous avons trouvé des corrélations positives élevées entre la vitesse de frappe, les mesures temporelles de la fluidité d'écriture (caractères par minute, mots par minute et rafales de pause) et la qualité du texte dans les deux langues (L1 et L2 / L3). Ce résultat confirme que la maîtrise dactyographique peut être un facteur prédictif important de la qualité de l'écriture pour les élèves non seulement en L1 / français dominant, mais aussi en L2 / L3 anglais (Ransdell & Levy, 1996; Thorson, 2000; Xu & Ding, 2014).

Une autre conclusion importante de notre recherche est que nous avons trouvé une corrélation positive élevée entre les moyennes du premier trimestre, la maîtrise de l'écriture et les scores de qualité du texte à la fois en français et en anglais L2 / L3. Ce résultat illustre le lien entre la maîtrise générale de la langue, et la fluidité avec laquelle l'écrivain produit son texte ainsi que de la qualité textuelle, confirmant la conclusion de Chenoweth et Hayes (2001) selon laquelle le processus de formulation est plus efficace avec une meilleure expression du sens lorsqu'un apprenant maîtrise mieux la langue de production. Comme les écrivains ont les connaissances linguistiques nécessaires pour la langue de production, ils peuvent focaliser leur attention sur les aspects sémantiques et organisationnels du processus que ce soit en L1 (Van den Bergh & Rijlaarsdam, 1999), ou en L2 / L3 (Roca de Larios et al., 2006).

**Etude 2**

Cette étude explore les différences dans les processus d'écriture et la qualité du texte des 15 élèves bilingues turc-français de 3e année (de 14 à 15 ans) lors de l'écriture dans leur langue dominante à l'école (français), leur langue d'origine (turc) et leur troisième langue (anglais comme langue étrangère). Dans cette étude, nous avons effectué des tests paramétriques et non paramétriques. Nous avons utilisé l'analyse de modèle linéaire général (mesures répétées intra-sujets) pour examiner la tâche, la alangue et les effets d'interaction entre la tâche et la langue. De plus, nous avons effectué khi² pour examiner les proportions d'hésitations à différents emplacements (à l'intérieur ou entre les mots) et des tests de corrélation de Spearman pour examiner la relation entre les mesures générées par *inputlog*.

Nos résultats suggèrent que les processus d'écriture présentent des similarités ainsi que des différences entre les trois langues en fonction de la langue concernée. Nous avons constaté qu'il existe des différences entre l'écriture en L1 et L2 (Breuer, 2019; Chenoweth & Hayes, 2001; Ransdell & Levy, 1996; Tiryakioglu et al., 2019), en L1 et L3, ainsi qu'ntre la langue seconde et la langue étrangère L2 et L3 pour ces élèves bilingues. Nous avons trouvé plus de différences dans les processus d'écriture des apprenants bilingues entre leurs trois langues de

production – avec des valeurs semblables pour le turc (langue d'origine) et l'anglais. Par exemple, nos apprenants bilingues écrivaient plus couramment avec moins de pauses et de taux de révision dans leur langue dominante, le français, que leur langue d'origine, le turc ou l'anglais comme langue étrangère. Ce résultat confirme que l'automatisation des compétences linguistiques facilite la production de texte dans cette langue (Lindgren, 2004; McCutchen, 2000; Schoonen et al., 2003; Van Gelderen et al., 2011).

L'écriture de nos élèves dans leur langue d'origine (turc) est moins développée que leur langue dominante / scolaire (français), bien que le turc soit leur langue maternelle. Ils n'ont pas reçu autant d'instruction en turc qu'en français, seulement une heure par semaine depuis environ sept ans. Ce résultat est conforme à la théorie selon laquelle les systèmes multilingues qui sont influencés par l'enseignement et le contexte d'apprentissage peuvent varier (Yang & Sun, 2015).

Nous avons pu aussi mesurer la vitesse de frappe dans les trois langues de l'étude. La connaissance des bigrammes à haute fréquence dans une langue prédit la maîtrise de l'écriture dans cette langue en écriture multilingue, pour des langues (le turc) linguistiquement distante des deux autres (français-anglais). Les résultats montrent que nos étudiants multilingues tapent plus rapidement les bigrammes à haute fréquence en français et en anglais qu'en turc. Si l''apprenant connaît les bigrammes à haute fréquence dans une langue, plus il / elle est susceptible de taper les mêmes bigrammes dans une langue qui les partage.

Nous avons trouvé des corrélations significatives entre les mesures du processus d'écriture et la qualité du texte dans les trois langues. Cependant, les mesures corrélées varient en fonction de la langue : les mêmes mesures sont en corrélation avec la qualité des textes produits en turc et en anglais L3. Nous avons trouvé des corrélations significatives entre la vitesse de frappe, la fluidité d'écriture (caractères par minute, mots par minute et longueur des rafales entre pauses) et la qualité du texte dans les trois langues de l'étude. Plus l'écrivain bilingue tape vite sur l'ordinateur, plus il / elle produit un texte de meilleure qualité dans la langue concernée : « une compétence de frappe élevée permet l'activation simultanée des processus d'écriture, contrairement à une faible compétence d'écriture » (Alves, Castro & Olive, 2008, p.972). Nous avons également trouvé une corrélation positive élevée entre la longueur des rafales entre pauses, et la fluidité d'écriture (caractères par minute, mots par minute) dans les trois langues.

**Etude 3**

Dans notre troisième étude, nous examinons la relation entre les caractéristiques de l'apprenant (connaissances linguistiques, vitesse de frappe), les processus d'écriture (fluidité d'écriture, hésitations et révisions) et la qualité du texte en français monolingue (n = 13) et bilingue (n = 17) en L1 / français dominant et L2 / L3 anglais. Notre groupe d'apprenants bilingues se compose des 15 apprenants bilingues turco-français et de 2 autres apprenants bilingues (arabe-français). Nous avons effectué des testsde Mann-Whitney non paramétriques et des khi², car notre échantillon est petit et certaines données ne sont pas normalement distribuées. Nous avons également examiné les taux de pause et de révision par 100 mots produits.

Nos résultats montrent que les différences majeures dans la production de textes monolingues et bilingues concernent la productivité, l'emplacement des pauses et les révisions. Nous avons trouvé plus de différences entre les monolingues et les bilingues dans l'écriture anglaise L2 / L3 que dans l'écriture en français. Nos apprenants monolingues ont produit beaucoup plus de mots dans leur écriture en anglais. Cependant, nous n'avons pas trouvé de différences significatives dans la vitesse de frappe et la fluidité d'écriture (caractères par minute, mots par minute et longueur de rafales de pause) entre les monolingues et les bilingues en L1 français ou L2 / L3 anglais. Ainsi, les monolingues semblent prendre la tâche d'écriture en L2 « plus au sérieux » que les bilingues, ou ils avaient plus à dire, pour des raisons que nous n'avons pas encore explorées.

Notre sous-groupe bilingue a également produit (en français) proportionnellement plus de pauses à l'intérieur ou entre les mots que les écrivains monolingues. Le nombre plus élevé de pauses entre les mots par notre sous-groupe bilingue peut être une conséquence du fait que leur lexique en langue seconde (français) et de troisième langue est plus limité que leurs homologues monolingues, car ils divisent leur temps communicatif (à l'école, et en dehors) entre deux langues (Bartolotti & Marian, 2012). Cela explique aussi les moyennes scolaires plus élevées des monolingues au premier trimestre en français, qui confirme une compétence linguistique générale plus élevées chez les monolingues, comme l'ont également constaté des recherches antérieures (Schoonen et al., 2003). En ce qui concerne l'automatisation de la production du langage, Hilton (2011, p. 248) suggère que «[l']encodage lexical des informations conceptuelles est largement automatique en L1, et beaucoup plus souvent laborieux - un processus explicite - dans un langue moins connue ».

Cependant, notre sous-groupe monolingue a produit plus de pauses intralexicales dans l'écriture narrative en anglais que le sous-groupe bilingue. Ces pauses, ils sont peut-être engagés dans une réflexion concernant l'orthographe et / ou le codage morphosyntaxique. Linnemann (2019, p. 342) pense que « la correction de plus d'erreurs de frappe peut signifier moins de contrôle du processus. Un [...] contrôle au niveau des caractères arrêterait probablement le processus d'écriture ». Par exemple, les écrivains ayant des difficultés de lecture et d'écriture produisent plus de pauses intralexicales que le groupe témoin (Wengelin et al., 2019).

Nos résultats démontrent que la qualité des textes écrits par nos apprenants bilingues n'était pas différente de celle des monolingues en français L1 (pour les deux tâches), ni pour la tâche descriptive en anglais, alors qu'il y avait une différence dans la qualité des textes narratifs en anglais L2/L3. Le développement du contenu, l'organisation et l'utilisation de la langue de nos bilingues dans l'écriture narrative en anglais L2 / L3 se sont avérés de moins bonne qualité que dans les textes narratifs produits par nos monolingues. Leurs textes étaient jugés mieux organisés (en français et en anglais) que les textes des écrivains bilingues (comme chez Schoonen et coll. 2003). Il semble aussi que les évaluateurs d'anglais L2 / L3 ont attribué des notes plus élevées aux textes en L2 / L3, dans une démarache d'encouragement de la production écrite, ou une prise en compte du fait que les élèves écrivent en L2/L3.

**Résultats des questionnaires**

Nous avons divisé les étudiants en deux groupes en tant qu'écrivains moins et plus experts (n = 15 pour chaque groupe), sur la base des scores obtenus pour notre Questionnaire sur le profil d'écriture des élèves (adapté de Bosredon, 2014) : un sous-groupe d'écrivains experts (score de 13-23 sur le questionnaire), et d'écrivains moins experts (score de 4-12). En comparant ces deux sous-groupes pour les différentes tâches du projet, nous avons trouvé plusieurs différences significatives. Dans l'écriture descriptive française, les différences concernent le nombre total de mots produits, les caractères et mots par minute, le nombre de pauses entre les mots. Dans l'écriture narrative en français, nous avons trouvé des différences significatives pour les caractères et mots par minute, ainsi que pour la longueur des rafales entre pauses .Nos résultats montrent qu'il y avait des différences marginales dans les trois mesures de tâches de copie en français entre les rédacteurs experts et moins experts, mais pas dans aucune des mesures de tâches de copie en anglais.

Cependant, dans la rédaction de L2, les rédacteurs experts (en français, rappelons-le) ont passé beaucoup plus de temps dans la rédaction descriptive en anglais que les écrivains moins experts, ce qui suggère que les écrivains experts puisent dans un ensemble de techniques (pragmatiques, stylistiques) pour narrer ces événements. Les écrivains moins experts ont arrêté d'écrire avant l'expiration du délai imparti, ou tout simplement moins d'idées à exprimer.

Nous avons trouvé une corrélation positive entre la motivation pour l'apprentissage de l'anglais et les perceptions post-écriture de nos apprenants dans l'écriture narrative en anglais. La motivation pour l'anglais était également positivement corrélée avec les mesures de productivité dans *Inputlog*, mais pas avec la moyenne de premier trimestre en anglais. Ces corrélations renforcent l'idée (assez intuitive) les apprenants plus motivés pour la langue anglaise sont plus à l'aise en écrivant dans cette langue, sans doute ayant plus appris en classe grâce à leur motivation. La note moyenne de premier trimestre en anglais est également corrélée à la perception post-écriture de la tâche en anglais. De meilleures connaissances de la langue semblent avoir rendu la tâche plus facile – ou au moins donné une perception de plus grande facilité.

**Résultats des entretiens de rappel stimulé**

Sept étudiants volontaires de notre groupe de 30 apprenants ont constitué un nouveau sous-groupe (*a focus group*) pour notre récolte des données rétrospectives individuelles, l'entretien ayant lieu pendant que chaque élève du groupe regardaient son fichier *Inputlog* se dérouler, pour la tâche narrative en français, en anglais et – pour deux élvèes – en turc. Nous avons utilisé le protocole de rappel stimulé pour interroger les apprenants sur leur comportement pendant les pauses de longue durée (plus de 2000ms) et les évisions, pour tenter de sonder les causes de ces comportements.

Nous avons constaté que ce petit sous-ensemble d'apprenants était plus préoccupé par des éléments pragmatiques pendant la rédaction en français : l'amélioration du contenu et l'organisation du texte, suivies de l'orthographe et de la grammaire. Leurs commentaires en regardant le fichier *Inputlog* pour l'anglais et le turc mentionnent moins fréquemment ces préoccupations pragmatiques. Cependant, dans l'écriture en anglais et en turc, les élèves mentionnaient plus de problèmes liés à la langue (l'orthographe et le rappel des mots), ce qui est conforme aux recherches précédentes (Barkaoui, 2015; Révész et al., 2019; Stevenson et al., 2006).

Selon leurs commentaires, ce petit groupe d'élèves a rencontré les difficultés majeures suivantes lors de l'écriture en anglais : 1) orthographe, 2) pragmatique 3) précision grammaticale 4) difficultés liées au vocabulaire. Nos résultats sont conformes à ceux d'Akyel et Kamisli (1997) et d'autres chercheurs (par exemple Breuer, 2019; Cumming, 1989; Raimes, 1985; Schoonen et al., 2003; Tiryakioglu et al., 2019), qui ont trouvé que les rédacteurs de langue sont confrontés à des problèmes d'encodage grammatical et lexcial. Nos apprenants rapportent toutes sortes de préoccupations de ce genre lorsqu'ils regardent leurs processus d'écriture *a posteriori*.

Concernant l'écriture turque, les deux élèves bilingues particpant à notre protocole de rappel ont mentionné le plus souvent l'orthographe, le vocabulaire, et leur interprétation de la tâche (et des supports). Il n'est pas surprenant que l'orthographe soit le phénomène le plus fréquent dans l'écriture turque, car bien que le turc soit leur langue maternelle, et une langue orthographiquement transparente, nos élèves n'ont pas appris le turc écrit à la maison. Il semble donc logique qu'ils ne soient pas sûrs de l'orthographe ; ils sont aussi sans doute moins familiers avec l'agencement des touches pour taper en turc.

Nous avons également observé des différences entre les écrivains experts et moins experts écrivant en français, turc et anglais. Les écrivains experts ont écrit des textes en français et en anglais plus couramment que les écrivains moins experts avec moins de pauses et de révisions (ajouts et suppressions). Les écrivains moins experts, cependant, disent passer leur temps à rechercher des mots, l'orthographe correcte des mots et l'exactitude grammaticale de la phrase en anglais et en français. Les processus linguistiques pendant une longue pause, tels que la vérification de l'orthographe d'un mot, illustrent des difficultés d'encodage, qui peuvent freiner des opérations plus pragmatiques : « se concentrant sur les processus de niveau inférieur ont moins de capacité de mémoire de travail disponible pour suivre la construction du discours » (Hilton, 2011, p. 250).

Une constatation importante observée dans nos entretiens rétrospectifs est l'interférence d'une langue sur l'autre lors de l'encodage des idées, comme nous l'avons décrit dans notre modèle d'écriture multilingue. Une interaction se produit entre les langues de l'écrivain. Bien que la recherche suggère que les interférences proviennent la plupart du temps de la langue dominante de l'apprenant (par exemple Bialystok, 2009), nous avons constaté que les interférences peuvent avoir lieu dans diverses directions. Par exemple, nos entretiens

montrent qu'une L3 ou L4 (espagnol) récemment apprise peut interférer avec l'encodage lexical en anglais (ou en turc) pour l'un de nos apprenants.

## Conclusion générale

Premièrement, et surtout, il s'agit de la première étude qui examine les processus d'écriture des collégiens à la fois dans leur L1 / français dominant et L2 / L3 anglais, bien qu'il existe des études comparant les processus d'écriture en français L1 selon les groupes d'âge (par exemple Aillaud, 2016; Alamargot & Chanquoy, 2001; Olive et al., 2009), ou sur les processus d'écriture en L1 et L2 des étudiants universitaires français (Barbier, 1998). Deuxièmement, nos résultats contribuent à notre compréhension des processus de production de texte chez les écrivains monolingues et bilingues. Notre étude montre que les monolingues produisent des textes plus longs en français; cependant, les bilingues produisent des « rafales » de texte légèrement plus longs entre deux longues pauses en anglais. Les bilingues effectuent aussi moins de révisions que les monolingues lorsqu'ils écrivent en langue étrangère. Ce résultat pourrait aussi simplement signifier qu'ils écrivent moins soigneusement. D'autres auteurs ont suggéré que les mécanismes de contrôle des bilingues sont plus développés, puisqu'ils doivent contrôler constamment la commutation entre deux langues quand ils parlent et écrivent. Ce comportement de contrôle constant semble développer le fonctionnement exécutif des apprenants bilingues (Bartolotti & Marian, 2012).

Troisièmement, notre recherche est la première étude qui se concentre sur les processus d'écriture des apprenants trilingues âgés de 14 à 15 ans en trois langues à l'aide d'un logiciel d'enregistrement de frappe. Nous avons pu comparer la vitesse de frappe, la fluidité et les comportements liés aux pauses et révisions – en plus de la qualité du texte – dans trois langues. Nous avons constaté que l'écriture dans n'importe quelle langue était fortement influencée par les compétences linguistiques de l'écrivain dans cette langue. Plus la langue est développée, plus l'élève a produit le texte avec aisance (moins de temps de pause et moins de révisions) et de meilleure qualité.

Quatrièmement, l'une des contributions concrètes de nos recherches au domaine de la recherche en écriture est le développement d'une tâche de copie en turc. La tâche de copie dans *Inputlog* est un outil récemment développé pour mesurer les compétences de frappe spécifiques à la langue de rédaction. Il est disponible en huit langues. J'ai aidé à développer la version turque de la tâche de copie pour le but de cette étude et en tant qu'outil de recherche scientifique en accès libre. Cette étude est la première à utiliser trois versions de la tâche de

copie (français, turc et anglais) pour mesurer les compétences en dactylographie des élèves mono- et bilingues dans leurs langues différentes. Nous avons constaté que le comportement de frappe des rédacteurs est différent selon les langues. Les compétences en dactylographie dans une langue semblent être liées à la maîtrise de cette langue. Plus la langue de l'écrivain est développée, mieux il/elle tape dans cette langue. De plus, le fait de taper dans une langue semble être lié à l'aptitude à taper dans des langues orthographiquement similaires (comme le français et l'anglais), en raison de la connaissance des bigrammes à haute fréquence.

Étant donné que nos résultats montrent des relations entre les connaissances linguistiques et la fluidité et la qualité de la production de texte, nous pouvons réfléchir aux types d'activités d'enseignement et d'apprentissage qui pourraient améliorer la maîtrise de l'écriture dans la classe de langue étrangère (et peut-être même native). Il est important d'améliorer la connaissance de la langue, pour mieux rédiger. La maîtrise de la langue implique des encodages linguistiques automatiques ; la maîtrise de l'écriture en L2 s'améliorera certainement si les apprenants disposent d'un lexique volumineux et automatiquement disponible qu'ils peuvent utiliser pour encoder leurs idées. Les élèves doivent apprendre plus de mots et s'entraîner à les utiliser automatiquement pour contribuer à l'aisance de la production en L2 (Hilton, 2008; Van Gelderen et al., 2011). Ils peuvent apprendre à construire des phrases avec des formules dans leurs classes de langue (Hilton, 2008; Peters & Pauwels, 2015) :

> Les formules sont ces groupes de mots qui coexistent régulièrement dans une langue, allant d'expressions idiomatiques et de clichés, en passant par des collocations, à de simples séquences récurrentes, comme éteindre la lumière ou tomber? + nom. (Hilton, 2008, p.162)

Une meilleure connaissance linguistique est liée à une connaissance plus automatique de la langue - le seul moyen de « réduire le coût cognitif » de l'écriture. Plus les élèves accèdent facilement aux formes linguistiques, plus ils pourront écrire avec aisance.

L'enregistrement des touches tapées au clavier (*keystroke loggings*), peut être mobilisé de différentes façons dans l'enseignement de l'écriture : par l'enseignant (devant la classe), ou dans un travail entre pairs (Lindgren, 2004; Lindgren & Sullivan, 2003, 2006; Sullivan & Lindgren, 2002). Un enseignant présentant un fichier en playback peut l'arrêter, et donner des conseils sur la façon de développer les compétences en écriture en L1 ou L2/L3.

L'enseignement explicite et systématique de stratégies d'écriture – telles que la planification, la génération de phrases et la révision – peut aussi constituer de vraies séquences d'apprentissage de l'écriture. Ces stratégies aident à construire une connaissance du

« comment », et peuvent être liées à différents types de texte d'écriture (Harris & Graham, 1996). Pourtant, il faut souligner que les élèves semblent bénéficier différemment de l'enseignement explicite des stratégies d'écriture en L2, selon leur niveaux d'écriture ou de maîtrise de la langue (Tiryakioglu et al., 2014; Van Steendam et al., 2010). Les écrivains moins experts en L2 peuvent apprendre à mettre en œuvre des stratégies d'écriture (Sasaki, 2000) par le biais d'activités en binôme et en groupe, pour améliorer leur production écrite ; un environnement d'apprentissage favorable les aidera à passer d'un mode de « transmission des connaissances » au mode de « transformation des connaissances » utilisé par des rédacteurs experts (Bereiter & Scardamalia, 1987). À cet égard, pour les élèves de faible niveau de compétence, les stratégies de construction de phrases et de combinaison des mots, les stratégies d'utilisation du vocabulaire devraient être enseignées (en plus des stratégies plus rédactionnelles) pour les sensibiliser à l'importance de l'encodage linguistique efficace, non seulement en langue étrangère, mais également dans l'écriture en L1 (Tiryakioglu et al., 2014).

L'expérience limitée de nos étudiants bilingues turco-français en matière d'écriture en turc suggère que le programme de langue d'origine devrait inclure un travail ciblé sur la production écrite. Bien que les locuteurs d'une langue d'origine aient développé des compétences orales poussées, ils ont besoin d'un travail systématique sur leurs compétences écrites dans cette langue : l'orthographe lexicale, la syntaxe, les structures discursives, etc. (Akinci, 2010; Tiryakioglu, 2008; 2011; Tiryakioglu & Hilton, 2019). Nous suggérons donc que davantage d'actions didactiques soient menées au niveau « macro » en France et dans les écoles européennes. L'apprentissage systématique des langues du patrimoine - y compris leurs composantes écrites - devrait être ciblé dans les pays européens.

Dans le cadre de recherches supplémentaires, nous prévoyons d'étendre nos recherches en première, deuxième et troisième langues, avec des groupes d'âge appariés pour obtenir de plus amples informations sur la production écrite multilingue. Nous aimerions collecter des données auprès d'adolescents turcs de langue maternelle en Turquie qui apprennent le français comme langue scolaire et l'anglais comme langue étrangère pour déterminer s'il existe des différences dans les processus d'écriture en L1 turc, L2 français et L3 anglais.

Les données obtenues dans cette étude avec une approche à méthodes mixtes illustrent les processus dynamiques impliqués dans l'écriture multilingue. Nous espérons que notre recherche fournira des informations aux éducateurs, aux développeurs de programmes et aux

enseignants, et que l'enregistrement des frappes sera considéré parmi les méthodes pédagogiques que les enseignants peuvent utiliser pour développer des techniques d'écriture efficaces en français, turc et anglais ainsi que dans d'autres langues.