

Vexique: Vocabulary Enhancement Software for French Immersion Students

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Abstract

This dissertation developed and tested online writing analytics software, Vexique, designed to improve French immersion (FI) high school students' lexical richness by promoting use of alternative vocabulary in phrasing an essay. Vexique's features were grounded in the Hulstijn and Laufer (2001) Involvement Load Hypothesis for second language (L2) vocabulary acquisition, whereby giving more attention to processing lexical information encourages vocabulary acquisition and retention in L2. Forty-five Grade 12 FI students participated. Students wrote two argumentative essays. Vexique provided quantified feedback of vocabulary and usage on the first essay that afforded making lexical improvements prior to submission. To test effects of the software's analytics, students wrote a second essay without feedback. Lexical richness increased after learners received prompts about their first essay. Results showed statistically detectable benefits to lexical richness indicated by lexical density and diversity. Results also indicated no statistically detectable difference in repetitive content words in the second essay.

Keywords: French Immersion; involvement load hypothesis; language learning; second language; vocabulary acquisition; writing analytics

Dedication

I dedicate this work to my family.

Mom and Dad, you taught me to be ambitious and pursue my path without limitation. You supported me through this journey with love, optimism, and encouragement so that I could see my dream to fruition. This work is a testament to the possibilities created by your unwavering belief in me. You inspire me every day to appreciate and thrive in the beautiful life you gave me.

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List of Acronyms

EFI	Early French Immersion
FI	French Immersion program
FSL	French Second Language program
L1	First language
L2	Second language
LA	Learning Analytics
LFI	Late French Immersion
SFU	Simon Fraser University
SLA	Second Language Acquisition
SLL	Second Language Learning

Glossary

New word	In the current work, a <i>new word</i> refers to a vocabulary term that is unrelated to another term.
Synonym	In this work, <i>synonym</i> refers to a vocabulary term used to replace a related term. It can be new to the L2 learner.

C'est un monde moderne. Chaque jour, il y a de nouveaux avancements technologiques dans la société. Les cultures autour du monde

son et
leur ait
que À



cause de cela, les cultures à travers du monde perdent leurs particularités. Notre monde est plein de cultures, personnes, et façons de vivre.

La colonisation du monde a commencé il y a 1000 ans environ avec certaines parties du monde. Les empires sont encore partout dans le monde. C'est un monde moderne. De plus, il

Chapter 1.

Introduction

The fields of learning analytics and writing analytics offer promise to second language learning by gathering linguistic data produced by second language learners and applying findings generated using these data to enhance language processes and skills. There are different online software tools that claim to help second language learners with grammar, spelling, pronunciation and reading, etc. Few of these systems target senior French Immersion secondary students specifically, a unique group of learners at an upper intermediate language level who ought to have proficiency at level B2 on the Common European Framework of Reference for Language. Nor have prior systems been developed to engage these learners in activities to improve lexical richness and productive vocabulary.

The first phase of this research was to design and develop a new second language writing analytics software tool to fill this gap. I created Vexique to analyze lexical data produced by French immersion (FI) learners, produce an automated lexical frequency table as a personalized data visualization, and invite improvements to vocabulary by review and explanation prompts designed to promote metacognitive lexical strategies. The second phase of the study was to test if and in what ways Vexique helps FI students increase lexical richness and vocabulary in essays.

The theoretical framework from which features of Vexique were conceptualized is Hulstijn and Laufer's (2001) Involvement Load Hypothesis. The theory posits that second language (L2) vocabulary tasks with higher involvement load increase retention of new L2 words. In the case of Vexique, involvement load is related to greater lexical richness in an essay in contrast to simply remembering new L2 words.

FI is a second language acquisition and second language learning model offered across Canada. This model emphasizes immersing learners in the target L2, French. The FI program is federally and provincially funded in an attempt to provide opportunities for Canadians to become fluently bilingual in French, one of Canada's two official languages. FI has been criticized because many students completing it have deficient

French skills, including writing and vocabulary, despite studying French throughout their schooling. Vexique was designed to ameliorate some aspects of this problem.

In this study, 45 Grade 12 FI students wrote two argumentative essays using Vexique. The first essay was drafted in Vexique and provided learners with an opportunity to make lexical improvements prior to submitting it for grading. The software quantifies overuse of words and provides a visualization to guide revision. The second argumentative essay written in Vexique withheld these analytics. Results showed that learners increased lexical richness after using Vexique with the first essay and further increased their lexical richness in the second essay. However, a decrease in repetitive word choice did not transfer to this second essay written without software support.

This experiment adds empirical and quantitative research investigating the FI program and generates technological resources that can be used by students, teachers, and school districts to help improve writing skills by providing effective and automated lexical feedback. The fields of L2 vocabulary acquisition, writing analytics and learning analytics benefit from this work by testing theoretically and empirically supported features of a software tool that uses natural language processing. The results of this study recommend developing L2 tools that are user-friendly and give learners agency in their learning by providing personalized data-enriched feedback.

1.1. Problem statement

Grade 12 FI students study French for a number of years by being immersed in the language at school. The majority of their content area courses in elementary school have been taught solely in French, with some variation as described in Chapter 2. In high school, the percentage of courses taught in French decreases to 50% in Grades 8-10, and 25% in Grades 11 and 12 (British Columbia Ministry of Education, 2018a). The Canadian model of immersion language learning was introduced into public schools in the 1970s (Genesee, 1984) and has been adopted by other countries, including Egypt in 2002, as a successful and efficient means by which to learn French as an L2 (Canadian International School of Egypt, 2018). The goal of the program is to produce functional communication skills with bilingual proficiency in French (Lyster in CPF, 2019). The FI program, however, has been criticized for not producing functional bilinguals. While FI learners are able to master content material, they have deficiencies in their French

language skills, including writing (Archibald et al., 2006). There are many factors that contribute to this issue including a lack of pedagogical resources at an appropriate level for FI students, lack of qualified FI teachers with sufficient mastery of French (Kline-Martin, 2018; Paradis, 2018) as well as low student motivation and deficiencies in productive speaking and writing (Harley, 1998). In the research reported here, writing quality was examined with a particular focus on vocabulary.

Research in FI and second language acquisition (SLA) have shown students' overall receptive skills are strong but productive skills are limited (Lazaruk, 2007). Indeed, FI student writing skills are deficient in their L2 (Cummins, 2001; Genesee, 1987; Lyster, 2004; Swain, 2000). FI learners are exposed to new vocabulary through reading tasks and explicit vocabulary instruction yet still write using repetitive and high frequency words (Ovtcharov et al., 2006; Lindqvist, 2010). In SLA research, L2 word frequency has been shown to predict overall higher writing proficiency scores (Laufer, 1994; Kyle & Crossley, 2015). Moreover, Grade 12 FI students typically achieve a proficiency level of B1 (Lazaruk, 2007) instead of the intended B2. Thus, improving lexical richness could improve scores on writing tasks and language proficiency assessments. This research provides FI students and teachers with resources that promote active involvement to extend vocabulary in productive L2 tasks.

1.2. Purpose of Research

To help FI learners improve lexical richness, I designed an online webtool to quantify Grade 12 FI students' vocabulary frequency in an argumentative essay and provide opportunities to revise lexical output before submission. Learners also had opportunity to justify each suggested occasion for revising, creating opportunity to engage in metacognitive processes that could enhance language learning.

Many free online software tools exist to help FI learners improve grammar (*Le Bon Patron*), find French translations for English terms (*Le Petit Robert*, *wordreference.com*, *linguee.fr*) and translate full sentences (*Google Translate*, *deepl.com/translator*). *Vocabprofile*, maintained by Tom Cobb (Silva, 2011), is a linguistic analysis tool, designed to help L2 learners augment their lexicon. This particular tool has several versions, including a lexical profiler in French, however, it is not intended for adolescent learners and requires a great deal of knowledge of lexical

analysis to interpret results. To my knowledge, no software tool exists to help high school students develop lexical richness while completing a writing task by providing automated and personalized lexical feedback, opportunities to replace text, and explanation prompts to explain word choice and develop metacognitive strategies to support subsequent L2 writing. As such, my work is an original contribution to research.

1.3. Rationale and significance

Studies in FI focus on different aspects of that program including literacy instruction, grammar instruction, and inclusion (CPF, 2019). Few investigated lexical richness specifically in the FI context despite it being a focus of research in other second language learning (SLL) contexts. Indeed, FI students' writing lacks nuanced vocabulary and lexical richness (Astika, 1993; Engber, 1993; Linnarud, 1986). Thus, improving lexical richness would fill a learning gap in FI programs where L2 learners develop very competent comprehension skills but insufficient productive skills (CPF, 2019).

A goal of this research was to create a software tool to automate the process of identifying repetitive vocabulary in written work in a timely, efficient and accurate manner. Vexique gives learners automated feedback regarding lexical richness through visualizing parts of speech (POS) in a frequency table that displays nouns, verbs, adjectives and adverbs. It also prompts learners to modify vocabulary and justify their changes with explanation prompts. These features are unique to Vexique. Other automatic feedback analyses are typically only used as assessment tools and do not engage the learner (Goodfellow et al., 2002). Vexique enabled students to visualize their vocabulary quantitatively and make lexical replacements in an L2 efficiently, which, to my knowledge, does not exist in one system.

1.4. Definitions of key terminology

1.4.1. Learning Analytics

The term *analytics* was popularized in business to describe consumer behavior based on purchase data (Reyes, 2015). The field of LA, however, focuses specifically on students and their learning behaviours (van Barneveld et al., 2012) by collecting multifaceted data about and generated by learners, typically using software. Its goal is to

investigate the learning process and add to learning theory (Baker & Siemens, 2014). LA is a broad framework that seems to provide actionable feedback to educational stakeholders (Papamitsiou & Economides, 2014) by using data that give insight into the learning process and have the potential to influence future learning behaviour (Gašević & Siemens, 2015). LA also play a role in helping learners develop self-regulated learning strategies as agents who act upon the information provided by their data (Roll & Winne, 2015). Data generated by learner interactions with online learning tools, such as learning management systems (LMS), represent observable and measurable activities related to learning behaviour (Lockyer et al., 2013). Prior to LA, researchers mostly relied on questionnaire data to investigate underlying learning behaviours but these data cannot accurately detail intricacies of learning processes (Lockyer et al., 2013). Lockyer et al. describe two categories of analytics produced by different types of data streams: checkpoint and process analytics. The former provides data including time spent, number of logins, mouse clicks, accessed resources, produced artifacts and completed assignments (Duval, 2011). The latter relate to content learners produce in discussion posts, emails and assignments (Lockyer et al., 2013). Often, courseware or LMSs employ analytics that combine user interaction and demographic data to create a predictive model of learner performance (Tempelaar et al., 2015). The tool in this study gathers data to generate specific process analytics to inform L2 writing processes.

1.4.2. Writing Analytics

A new sector of the field of LA is writing analytics. The aim of this field is to improve writing skills through the use of LA that incorporate techniques such as natural language processing and automated text analysis (Shum et al., 2016). Although a new area, researchers in this field suggest that writing tools need to be created to give timely scaffolded feedback. A major question being investigated is the optimal point at which this guidance is provided to learners (Knight et al., 2017). Writing analytics tools identify areas of learner writing that can be improved, help learners develop metacognitive strategies which lead to self-regulation in writing tasks and assist learners to attain a level of expertise which discontinues reliance on the tool (Knight et al., 2017). These are main intentions of the proposed software tool, Vexique.

The fields of LA and writing analytics are relatively new fields. There are many directions for it to expand. Duval (2011) notes one area for future investigation in LA is

identifying what to measure to gain a deeper understanding of learning processes. As mentioned, many types of data collected provide checkpoint analytics related to whether and when students access resources on an LMS (Lockyer et al., 2013). Yet, this does not inform us about learning processes (Duval, 2011). Process analytics are difficult to analyze and can benefit by including content or semantic analyses to reveal information regarding learner understanding and knowledge building (Lockyer et al., 2013). Additional empirical research could uncover in which ways data visualizations are best presented to learners to inform and influence learning behavior and processes (Reyes, 2015). Typically, learner data such as log data, posts to discussion forums, responses to surveys and emails are visualized through dashboard systems for viewing predominantly by instructors and designers (Brown, 2012). I argue that learners should be shown their data to support self-regulation and reflection. Although dashboards have shown promise in providing learners with visual displays of their learning activity (Arnold & Pistilli, 2012; Verbert et al., 2013), there is little information on how learners understand their data. Aguilar (2014) and Duval (2011) found that it was difficult for learners to act based on data visualizations. Vexique is an attempt to further work in these areas by testing data visualization features and how learners interact with this information.

1.4.3. Second Language Acquisition

The notion of second language acquisition (SLA) dates back as far as the sixth century CE when European schoolchildren required instruction in Latin to read classic Roman literature (Herschensohn & Young-Scholten, 2013). Since then, many differing theories and views evolved. For the purpose of this study, only a very brief description of the field is outlined to differentiate it from second language learning, described below. Both terms are summarized but not deeply analyzed here.

SLA supposes that one's first language (L1) plays a role or influences how an L2 is acquired (Herschensohn & Young-Scholten, 2013; Krashen, 1981). An L1 is learned through exposure early in life (Herschensohn & Young-Scholten, 2013). SLA occurs similarly to acquiring an L1. The target L2 is used in authentic contexts with native-speakers and the focus is conveying a message rather than teaching linguistic forms and explicit rules (Krashen, 1981). Krashen also explains that language performance from an SLA perspective is automatic since the learner is required to use language

structures spontaneously without time to problem-solve linguistic or grammatical dilemmas or analyze forms prior to using the L2.

1.4.4. Second Language Learning

SLL differs from SLA in that it refers to consciously learning an L2, typically emphasizing explicit rules and corrective feedback (Krashen & Seliger, 1975). The focus in SLL is on form and linguistic structures (Krashen, 1981). Practicing the L2 can occur in authentic situations or in a more formal setting such as the classroom. Instruction aims to help the learner problem solve and apply learned forms and grammar structures to particular language situations and receive feedback (Krashen, 1981). SLL and SLA form the groundwork for L2 learning in Canada including British Columbia's FI program.

1.4.5. French Immersion

In British Columbia, as of 1997, every student between Grades 5-8 is required to learn French as a second language (British Columbia Ministry of Education, 1997). More broadly, three models of French programs exist in Canada: 1) Core French; 2) Intensive French; and 3) French Immersion. I describe only the latter in detail.

SLA and SLL are fundamentally different as previously explained but both serve as foundations for the FI program. The focus of FI (both early and late FI) is ensuring the L2, French, is the language of instruction across various subject areas. FI students are required to use the target language in their FI classes, and engage in authentic and spontaneous L2 activities to develop their proficiency in French. In addition, learners are also exposed to learn explicit grammatical structures and linguistic forms to support their language learning efforts. More details about the program will be described in subsequent chapters.

Lexical Richness

A universal definition of lexical richness, or lexical proficiency, does not yet exist (Kim, Crossley & Kyle, 2018). Generally, it has been accepted that it refers to the quality of vocabulary in a language sample (Kim, Crossley & Kyle, 2018; Read, 2000). Lexical richness is a construct comprised of different measures of vocabulary in an L2 including lexical density, the proportion of content words (e.g., nouns, verbs, adjectives and

adverbs) to total number of words in a text (Johansson, 2008; Ure, 1971); lexical diversity, the number of different word types in a text (Kim, Crossley & Kyle, 2018; Read, 2000); and lexical sophistication, a proportion comparing high frequency words to low frequency words (Henriksen & Danelund, 2015), to name a few (Laufer & Nation, 1995). This dissertation analyzed data for lexical density and lexical diversity to assess lexical richness. One of the main goals in FI is communicating a message, which is information. A high measure of lexical density, a high proportion of content words relative to function words (e.g., prepositions, interjections, etc.), provides more information (Johansson, 2008). Calculating this measure is indicative of the proportion of information in the text. In addition, the measure of lexical diversity, variety of unique vocabulary terms in context, provides insight into the L2 learner's vocabulary knowledge. Due to the scale and scope of this research, lexical sophistication was not measured. An account of how these two facets of lexical richness were measured is described in the Methods and Results chapters.

1.5. Organization of the Thesis

This dissertation includes 5 chapters. Chapter 1 has provided a brief synopsis of my research and the importance and need for software tools that can address deficiencies in FI student writing skills and vocabulary acquisition. Chapter 2 reviews literature that builds an empirical foundation for the study and warrants the major features of Vexique. Chapter 3 details the research design, methodology, ethics, recruitment and consent, data collection and analysis. Chapter 4 describes results of the analyses of participants' data. Chapter 5 discusses the research findings and offers implications in L2 and FI research plus potential future research with this tool.

Chapter 2.

Literature review

2.1. French Immersion for Learning a Second Language

FI instruction began in the Province of Quebec in the 1960s to provide anglophone children, English speakers, with an efficient and high-quality education in the French language so they could comfortably live and work in their surrounding francophone communities (Genesee, 1984). A group of parents together with leading experts in the psychology of bilingualism and in brain and language studies from Canadian institutions helped develop the FI program. FI has two defining features: 1) French is the language of instruction and 2) a variety of subjects, such as math, science, socials, PE, etc., are taught in the target language (Genesee, 1984).

FI is a time-intensive content-based language teaching model (Archibald et al., 2006). In addition, the percentage of French instruction per day was and is dependent on the point of entry into the program. Early French Immersion (EFI) is for students who enter between Kindergarten to Grade 3; Late French Immersion (LFI) for those beginning L2 learning in Grade 6 or 7. Learners in both programs are integrated in secondary school. Initially, 100% of instruction is in French and decreases as English instruction is introduced after learners have developed a foundation of French skills (Genesee, 1984).

There was some concern from the public that students enrolled in FI would lose their L1 skills. However, Lambert and Tucker (1972) conducted the St. Lambert experiment in Quebec and found that FI students who began their immersion education in kindergarten were functionally bilingual by grade 4 in English and French with near-native fluency in French without diminution of their English skills. Other research in early iterations of the FI program showed that FI students had nativelike proficiency in reading and listening comprehension, but they did not have the same proficiency with speaking and writing although they were still quite competent (Genesee, 1984; Swain, 1981). Thus, FI has been shown to be an effective model for French education.

The FI program has seen many changes since the 1960s and continues to evolve across all provinces and territories, each of which has developed its own program requirements. The FI program is an ideal context in which to conduct L2 research in that the program offers continuous exposure to the target language in an authentic and enriched language learning environment.

In Canada, the 1968 Official Languages Act made the French language one of the country's official languages. Study of this language is referred to as French as a second language (FSL) rather than referring to it as learning an additional language (Mady, 2014). Many FSL classroom contexts focus on meaning rather than form. Indeed, FSL programs including FI predominantly use an experiential model of instruction and focus on communication (Ammar & Hassan, 2018). This model holds the underlying assumption that language learning occurs incidentally (Spada & Lightbown, 2008). Some have argued that content and language instruction are very distinct concepts (Swain, 1988). Learning a language requires developing receptive skills and productive skills to fully communicate in the L2. The current work focuses on L2 productive writing skills, specifically, vocabulary use.

2.1.1. FI writing deficiencies

The FI educational model effectively develops L2 communication skills although students often exhibit some linguistic shortcomings (Lyster, 2004). Students' writing skills are subpar (Cummins, 2001; Genesee, 1987; Swain, 2000) and hindered by underdeveloped lexical proficiency (Lawrence, 1996). While many variables correlate with L2 writing quality, lexical richness has accounted for the most variance in overall assessment scores (Astika, 1993; Engber, 1993; Linnarud, 1986). Although exposed to a variety of new vocabulary through reading and explicit lexical instruction, FI learners tend to employ high frequency words familiar to their L1 and learned early in their L2 education. This is also seen in research in other languages (Henriksen & Danelund, 2015; Lindqvist, 2010; Ovtcharov et al., 2006). Some lexical deficiencies could be attributed to a lack of authenticity in L2 classroom writing tasks (Swain, 2000). External and authentic feedback provides learners with information that further develops their proficiency but only internal (self-generated) feedback or an externally provided grade limits the possibility of increasing lexical competence (Swain & Lapkin, 1995).

Vocabulary knowledge in an L2 is a complex system (Nation, 2001) and is the foundation for structures such as sentences and paragraphs (Read, 2000). An L1 is learned throughout one's lifetime via new experiences whereas an L2 is learned consciously and sometimes through explicit instruction (Read, 2000). Professional autonomy allows FI teachers to teach vocabulary in a variety of ways. Scholars have researched vocabulary acquisition for different L2 programs through implicit, explicit, and incidental learning, via listening, reading, writing and speaking (Duquette et al., 1998; Goodfellow et al., 2002; Van Zeeland & Schmitt, 2013). A common view is that vocabulary acquisition occurs incidentally through reading as learners are exposed to a repertoire of frequently repeated L2 vocabulary (Goodfellow et al., 2002). Some research suggests, however, that incidental vocabulary acquisition is inefficient and time-consuming (Pigada & Schmitt, 2006). Other research posits that explicit L2 vocabulary exercises promote vocabulary acquisition, as they too, are linked to frequency and exposure (Ellis, 1995) but also requires learners to apply cognitive strategies to learn new vocabulary, perhaps using mnemonic strategies (key-word association), mapping and lexical inferencing (Duquette et al., 1998). L2 language classrooms employ a variety of explicit vocabulary building activities such as cloze-exercises and spelling activities, etc., that involve practice, but these lexical activities have been criticized as superficial and restricting learners from using words in an authentic context (Folse, 2006).

There is also debate over whether reading or writing processes are more effective in promoting acquisition and retention of new words in an L2 (Hulstijn & Laufer, 2001). Words used in written productions are retained more than words in reading comprehension tasks (Webb, 2005). This may be partly attributed to using more time with new words in writing tasks versus reading (Folse, 2006), lack of lexical focus involved in reading tasks (Keating, 2008), and word type (i.e., nouns are assimilated more rapidly than adjectives due to their essential nature in understanding messages; Duquette et al., 1998; Nation, 1990).

The FI program has been scrutinized for producing L2 learners who have deficient skills such as erroneous and imprecise vocabulary when writing (Ammar & Hassan, 2018). These authors posit that FI students' language skills are deficient due to several factors including an absence of productive writing activities with corrective feedback.

Similar results were found in research in L2 English programs, which made an argument for L2 instruction that draws attention to the formal properties of language (Lightbown & Spada, 1994). Guiding learner attention to language forms is challenging and less effective when it is teacher-focused and designed via structured, whole-class lessons on one particular language form (Ammar & Hassan, 2018). This cannot address the lexical needs of all individual learners. Research suggests that learners who attend to linguistic forms tend to incorporate these into their productions, although this work has been conducted with adult learners who have an appropriate level of awareness to express their language needs (Ammar & Hassan, 2018). Attention to language forms in FI can lead to progress in language development (Spada & Lightbown, 2008). Tasks that emphasize particular linguistic elements of learners' L2 have been effective in improving language production (Lyster, 2004). Drawing attention to repetitious vocabulary and supporting the use of new words or synonyms for known words, encourages learners to use different forms rather than easily accessible forms (i.e., a repetitive lexicon). Lyster (2004) also suggests that controlled rather than communicative practice is more effective when working in areas where linguistic errors occur, as it allows for concrete feedback.

Based on these findings, I developed Vexique using Hulstijn and Laufer's (2001) Involvement Load Hypothesis to draw learner attention to lexical richness in a learner-generated written production. The software also engages learners in using computer-assisted support tools (a dictionary and thesaurus). Vexique provides personalized writing analytics to help learners notice lexical repetition and use alternate vocabulary to potentially enhance writing quality (Duquette et al., 1998), and develop metacognitive strategies that could improve lexical richness in future writing tasks.

Vexique offers several unique treatments to help learners develop lexical proficiency. Unlike traditional computer-assisted language learning software, which will not be discussed in this dissertation, Vexique enables learners to engage in deeper processing tasks with L2 vocabulary by personalizing the task to each learner's written production, which most other tools do not (Folse, 2006). Vexique focuses explicitly on vocabulary, which has been argued to increase the lexical profile of L2 learners (Laufer, 1994).

As Hulstijn and Laufer's (2001) Involvement Load Hypothesis was the theoretical framework that informed the development and design of this tool, the following section

describes the Involvement Load Hypothesis, how it applies to Vexique and empirical evidence that influenced the development of major features of the software tool.

2.2. Involvement Load Hypothesis for L2 vocabulary learning

Craik and Lockhart (1972) theorized the notion of depth of processing. This describes the acquisition and storage in long-term memory of new and explicit information (facts, events, words) as not dependent on the time that information was in short-term memory but as a function of the “depth with which that information is initially processed” (Hulstijn & Laufer, 2001, p. 540). As well as other theories, such as Craik and Tulving’s (1975) theory of elaboration, Craik and Lockhart hypothesize that elaboratively processing lexical information leads to higher rates of retention. Their view has been criticized because its constructs are challenging to define operationally (Hulstijn & Laufer, 2001). Hulstijn and Laufer further suggest that retaining new lexical information requires attention paid to new words rather than learning these only incidentally, through reading for instance. Indeed, Hulstijn and Laufer (2001) found that vocabulary acquisition tasks in which learners performed better involved elaborative deep-level processing of the new lexical information. This led them to develop the *Involvement Load Hypothesis for L2 vocabulary learning* to operationally define depth of processing.

The Involvement Load Hypothesis (Laufer & Hulstijn, 2001) posits that word knowledge and retention occur to different degrees depending on attention given. In their terms, *involvement load* is the amount of engagement a learner has with a vocabulary task (Zou, 2017). Hulstijn and Laufer (2001) argue that *involvement load* is a motivational-cognitive construct comprised of three factors: *need*, *search* and *evaluation*. Their theory proposes that retention of words depends on these task factors (Keating, 2008). Specifically, more effective lexical acquisition occurs when tasks have greater levels of need, search, and evaluation, i.e., a higher involvement load, which therefore, invites more elaborate processing (Hulstijn & Laufer, 2001; Keating, 2008; Zou, 2017). Many studies have tested various vocabulary retention tasks in L2 and shown tasks with the lowest involvement load are reading and cloze exercises. Translation exercises have a moderate involvement load and productive writing tasks, such as sentence-writing and composition writing, have the highest involvement load (Zou, 2017).

Studies that examined Hulstijn and Laufer's (2001) involvement load hypothesis tested a diverse array of vocabulary retention tasks to promote optimal word retention in an L2 (Zou, 2017). In one study, for instance, participants were assigned to groups which completed different vocabulary tasks: cloze-exercises, sentence writing or composition writing. Participants in each group were given the same 10 target words in their L2, English, to use in their respective vocabulary tasks. To investigate whether participants retained the 10 words, some were given posttests immediately after the initial treatment, others were given a posttest without warning a week later (Zou, 2017). Results showed that all tasks led to participants learning new L2 words, but participants in the composition-writing group acquired higher mean scores in the posttests. This study demonstrated that composition-writing had a higher involvement load than cloze-exercises and therefore, enabled participants to learn more L2 vocabulary.

My research applies the Involvement Load Hypothesis framework to lexical richness rather than word retention. My goal was to develop Vexique to increase involvement load by assisting learners to consider lexical repetitions and changes thereof to their productive vocabulary. This was essential because, even though intermediate L2 learners (i.e., Grade 12 FI learners) have been shown to have the highest lexical richness and variety of L2 vocabulary as compared to other grade levels (Astridya, 2018), their productive vocabulary is commonly simplistic and static.

The pedagogical task of drawing learners' attention to lexical richness is challenging. A teacher could employ a variety of activities that focus on reviewing repetitive vocabulary in written work students generate. Student-centered activities could include instructing learners to review their work by reading, highlighting repetitive words and replacing some of their repetitious vocabulary with synonyms or new words. Alternatively, an instructor could do this same task by reviewing student writing and identifying repetitive words, then giving students corrective feedback to replace vocabulary. These classroom tasks are time-consuming and may not be an effective way to improve lexical richness. These same activities could be completed in a more efficient way digitally, using text editing software. Particular words could be searched in the text, highlighting all instances of that word, then students could make changes. Yet, this activity presupposes that students and teachers identify the words to be searched, either through reading the text first or knowing that particular words were overused.

Other methods for drawing learners' attention to repetitive vocabulary use a wholistic method with rubrics. An example is British Columbia's former Provincial Exam Scoring rubric for FI that assessed language for a written composition on a six-point scale. The scale assessed several elements of language including grammar, syntax and vocabulary. The following excerpt shows the vocabulary assessment elements used to score FI provincial exam essays (British Columbia Ministry of Education, 2018b – link to the complete scoring rubric is provided in References).

Niveau 6 : Excellent	- Le vocabulaire est précis et riche.	<i>(Vocabulary is rich and precise)</i>
Niveau 5 : Réfléchi	- Le vocabulaire est approprié.	<i>(Vocabulary is appropriate)</i>
Niveau 4 : Compétent	- Le vocabulaire est varié.	<i>(Vocabulary is varied)</i>
Niveau 3 : Adéquat	- Le vocabulaire est familier.	<i>(Vocabulary is informal)</i>
Niveau 2 : Confus	- Le vocabulaire est mal choisi.	<i>(Vocabulary is poorly chosen)</i>
Niveau 1 : Inacceptable		

These features of vocabulary assessment are difficult to quantify and are challenging for learners to use as a guide to improve their vocabulary. They were created to serve summative assessment rather than be a teaching tool. I judged it was essential to draw a learner's attention to word frequency in a timely and detailed manner. In addition, the tool I designed provides learners with opportunity to make replacements by drawing on lexical resources so they could potentially learn new vocabulary and apply it to writing tasks.

2.3. Major features of Vexique

After participants log in to the system (see Figure 1), Vexique has four main features: 1) a text input field; 2) a frequency count window to display results from a parts of speech (POS) tagger; 3) a hover-window with potential replacements; and, 4) explanation prompts. The hosting website also features links to an online French dictionary and thesaurus. Each feature is described in relation to empirical evidence supporting its design. Limitations of each feature are discussed in Chapter 5.

2.3.1. Feature 1: Text Input Field

The text input field is where participants drafted essays (see Figure 2). High school FI students often write essays in school to practice elements of writing skills including language, style, and argumentation (Swain, 2000). Vexique focuses on only one element of L2 writing, vocabulary (language). It is challenging for teachers to

quantitatively assess lexical richness as it requires time and precision on the part of the instructor to accurately and efficiently identify repetitive vocabulary in a learner essay. These assessment measures are not quantitatively objective. Thus, an online practice space offers advantages in gathering data to generate personalized, rule-governed and data driven lexical feedback for each learner.

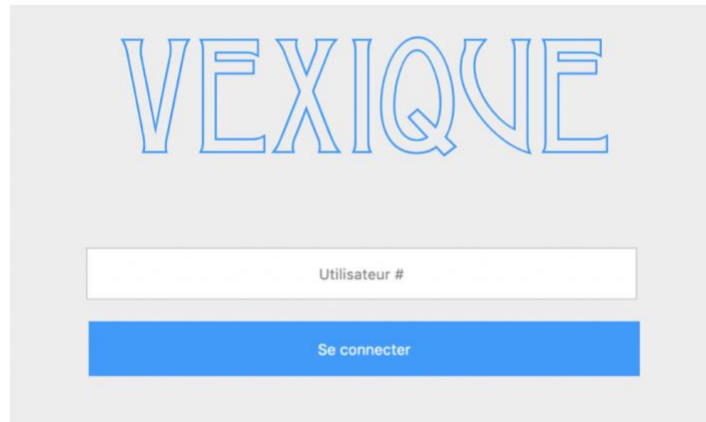


Figure 1. Vexique Login Page

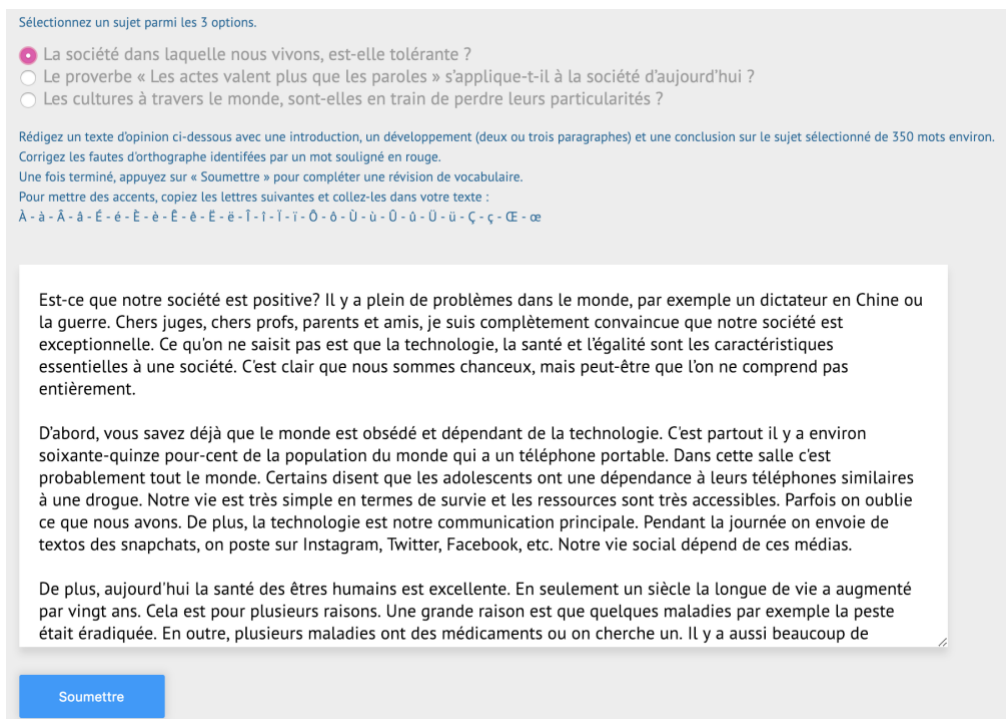


Figure 2. Text Input Field

Student authors are provided three argumentative essay topics and instructions. Accents to be copied and pasted were provided if learners did not know the keyboard

combinations for symbols. The instructions model those from the essay questions on the former provincial exam, an exam this group of students was preparing to take. Once students select a topic and complete typing their essay, they press *Submit* to initiate an automated lexical analysis of the draft.

Learners find feedback useful for L2 vocabulary acquisition (Montgomery & Baker, 2007). While traditional automatic text analysis for L2 involves spelling, grammar, and style and usage tools (Goodfellow et al., 2002), Vexique implements unique automatic text analysis feedback that provides learners with personalized and actionable data (Aguilar, 2014) hypothesized to improve vocabulary proficiency.

2.3.2. Feature 2: Word Frequency Count

Vexique presents a word frequency display window embedded on the same screen as the text input field. After a student types their essay and presses *Submit*, a parts of speech (POS) tagger classifies each word in the composition (Schmid, 1994). In Vexique, only nouns, verbs, adjectives and adverbs that appeared more than three instances were extracted from the draft and listed in the word frequency display to the right of the essay (see Figure 3).

Révision du vocabulaire

Tous les mots surlignés en jaune sont des NOMS, VERBES, ADVERBES et ADJECTIFS. La liste à gauche vous donne tous les mots et le nombre de fois qu'ils se répètent.

Il est obligatoire de remplacer tous les mots qui se répètent plus de trois fois.
Vous pouvez également remplacer les mots qui se répètent trois fois ou moins.

Vous avez le droit d'utiliser vos propres connaissances ou des ressources telles que des outils électroniques ou des dictionnaires et des sites Web pour trouver des synonymes, leurs définitions et tout ce dont il vous faut pour bien réviser le vocabulaire, le contexte du texte et les synonymes.

Une fois que vous avez tout révisé, appuyez sur « Soumettre ».

[Word Reference](#)
[Synonymes](#)

C'est un monde moderne aujourd'hui. Chaque jour il y a des nouveaux avancements dans la société et la technologie, les choses que les personnes dans le passé peut seulement rêve à propos. Les cultures et les peuples autour du monde sont toujours en train de garder leur propre identité et valeurs, mais ça peut être difficile pour les enfants de ces peuples qui sont incorpore dans une civilisation très différent que leurs parents et leurs grands-parents en vivais. Les cultures à travers du monde perdent leurs particularités et les valeurs a causent de la technologie moderne que nous sont forces d'utiliser pour une vie normale et l'exposition a le grand monde dehors qui est plein d'autres cultures, personnes, façons de vie, et beaucoup de problèmes. La colonisation du monde a commencé environ 1000 ans de la passé et beaucoup de civilisations en essayer de colonisé les parties du monde ou même tous le terre. Les plus grands empires qui en conquérir la majorité de la terre sont ; le Grand Bretagne, l'Espagne et les Français. Chaque continent sur la terre avait au

- 14: MONDE NOM
- 7: DANS UNK
- 6: CULTURES NOM
- 6: SONT VER
- 5: PERSONNES ADJ,NOM
- 4: VALEURS NOM
- 4: POUR NOM
- 4: LEURS ADJ:pos

Soumettre

Figure 3. Word Frequency Display

The word frequency display is an ordered list beginning with the most frequently used word and its numerical count. The list also features a POS category after each word. In Figure 3, the noun *Monde* (encircled in the Figure for identification) was used 14 times in this short 328-word sample essay. All content words including those in the frequency table were also highlighted in yellow with a dark yellow border used to differentiate them from words that have not been reviewed. While all highlighted content words had the potential to be reviewed, the ordered list was meant to draw attention to the most repeated words. Word counts have been used in FL studies to assess fluency (Germain et al., 2004; Stillwell et al., 2010). Here, the word count is intended to draw learner attention to word choice and number of instances of each word, potentially influencing lexical retention (Hulstijn & Laufer, 2001). Learners did not see the POS tagger's output directly, as reading it requires a particular skillset (Duval, 2011; Goodfellow et al., 2002) that is unnecessary for the learning task.

Restricting lexical categories to nouns, verbs, adjectives and adverbs was intended to 1) limit the scope of the task for learners and 2) provide the learner with lexical categories that increase learnability. Prior research has shown word-class influences vocabulary learning (Ellis & Beaton, 1993); indeed, nouns, adjectives, verbs and adverbs are easier to learn and retain than other word classes (Choi, 1997). Nouns, in particular, are learned and retained more than other word types (Gentner, 1982). Since research has found more sophisticated writing is associated with greater use of low frequency words (Crossley et al., 2013, p. 966), and the goal of Vexique is to increase lexical variety, it was important to provide learners with lexical categories that have a wide range of word choices and which could be more easily retained. Future iterations of Vexique may add other lexical categories such as prepositions to extend scaffolded feedback on additional lexical properties of L2 writing.

Selecting a word in the frequency list also highlighted in a different colour all instances of that word in the essay, thus helping to locate instances of the word and examine its use in context (see Figure 4). This invited learners to review word choice for each instance. Hulstijn et al. (2001) found that lexical memory is dependent on the amount and quality of focus given to a word in context. Thus, showing a frequency count alone would not provide learners enough information to fully improve word choice.

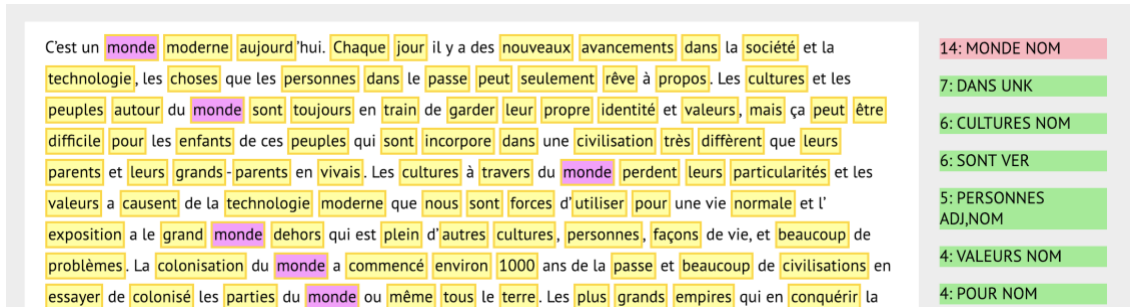


Figure 4. Word Identification

2.3.3. Feature 3: Replacement and Prompted Explanations

When a learner selected one of the highlighted words, a pop-up window appeared providing the opportunity to replace words in the essay with possible synonyms or new words, and list of reasons which students could choose to explain their choice. The word frequency display was dynamic. Thus, if any words were replaced, the frequency table updated immediately to show a new word count. This was intended as a safeguard against participants simply replacing repetitive vocabulary all with the same synonym, thereby leaving the repetition count unchanged by repetitively using a different word. Students were not required to replace every instance of a repeated word. They were, however, required to select from a drop-down menu an explanation for every word choice whether it was replaced or not. Prompted explanations are displayed in Figure 5.

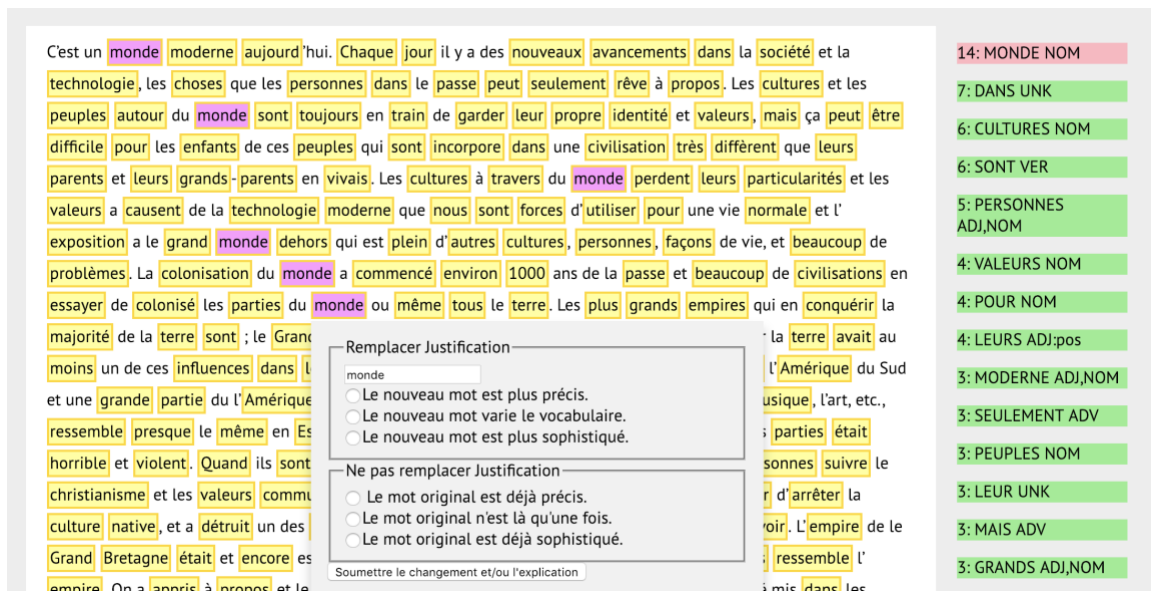


Figure 5. Replacement Window and Prompted Explanations

Metacognitive strategy: Prompted Explanation

Self-explanation is a strategy used in various learning tasks to assist learners to assimilate new information and assemble connections with existing knowledge (Bisra, Liu, Nesbit, Salimi & Winne, 2018; Chi et al., 1994). Theory suggests explanations help learners extend understanding of concepts by making inferences, linking new information to prior knowledge and drawing conclusions (Chi et al., 1989). Explanations have been studied to examine how they facilitate learning problem-solving tasks, procedures and concepts, among others (Bisra, Liu, Nesbit, Salami & Winne, 2018). Previous research found learners who autonomously self-explain while working with examples scored higher on assessments of learning (Chi et al., 1994) and understanding (Bisra, Liu, Nesbit, Salimi & Winne, 2018; Conati & van Lehn, 2000).

According to Conati and van Lehn (2000), students can learn to self-explain if guided (Bielaczyc et al., 1995; Ryan, 1996) or prompted (Chi et al., 1994) to enhance metacognitive awareness about their learning. Although spontaneous self-explanations may be more effective than prompted explanations (Chi et al., 1994), most learners falter in generating explanations on their own as they overestimate their understanding (Renkl, 1997). Providing a prompt in Vexique is intended to promote metacognitive monitoring and explanation that builds lexical knowledge (Vandergrift, 2013). While Bisra, Liu, Nesbit, Salimi and Winne's (2018) meta-analysis found employing self-generated explanations was more effective than prompted explanations, the current study used multiple-choice prompted explanation cues as a starting point for this research. Prompts in the form of a drop-down menu are a minimal yet sufficient intervention to help learners develop metacognitive strategies relating to explanations (Conati & van Lehn, 2000, p. 392).

To my knowledge, no research describes types of vocabulary explanation prompts that best enable learners to develop skills relating to word choice. Although Vexique's prompts are not aligned with the notion of self-explanation, Wylie et al. (2009) used self-explanation prompts with a tutoring system to help L2 English learners acquire grammatical concepts about English articles: a, the, an, etc. These authors added two types of self-explanation prompts to existing tutoring systems for L2 English learners. One was a free response self-explanation, based on Chi et al.'s biology study (1994), where participants could self-generate an explanation about answers when prompted by

two questions. The second was a self-explanation drop-down menu. After selecting a grammatical response, learners also selected an explanation for their grammar choice from the drop-down menu. Following a variant of the latter method, the current study used prompted explanations to help learners develop metalanguage necessary to review their lexical choices. Future iterations of the software might incorporate scaffolding leading to generating spontaneous explanations.

The frequency table, replacement and prompted explanation features were grounded in Hulstijn and Laufer's (2001) Involvement Load Hypothesis for L2 vocabulary learning. The involvement index proposed by Hulstijn & Laufer (2001) assesses each L2 vocabulary task by attributing a score for each of the three factors: need, search and evaluation. Each factor is scored as absent (or weak), moderate or strong. *Need* is the motivation to complete a vocabulary task and is measured as moderate when imposed by an outside source (a teacher) and strong when it is intrinsically chosen (by the learner). *Search* and *evaluation* are cognitive aspects defined by finding the meaning of an L2 word, achieved via an online thesaurus or dictionary, and comparing word meanings to select an optimal choice for the context. *Search* is absent if learners do not utilize additional tools to seek out new vocabulary and is strong if they do. *Evaluation* is measured as moderate when learners engage with fill-in-the-blank activities or strong when the learner autonomously selects a new word to fill in a context. Vexique's involvement load includes: 1) a strong *need* – although learners are assigned an argumentative essay and vocabulary task, they have complete agency whether to replace words and the word replacement itself; 2) a strong *search* – Vexique provides learners with access to an online dictionary and thesaurus, both frequently used in the course, to search for known synonyms or new words as lexical replacements. This task requires them to examine vocabulary in context, use the online thesaurus to identify potential synonyms and verify their meanings with the dictionary to ensure the replacement words fit the original context; and 3) a strong *evaluation* – learners must judge word selection according to an explanation that fits the text for each word in their draft.

Chapter 3.

Methods

3.1. Research Problem

To investigate a method designed to help FI learners improve lexical richness, I developed an online webtool to quantify Grade 12 FI students' lexical variation and guide them to modify and justify their lexical output expressed as word choice. The study addressed three key research questions: (1) Does automated feedback operationalized as metacognitive and explanation prompts increase lexical richness in FI students' essays? (2) Does vocabulary and lexical richness transfer to a second, parallel writing activity? (3) How did learners use features of the software tool?

3.2. Research Design

The research design involved all participants in the intervention. There was no control group. Every student participated in every aspect of the study, as parallels common classroom practices used to prepare FI learners for Grade 12 exams. Comparisons across two essays, the first of which was a reviewed draft, were used to examine transfer of effects. Students who agreed to be a part of the research study volunteered to share their data.

3.2.1. Participants

Two classes of Grade 12 FI students ($N = 45$) from one high school in the Lower Mainland of British Columbia participated in the study. I was the principal investigator and the classroom teacher. As such, I accessed demographic information from the school attendance database such as age and academic program at the beginning of the study. All students completed the writing activities using Vexique, software I designed, as part of regular classroom activities. Informed consent procedures were described to students as detailed below. All students in the class consented to contribute data to the study. In the sample, 27 students reported they were female, 17 male and 1 reported as gender non-conforming. One participant was 16 years old at the time of the study, 27

students were 17 years old and 17 students were 18 years old. One student was of indigenous descent. The majority of participants were from the Early French Immersion (EFI) program (34) compared to the Late French Immersion (LFI) program (10); one participant was from the Francophone program.

Informed consent. Informed consent was obtained from participants before the study commenced. All participants were over the age of 16 and could provide legal consent. I also provided a letter describing the study which students carried home to parents.

I read aloud the consent forms and explained two writing activities would be completed by all students to practice for an upcoming FI Provincial exam. Participation in the study would allow the researcher to analyze lexical data they produced using Vexique. Participant identities would remain anonymous. It was explicit that students could withdraw access to their data at any point without any consequences. To accomplish this, their lexical output would be erased and excluded from analyses of data. All participants were given 30 minutes to review the consent form and parent letter after which time they were instructed to fill in the form by checking a box acknowledging agreement to participate or not, and signing the form. All students agreed to participate in the study and none subsequently withdrew.

3.2.2. Measures

Classroom requirements. Following informed consent, the study spanned four 75-minute class periods. The summary of each session is as follows:

- **Session 1:** I explained essay writing procedures, distributed a handout describing the activity and collected the handout after participants drafted essay 1.
- **Session 2:** Participants log in to Vexique, draft essay 1, correct spelling, submit, perform modifications based on frequency table feedback with available links to the online dictionary and thesaurus, provide explanations for revisions with or without replacements and submit.
- **Session 3:** Participants draft essay 2 in class on new topics.
- **Session 4:** Participants log in to Vexique, select second essay topic, type essay 2, correct spelling and submit.

Due to the slow typing speed of participants in French, as evidenced by previous classroom typing activities, students drafted their essays on paper in separate classroom sessions. There was concern learners would not have enough time to draft their essay and use the software effectively if they drafted using the computer keyboard.

Setting. Each participant worked on a school laptop in their classroom.

Software tool. Vexique is an online software tool designed to enhance lexical richness for FI high school students. Features were described in Chapter 2. Code for Vexique will be available in SFU's repository (see Appendix A).

Essay topics. Participants were required to write two essays. Three open-ended, argumentative essay topics from decommissioned Provincial exams were provided in Vexique. The essay topics, developed for high-stakes assessments, had been vetted over several years. In addition, Grade 12 FI students had already been exposed to similar types of essay questions from practice provincial assessments as part of regular classroom activities in both English Language Arts and French Language Arts courses although the essay topics identified in Vexique had not been used in classroom teaching. Students selected one of the three essay topics for their first essay and one of the two remaining topics for their second essay. These topics appeared on both handouts and Vexique. Translations were not provided to participants:

- Topic 1: La société dans laquelle nous vivons, est-elle tolérante ? (*Is the society in which we live tolerant?*)
- Topic 2: Le proverbe « Les actes valent plus que les paroles » s'applique-t-il à la société d'aujourd'hui ? (*Does the proverb "Actions speak louder than words" apply to today's society?*)
- Topic 3: Les cultures à travers le monde, sont-elles en train de perdre leurs particularités ? (*Are cultures around the world losing their peculiarities?*)

Evaluation tools. There are a multitude of measures for gauging lexical richness, many of which depend on text length (Torruella & Capsada, 2013) and require data that includes all POS classes. Since this study assigned brief essays and focussed only on four POS classes, traditional lexical analyses were inappropriate. As mentioned in the first chapter, lexical richness in this study was measured by two facets, lexical density (proportion of content words to total word count in each text) and lexical diversity (number of different word types).

Descriptive statistics characterized essay length (words), lexical density, lexical diversity, counts of repeated words and counts of explanation codes. In addition, a semantic field was created using the three most frequently replaced words for each essay topic. A full data table appears in Appendix A. Lexical output comparing each participant's first and second essays was evaluated through dependent-samples *t*-tests.

3.2.3. Procedures

Session 1

- **Explanation:** I explained and reiterated features of the writing activity at the beginning of each session by distributing a handout and reading aloud the instructions. I also explained students would be drafting essays on paper, then typing the essay into a webtool the following day when they would use Vexique to modify it. Participants selected their first essay topic by checking one of the boxes.
- **Draft essay 1:** After selecting a first essay topic, participants began writing their essays on paper and were given the rest of the class period to complete it. Instructions on the handout copied those of the Provincial exam:

Rédigez un texte d'opinion avec une introduction, un développement (deux ou trois paragraphes) et une conclusion sur le sujet présenté. Votre texte d'opinion devrait avoir 350 mots environ. (*Write an argumentative essay with an introduction, a development (two or three paragraphs) and a conclusion on the subject presented. Your essay should have about 350 words.*)

During the drafting stage, I did not answer questions regarding topic clarification, grammar, vocabulary, or any word translation, as these are the standard procedures for the FI provincial exam. Participants were prohibited from bringing cell phones to class and were asked not to speak during the activity unless they had a specific question for me. Once students completed their drafts, I collected them.

Session 2

- **Login and procedures:** Students arrived in class and were assigned to a computer. I distributed the essays drafted the previous day and requested each student log in to the system using a four-digit randomized code on the top of their handout. Any issues were solved on the spot. Several extra login codes were built into the system in case a code failed. Then, I explained (in French) the activity by demonstrating Vexique's features using the projector in the classroom. As needed, I helped learners access the webtool to commence.

- **Type essay 1:** Participants accessed Vexique, identified the essay topic and typed their essays in the field provided without changes or additions. After the essay was entered, I explained that Google Chrome would underline any misspellings in red which students were to correct prior to submitting the essay for review. Most spelling errors were exclusions of accents, thus, students copied and pasted accented characters from Vexique where necessary. Other spelling words were verified using the link to an online dictionary provided on the main page of Vexique. Once participants completed typing the drafts, they pressed submit. On average, students typed their 300-350 word essays in approximately 30-45 minutes.
- **Automated lexical feedback, replacements and explanation prompts:** After submitting the first essay, a POS tagger identified and tagged all words in the essay. Then, Vexique extracted all nouns, verbs, adjectives and adverbs appearing three or more times and displayed them as a list in order of word frequency. Students were instructed, however, to review all words appearing in the frequency table with four or more instances and replace repetitive words until this count of repetitions decreased to 3 or fewer. Each time a word was replaced, students were instructed to choose an explanation for the replacement in the pop-up window. They were also told to provide an explanation for any words that appeared more than three times in the essay but not replaced. I suggested that if a word appeared in a sentence two times or within close proximity, the word should be replaced with a synonym or a new word. Vexique provided a link to an online dictionary, www.wordreference.com and a thesaurus, www.synonymes.com, both frequently used in my classroom and familiar to students. These tools were provided to assist students in using more varied vocabulary.

Students were not allowed to correct their essay for grammar by consulting online tools such as *Le Bon Patron* as the purpose of this study was not to improve grammar. Since it was not possible to disable or restrict access to other websites during the study, I ensured these were not used by circulating continuously throughout the classroom. No participant attempted to use tools other than those provided within Vexique. Once all review tasks using Vexique were completed, students pressed submit which brought them to a thank you screen.

Session 3

- **Explanation:** Parameters of the activity were explained and reiterated. I distributed a second handout and read aloud the instructions, which were the same as the first.
- **Draft essay 2:** After selecting a second essay topic from the remaining two topics, students began writing their essays on paper and were given the rest of the class period to complete it. Once it was completed, I collected their drafts.

Session 4

- **Login and procedures:** Students arrived in class and were assigned to a computer. I distributed the handouts from the previous day and requested each student log in to the system using their code. Some of the access codes did not work and participants had to use their second code. I kept notes to ensure data from both sessions could be matched for these students.
- **Type essay 2:** After students logged in and identified one of the remaining two possible open-ended argumentative essay topics, they were brought to the main page of Vexique to commence entering their essays. Once students completed their essays and corrected spelling errors, they pressed submit. The POS tagger was activated for the second essay but the output was not shown to learners.

I scored essays using the 6-scale holistic rubric provided by the Ministry of Education for the essay section of the FI Provincial exam. Results were only used for a classroom score and as feedback for students preparing for this exam. These scores were not analyzed in this dissertation, as this measuring tool evaluates multiple features of writing that this dissertation does not address.

Chapter 4.

Results

4.1. Study purpose

This study investigated how Grade 12 FI students used a software tool that identifies lexical features of essays by prompting them to review, edit and justify word choices. The immediate aim was to extend L2 vocabulary used in argumentative writing. The ultimate goal was to create a software tool that effectively identifies lexical features of L2 students' writing as a basis for providing automated, personalized feedback to improve lexical richness.

4.2. Research questions

The following research questions guided the investigation:

1. Does automated feedback operationalized as metacognitive and explanation prompts increase lexical richness in FI students' essays?
2. Does vocabulary and lexical richness transfer to a second, parallel writing activity?
3. How did learners use features of the software tool?

4.3. Data examination, variable scoring and descriptive statistics

Analysis began by reviewing errors and outliers in software logs of student activity.

4.3.1. Errors

I had access to more data than did participants. Frequency tables, produced within Vexique, displayed for participants only content words that appeared more than three instances in the first essay. I had access to a frequency table of all content words

produced by each participant. I began analyzing data by reviewing frequency tables for words produced by each participant for each Essay 1a (draft), Essay 1b (edited/reviewed) and Essay 2. The algorithm used within Vexique identified and tagged words by part of speech (POS) for content words: nouns, verbs, adjectives and adverbs. Vexique misclassified some pronouns as *unknown* and included them in the output frequency table: *nous* (we), *vous* (you - plural), *elle* (she). Only some of these pronouns appeared in displays presented to a few participants. No other pronouns were identified, misclassified or displayed in the participants' frequency tables. In addition, my tables showed several prepositions were identified as *unknown* or a different class such as adverb. These included *dans* (in), *mais* (but), *donc* (therefore, so, thus), *avec* (with) and *pour* (for). Other pronouns – *leur* (their) and *ce/cette/ces* (this/that/these) – identified as *adjective possessif* and *démonstratif*, classes of adjectives which are older terms that have been replaced in the French language by the *déterminant* class. Several proper nouns were identified by Vexique, but these were visible only in my output.

To limit impact on data analyzed, each misclassification was managed in two possible ways. If the misclassified word was identified in the frequency table with less than four instances, it was removed from the frequency list, and not counted in the total content word count or for lexical variety. Learners did not see most of these in their frequency tables and were not instructed to review or replace them. If (a) the misclassified word was identified in the frequency table participants saw and were instructed to review, and (b) the term appeared in their work more than three instances, it was kept as part of the frequency count. If Vexique erroneously identified a noun, verb, adjective or adverb as *unknown*, it was included in the analyses.

4.3.2. Outliers

A total of 45 students participated in the study. All analyses, however, were applied to 43 students. One participant did not complete the second essay, so this participant's data were discarded from the study. One participant completed 600% more than the frequency table's suggested revisions. Keeping this participant's extreme data severely skews the mean for revisions made. Thus, I discarded this participant's data for statistical purposes. This case does, however, illustrate Vexique's capabilities and invites considerations by practitioners and software developers and is discussed in Chapter 5.

4.3.3. Data analyzed

- Total word count of essay 1a (draft version) and essay 2. These were used to calculate the average length of each essay. Total word count for essay 1b was defined the same as for 1a. Since participants could not edit the entire essay, only words identified in the frequency table, word count remained the same.
- Lexical density (proportion of content words – nouns, verbs, adjectives, adverbs - to total words) in essays 1a and 2. This was also used to calculate proportion of content words appearing four or more times in each essay.
- Number of content words reviewed but not replaced and words replaced in essay 1b (revised essay), as indicated by an explanation code.
- Lexical diversity - Word types for a type-token ratio in Essay 1a (draft), 1b (edited) and Essay 2.
- Count of each explanation code.
- List of the three most frequently replaced words for each participant binned by essay topic.
- Count of use of the thesaurus and/or dictionary feature of Vexique during essay 1a review, gathered via observational data during lessons using a chart created by the instructor.

4.4. Statistical findings

Results of statistical analyses are presented in reference to each research question.

1. Does automated feedback operationalized as metacognitive and explanation prompts increase lexical richness in FI students' essays?

Lexical richness was measured through lexical density and a rudimentary version of lexical diversity. Lexical density is calculated as a proportion of content words (nouns, verbs, adjectives and adverbs) to total words. Lexical diversity, the number of different word types, was calculated via several steps. All content words were lemmatized to their base form. Pluralization and feminization of nouns and adjectives were reduced to a base form and verb conjugations were reverted to their infinitive form. Only one instance of each lemma (word type) for individual participants was counted. Then, a type-token ratio (TTR) was calculated comparing content word types to the total number of content words. This is not a traditional method for calculating lexical diversity as most methods

measure all word types (function and content words) and are dependent on text length. Typical measures of lexical diversity are problematic as texts with many tokens give low values of TTR because more word types typically come with more word tokens in a text (Johansson, 2008). There are many proposed definitions for TTR designed to overcome some of these issues but none could measure what was required in this study.

During analysis, distributions were reviewed for symmetry. Skew statistics were within the acceptable range ± 3.0 indicating there were no serious departures from normality. As shown in Table 1, participants' first drafts had a mean content word TTR of 53%. This increased to 58% after the intervention (see Table 1). After confirming data were normally distributed, comparing these means with a dependent samples *t*-test reveals a statistically detectable difference in lexical diversity of Essay 1a compared to Essay 1b after receiving automated feedback, metacognitive and explanation prompts ($M = -.05$, $SD = .04$); $t(42) = -8.4$, $p = .001$, with an effect size ($d = 1.25$) exceeding Cohen's (1988) convention for a large effect size. This means Essay 1 became less repetitive and increased in word type variety.

Table 1. Lexical Richness - Essay 1a and 1b

	<i>N</i>	Min	Max	Mean	SD
Essay 1a - Original Draft					
Essay 1a - Total Words	43	235	545	392	76.45
Essay 1a - Lexical Density - Total content words	43	132	301	216	42.71
Essay 1a - Lexical Density - Proportion content words	43	50%	74%	55%	4%
Essay 1a - Proportion content words repeated 3+ times	43	3%	44%	23%	9%
Essay 1a - Lexical Diversity - Total different content word types	43	66	168	113	23.83
Essay 1a - Lexical Diversity - TTR content words	43	35%	73%	53%	9%
Essay 1b - Revised Draft					
Essay 1b - Lexical Diversity - Total different content word types	43	80	189	124	27.06
Essay 1b - Lexical Diversity - TTR content words	43	41%	82%	58%	10%

2. Does vocabulary and lexical richness transfer to a second, parallel writing activity?

The following analyses were conducted to investigate students' uses of features of Vexique to review repetitive vocabulary, replace select vocabulary with a variety of terms, and engage metacognition. The intention of this experiment was to investigate if lexical awareness and metacognitive skills were developed and transferred to a subsequent essay, with the result of improving lexical richness without prompts or

guidance. Essay 1a and Essay 2 were compared since both were unedited essays. Dependent samples *t*-tests revealed a statistically detectable difference in lexical density between Essay 1a and Essay 2 ($M = .04$, $SD = .05$, $t(42) = 5.2$, $p < .001$) with a large effect size, Cohen's $d = 0.8$; and lexical diversity (TTR) Essay 1a and Essay 2 ($M = -.04$, $SD = .13$); $t(42) = -1.9$, $p = .05$) with a small effect size, Cohen's $d = -0.3$. These statistics indicate that lexical richness persisted after treatment. Learners wrote a second essay with more content words and with a variety of word types.

Lexical repetition was also measured. A dependent samples *t*-test did not indicate a statistically detectable difference in the number of vocabulary words repeated more than three times in Essay 1a and Essay 2 ($M = .01$, $SD = 0.11$, $t(42) = .73$, $p = .469$). Table 2 presents descriptive statistics. This reveals lexical repetition also persisted after the intervention. Although learners wrote more content words and used more word types, they wrote Essay 2 with as much repetitious vocabulary as their first essays.

Table 2. Lexical Richness Essay 1a and Essay 2

	N	Min	Max	Mean	SD
Essay 1a – Original draft					
Essay 1a - Total Words	43	235	545	392	76.45
Essay 1a - Lexical Density - Total content words	43	132	301	216	42.71
Essay 1a - Lexical Density - Proportion content words	43	50%	74%	55%	4%
Essay 1a - Proportion content words repeated 3+ times	43	3%	44%	23%	9%
Essay 1a - Lexical Diversity - Total different content word types	43	66	168	113	23.83
Essay 1a - Lexical Diversity - TTR content words	43	35%	73%	53%	9%
Essay 2					
Essay 2 - Total Words	43	256	531	360	65
Essay 2 - Lexical Density - Total content words	43	126	277	184	36
Essay 2 - Lexical Density - Proportion content words	43	44%	62%	51%	4%
Essay 2 - Proportion content words repeated 3+ times	43	3%	48%	22%	11%
Essay 2 - Lexical Diversity - Total different content word types	43	40	141	103	21
Essay 2 - Lexical Diversity - TTR content words	43	17%	84%	57%	12%

All participants except one showed some improvement using Vexique. The majority, $N = 39$, improved their lexical diversity during the intervention between Essay 1a and 1b. One participant decreased their lexical diversity by 1%. This student replaced a unique term that was repetitive with a word type that already appeared in the essay. But, this participant decreased lexical repetition from 11% in Essay 1a to only 4% in Essay 2. Three participants made very few revisions. As such, they did not increase in lexical variety between Essay 1a and Essay 1b. One, however, improved very slightly in

lexical repetition in Essay 2 and another increased in lexical variety in Essay 2. One participant completed only 7 revisions including replacements. This was the least engagement of any participant. Due to lack of engagement, this participant did not improve in any facet of lexical richness between any of the essay pairings.

Other dependent samples *t*-tests were conducted to compare the proportion of content words repeated more than three times in Essay 1a and Essay 2 across various factors such as FI program type and essay topic types. One participant's data was excluded from this analysis as this student is Francophone and was raised in a French speaking country from birth until Grade 9. This participant has been in FI classrooms for three years. Results are summarized below. There was no statistically detectable difference between the number of content words repeated more than three times between Essay 1a and Essay 2 for learners originating from different FI programs. Because these programs vary in L2 language acquisition philosophies, these results may prompt further investigations.

EFI (Early French Immersion Program) N = 33

Lexical density: Essay 1a and Essay 2 ($M = .05$, $SD = .06$, $t(32) = 4.73$, $p = .001$)

Lexical diversity: Essay 1a and Essay 2 ($M = -.03$, $SD = .13$, $t(32) = -1.15$, $p = .260$)

Repetition: Essay 1a and Essay 2 ($M = .01$, $SD = .10$, $t(32) = .593$, $p = .557$)

LFI (Late French Immersion Program) N = 9

Lexical density: Essay 1a and Essay 2 ($M = .03$, $SD = .04$, $t(8) = 1.83$, $p = .10$)

Lexical diversity: Essay 1a and Essay 2 ($M = -.06$, $SD = .08$, $t(8) = -2.2$, $p = .06$)

Repetition: Essay 1a and Essay 2 ($M = .01$, $SD = .14$, $t(8) = .211$, $p = .838$)

Essay topics were examined for effects on the number of content words repeated. Later in this chapter, I show that participants who chose essay topics 1 and 3 produced a high number of repetitive vocabulary deriving from the essay topic question. Results of dependent-samples *t*-tests, below, indicate there were no statistically detectable differences between essay topics, lexical richness and repetition.

Essay 1a (topic 1) & Essay 2 (topic 2) N = 13

Lexical density: Essay 1a and Essay 2 ($M = .05$, $SD = .03$, $t(12) = 5.4$, $p = .001$)

Lexical diversity: Essay 1a and Essay 2 ($M = -.02$, $SD = .07$, $t(12) = -1.0$, $p = .318$)

Repetition: Essay 1a and Essay 2 ($M = .001$, $SD = .10$, $t(12) = .06$, $p = .953$)

Essay 1a (topic 2) & Essay 2 (topic 1) N = 11

Lexical density: Essay 1a and Essay 2 ($M = .04$, $SD = .04$, $t(10) = 3.08$, $p = .01$)

Lexical diversity: Essay 1a and Essay 2 ($M = -.07$, $SD = .09$, $t(10) = -2.4$, $p = .04$)

Repetition: Essay 1a and Essay 2 ($M = .04$, $SD = .13$, $t(10) = 1.15$, $p = .274$)

Essay 1a (topic 1) & Essay 2 (topic 3) N = 4

Lexical density: Essay 1a and Essay 2 ($M = .02$, $SD = .05$, $t(3) = .89$, $p = .441$)

Lexical diversity: Essay 1a and Essay 2 ($M = -.09$, $SD = .13$, $t(3) = -1.4$, $p = .265$)

Repetition: Essay 1a and Essay 2 ($M = .05$, $SD = .11$, $t(3) = .86$, $p = .451$)

Essay 1a (topic 3) & Essay 2 (topic 1) N = 2

Lexical density: Essay 1a and Essay 2 ($M = -.004$, $SD = .05$, $t(1) = -.11$, $p = .929$)

Lexical diversity: Essay 1a and Essay 2 ($M = .03$, $SD = .03$, $t(1) = 1.2$, $p = .446$)

Repetition: Essay 1a and Essay 2 ($M = -.09$, $SD = .1006$, $t(1) = -2.3$, $p = .263$)

Essay 1a (topic 2) & Essay 2 (topic 3) N = 8

Lexical density: Essay 1a and Essay 2 ($M = .04$, $SD = .05$, $t(7) = 2.5$, $p = .04$)

Lexical diversity: Essay 1a and Essay 2 ($M = .06$, $SD = .16$, $t(7) = 1.0$, $p = .342$)

Repetition: Essay 1a and Essay 2 ($M = .002$, $SD = .05$, $t(7) = .145$, $p = .889$)

Essay 1a (topic 3) & Essay 2 (topic 2) N = 5

Lexical density: Essay 1a and Essay 2 ($M = .07$, $SD = .12$, $t(4) = 1.3$, $p = .253$)

Lexical diversity: Essay 1a and Essay 2 ($M = -.18$, $SD = .19$, $t(4) = -2.1$, $p = .101$)

Repetition: Essay 1a and Essay 2 ($M = .005$, $SD = .14$, $t(4) = -.07$, $p = .946$)

Overall these results show that after one use of Vexique, participants' lexical richness improved on a subsequent essay but there were no statistically detectable differences in the proportion of vocabulary repeated over three times. This conclusion is not surprising. Using a software tool of this nature in a FL classroom or any high school L2 course is new and would likely require multiple uses before seeing more beneficial results.

3. How did learners use features of the software tool?

Participants frequently used features of the software tool aside from using the dictionary tool during review. Only 3 participants of 43 used the dictionary during the revision process (as opposed to correcting spelling) while 31 participants used the thesaurus (see Discussion). All words reviewed, those changed and those not, were identified by an explanation code, which indicated if participants edited their essays. If participants did not select a code during the revision process, the system could not identify if learners reviewed the identified words.

Explanation codes for revisions with and without replacements: participants were directed to review each content word highlighted and displayed in the frequency table in Vexique and determine whether the word should be replaced with a synonym, a new word or left as the original word. In each instance of this review process, participants

were instructed to attribute an explanation for their choice to change a word or not by selecting one of the options provided in a hover window. Below is a list of the codes available to participants:

Explanation codes for revision with replacements:

- Code 1: Le nouveau mot est plus précis. (The new word is more precise).
- Code 2: Le nouveau mot varie le vocabulaire. (The new word varies vocabulary).
- Code 3: Le nouveau mot est plus sophistiqué. (The new word is more sophisticated).

Explanation codes for revisions without replacements:

- Code 4: Le mot original est déjà précis. (The original word is already precise).
- Code 5: Le mot original n'est là qu'une fois. (The original word only appears once).
- Code 6: Le mot original est déjà sophistiqué. (The original word is already sophisticated).

Essay 1b revision statistics indicate that the majority of repetitive words in the essays were reviewed by participants (see Table 3).

Essay 1b revisions **without** replacements – all words reviewed but not replaced as indicated by the code. Of a mean total of 51 words identified as appearing more than three times, a mean of 35 words (81%) were reviewed. And, 35% of these were revisions only where participants chose not to replace the word.

Essay 1b revisions **with** replacements – all words changed as indicated by the code. Participants in this study made a mean total 19.91 (45%) changes of words identified by Vexique in the frequency table. This indicates that almost half the words Vexique identified as candidates for change were changed. The minimum number of replacements made was 6 (8%) and the maximum 88 (300+%).

Table 3. Essay 1b Revision Statistics

	N	Minimum	Maximum	Mean	SD
Essay 1b					
Total content words repeated 3+ times	43	5	127	51.14	26.42
Proportion of content words repeated 3+ times	43	3%	44%	23%	9%
Total revisions without replacements	43	-1	55	15	14.88
Proportion of revisions without replacements	43	-2%	262%	35%	45%
Total revisions with replacements	43	6	88	35	24.71
Proportion of revisions with replacements	43	8%	395%	81%	70%

The most used code for making replacements was explanation 2, The new word varies vocabulary. This shows that participants preferred varying their vocabulary, the purpose of the study. Since students were aware of the goal of the study through the consent forms and parent letters, these may have swayed participants to select this particular code. Explanations 1, The new word is more precise, and 3, The new word is more sophisticated, were also equally employed to explain their word replacements as either making their vocabulary more precise or more sophisticated (see Table 4).

The most frequently used code for revisions without replacements was participants' judgment that words they used in the draft meant precisely what they intended, so they chose not to revise. Word revisions were frequent for content words that were repeated multiple times throughout the essay. Choices to revise to use a more sophisticated word were relatively few. This could be due to the lack of clear definition of the word "sophisticated"; participants may not have known how to qualify a vocabulary word as sophisticated due to underdeveloped metalinguistic language skills and their overall lexical skills. (See Table 4).

Table 4. Explanation Codes Used

Explanation codes for revisions completed on draft essay (Essay 1b)		<i>N</i>	Maximum use	Sum of all occurrences
Revision with replacements	Code 1: Le nouveau mot est plus précis. <i>(The new word is more precise)</i>	35	13	171
	Code 2: Le nouveau mot varie le vocabulaire. <i>(The new word varies vocabulary)</i>	42	40	511
	Code 3: Le nouveau mot est plus sophistiqué. <i>(The new word is more sophisticated)</i>	36	18	168
Total number of revisions with replacements completed in Essay 1 (N=43)				850
Revision without replacements	Code 4: Le mot original est déjà précis. <i>(The original word is already precise)</i>	34	47	394
	Code 5: Le mot original n'est là qu'une fois. <i>(The original word only appears once)</i>	34	27	216
	Code 6: Le mot original est déjà sophistiqué. <i>(The original word is already sophisticated)</i>	10	9	28
Total number of revisions without replacements completed in Essay 1 (N=43)				638

Most frequently changed words: Recording which words were most frequently repeated and subsequently changed provides FI teachers with lexical information to tailor instruction to meet learner needs. For each essay topic, participants employed a very limited scope of vocabulary. This suggests a starting off point for vocabulary acquisition and words with which to apply synonyms or new words. This information also provides lexical information to the field of L2 vocabulary acquisition to generate lexical information to be used in further studies and creating pedagogical resources. The following table lists the three most frequently changed words for each participant categorized by essay topic. In this table, *N* = 42 as one participant (as indicated by * in the table) only made two replacements and therefore did not have a list of their three most frequently changed words. Every other participant generated three most replaced words in their first essay. All words were grouped and counted to produce the frequency tables below. Essay topics 1 and 2 had a wider variety of most frequently replaced words: Topic 1 (24 words), Topic 2 (23 words) and Topic 3 (9 words). The latter count

can be attributed to the small number of participants per topic. The table also shows that all participants employed similar words as some appear in multiple topics.

The most frequently changed word types were nouns. Table 5 lists the most frequently changed words across all three essay topics categorized by POS type in descending order of total count.

- 15 nouns including: *actions, choses, culture, fusils, gens, jugements, monde, mots, paroles, personnes, phrase, problèmes, proverbe, société, technologie*
- 6 adjectives: *grand, même, notre, quelques, tolérante, tout*
- 4 adverbs: *aujourd'hui, aussi, beaucoup, plus, vraiment*
- 4 prepositions: *avec, dans, mais, pour*
- 4 verbs (with variations of the verb être): *être, sont, sera, peut, pense, vivons*
- 1 conjunction: *parce que*
- 1 pronoun: *nous*

This information shows the majority of frequently repeated word types are nouns. Using Vocabprofile I input the 15 nouns above to assess their lexical sophistication. This tool is intended to be used on a whole text rather than with select POS classes. But, as a point of interest and to show that FI learners use basic vocabulary when writing, I investigated whether the most frequently repeated terms used in my study were from high or low frequency lists. In French, 25 lists were developed in ascending order from highest frequency terms (K1 list) to lowest frequency terms (K25 list). Not surprisingly, 10 nouns were from the highest frequency list (the K1 list: *actions, choses, culture, gens, monde, mots, paroles, personnes, problèmes, société*), three were from the second highest frequency word list (K2 list): *jugements, phrase, technologie*). The word *fusils* was found on the K4 list and *proverbe*, used to formulate the topic, was from the K6 list. And, all the verbs, adjectives and adverbs above appeared on the K1 list. Even though traditional analyses of lexical sophistication were not conducted in this research, the simple analysis of the most frequently repeated terms in my study were from high frequency vocabulary lists demonstrating that intermediate L2 FI learners do not employ sophisticated content vocabulary.

A semantic field was generated with the most frequently produced content words. This provides useful information to FI students and teachers and is discussed further in Chapter 5. (See Table 5)

Table 5. Most Frequently Changed Words Produced by Participants Across All Three Topics

Essay 1 – TOPIC 1 <i>La société dans laquelle nous vivons, est-elle tolérante ?</i> N = 17*				Essay 1 – TOPIC 2 <i>Le proverbe « Les actes valent plus que les paroles » s'applique-t-il à la société d'aujourd'hui ?</i> N = 18				Essay 1 – TOPIC 3 <i>Les cultures à travers le monde, sont-elles en train de perdre leurs particularités ?</i> N = 7				
POS	Most frequently changed words	Total instances	Reduced to	POS	Most frequently changed words	Total instances	Reduced to	POS	Most frequently changed words	Total instances	Reduced to	
N	Société	98	37	P	Pour	59	20	N	Culture	67	38	
P	Pour	61	37	Av	Plus	40	17	N	Monde	39	14	
Av	Plus	40	23	P	Dans	38	22	Aj	Quelques	9	5	
N	Gens	21	4	P	Mais	24	13	N	Actions	8	6	
Av	Beaucoup	17	8	P	Avec	23	7	N	Gens	8	3	
P	Mais	15	6	N	Mots	17	7	Av	Plus	7	6	
Aj	Tolérante	11	3	N	Actions	15	7	N	Société	7	3	
C	Parce que	10	8	V	Sont	14	9	P	Dans	7	2	
N	Personnes	10	2	N	Personnes	14	11	V	Pense	5	3	
Aj	Tout	9	6	N	Proverbe	13	7	POS Totals				
P	Dans	9	4	N	Paroles	11	10	N	= 5			
N	Technologie	8	6	N	Société	8	3	V	= 1			
P	Avec	8	5	N	Gens	7	3	Aj	= 1			
V	Être	7	5	V	Faire	7	3	Av	= 1			
N	Choses	6	5	N	Problèmes	6	3	P	= 1			
Aj	Quelques	6	5	N	Phrase	6	3					
N	Jugements	6	3	N	Choses	6	3					
Pro	Nous	6	3	Av	Aujourd'hui	6	2					
V	Sera	5	4	V	Être	5	4					
Aj	Notre	4	3	N	Fusils	5	3					
V	Vivons	4	2	V	Peut	5	3					
Av	Vraiment	4	2	Av	Aussi	4	2					
Aj	Même	3	2	Aj	Grand	4	1					
POS Totals				N	Monde	3	2					
N	= 6			POS Totals								
V	= 3			N	= 12							
Aj	= 5			V	= 4							
Av	= 3			Aj	= 1							
P	= 4			Av	= 3							
C	= 1			P	= 4							
Pro	= 1											

LEGEND
 N = Noun
 V = Verb
 Aj = Adjective
 Av = Adverb
 P = Preposition
 C = Conjunction
 Pro = Pronoun

The following is a breakdown of each essay topic and the top three repeated words.

Topic 1: La société dans laquelle nous vivons, est-elle tolérante ?

Société (noun: society): 98 instances reduced to 37 - This was the single most frequently employed word for essay topic 1. This shows participants used the word from

the essay topic question repeatedly instead of also employing synonyms or new words. Once reviewed by participants, this word was replaced in more than half of all instances.

Pour (preposition: for): 61 instances reduced to 37 - This was a preposition that was misclassified by the POS tagger in Vexique but was kept for the integrity of the data. The number of instances this word was employed was reduced by almost half.

Plus (adverb: more): 40 instances reduced to 23.

Topic 2: Le proverbe « Les actes valent plus que les paroles » s'applique-t-il à la société d'aujourd'hui ?

Pour (preposition: for): 59 instances reduced to 20 – as above, this preposition was misclassified Vexique but kept for the integrity of the data. The number of instances this word was employed was reduced by two thirds.

Dans (preposition: in): 38 instances reduced to 22 - This was a preposition that was misclassified by the POS tagger in Vexique but was kept for the integrity of the data.

Plus (adverb: more): 30 instances reduced to 17.

Topic 3: Les cultures à travers le monde, sont-elles en train de perdre leurs particularités ? (Are cultures around the world losing their particularities (individual features)?)

Cultures (noun: cultures): 67 instances reduced to 38 - This was the single most frequently employed word for essay topic 3. This shows that participants used the word from the essay topic question repeatedly instead of also employing synonyms. Once reviewed by participants, this word was replaced by almost half of all instances.

Monde (noun: world): 39 instances reduced to 14 - Again, this word formulated the essay topic question and was the second most frequently employed word for essay topic 3. Once reviewed by participants, this word was replaced by more than half of all instances.

Chapter 5.

Discussion

5.1. Study findings

Results show the features in Vexique enabled students to make lexical changes to an essay by varying initial choices for L2 vocabulary, making their draft essays less repetitive by increasing lexical variety. Moreover, increased lexical richness transferred to a subsequent essay task. However, despite increased variety in vocabulary, students continued to employ repetitive language. There may be several possible reasons for this. Using the lexical features of Vexique on one occasion may not provide learners with enough practice to transfer new lexical knowledge or metacognitive understanding of their language skills to another writing task. Indeed, participants had never engaged in vocabulary choice and review activities in this manner. It might be beneficial to use Vexique over several classroom sessions to help learners develop metalanguage and metacognitive skills to review and vary their vocabulary and explain their choices.

5.2. Evaluation of results

5.2.1. Lexical Richness: lexical density and diversity

Lexical richness in Essay 1a increased after revisions and replacements were completed. Essay 2 also showed augmented lexical richness from Essay 1a. There was a statistically detectable shift in lexical density and content word diversity following the revision process and on a second essay without review. The lexical frequency table displayed to participants helped them refrain from repetitive replacements. Analyses also showed, however, there were no statistically detectable differences in the number of repetitive content words populating Essay 1a and Essay 2. Although these results may look disappointing, they are not surprising. Extensive use of the tool to complete revisions, using the explanation prompts and developing metacognitive revision skills is hypothesized to improve lexical richness. Future research using this tool may show improved results. In addition, a true evaluation of lexical richness would have also assessed lexical sophistication.

5.2.2. Lexical Repetition

Although lexical repetition decreased during the review process of Essay 1a to 1b, students wrote equally as repetitively in Essay 2. These findings may be related to research in L2 synonymy which shows that L2 learners learn synonyms later in their L2 education (Webb, 2007). Therefore, one might predict students at this level of study in an L2 would be able to consider employing synonyms when writing. Higa (1963), however, found that synonyms are more difficult to learn than new unrelated words. Other research demonstrates vocabulary that is semantically linked is more challenging to acquire and can incur more errors (Higa, 1963; Laufer, 1990; Tinkham, 1993 & Waring, 1997). For instance, synonyms do not share identical semantic features and therefore cannot be used in all contexts (Laufer, 1990). Moreover, L2 learners prefer learning the meanings of new words over new synonyms related to known words (Laufer, 1990). Thus, it is recommended that this study be replicated with modifications such as programming Vexique to generate a list of all words used as replacements. This list could provide information for extension activities in the classroom. Working more in depth with these after using Vexique might enable students to learn and practice new words and considering synonyms for known words. This list could also provide classroom instructors with specific information about student lexical knowledge that can then be adapted for classroom instruction. The following sections of this chapter describe limitations, an evaluation of the results, their importance, suggestions for future iterations of Vexique and directions for future research.

5.2.3. Learner Engagement

Other results from the study indicate learner engagement with the tool as measured by use of its features. This level of engagement could be important in further developing this software as an instructional tool for the classroom. For instance, of the total proportion of content words identified by Vexique for review, a mean of 81% were reviewed (assessed and replaced or not replaced) by participants. This not only indicates that learners used the main feature of the tool to guide them; it also shows they reviewed the majority of words identified.

Some participants did not complete many revisions. For example, one participant only completed 8% of the revisions suggested by Vexique's frequency table, while

several others completed more revisions than indicated in the table. All content words were highlighted in the text and were thus, able to be edited even if some words did not appear in the frequency table. One exceptional participant completed over 600% of the suggested revisions. Although this case was discarded from data analyses as an outlier, it does provide information regarding learner motivation. Features could be built into the system to encourage engagement. For instance, to promote metacognitive revision skills, the system could be programmed to require a user to provide, prior to submission, an explanation in the pop-up window for all words identified in the text. The proportion of revisions could be an indication of learner motivation and decision making about whether lexical richness is useful. For example, participants who completed fewer revisions than the number of words identified in the frequency table could indicate a low level of learner motivation. As mentioned in the previous chapter, one participant completed the least number of revisions. This low level of engagement could be the reason this participant did not show improvements on any factor of lexical richness in either essay. This makes a case for using the features of the tool to ensure improvements in lexical richness. In addition, some participants may have reviewed more words but did not select an explanation, and their revisions were unable to be tracked. As mentioned, very few participants used the dictionary tool. There is an issue with exclusively using a thesaurus because learners could simply choose an alternative synonym without understanding it or if it appropriately fits the context of the replacement. Selecting a synonym and then verifying its precise definition would improve the revision process.

5.3. Research Implications

First and foremost, results of the study make a case for using a software tool to quantify lexical richness in FI L2 writing activities. These analyses provide evidence supporting claims of previous research that intermediate L2 learners do, in fact, write quite repetitively. Every feature built into Vexique was used by participants signaling its usability as a FI classroom tool to provide FI students and teachers with automated, personalized and actionable feedback. Students: 1) receive information on vocabulary use through visuals including highlighted text and a frequency table; 2) have access to tools to make changes, including a thesaurus and dictionary to learn synonyms to replace frequently used words; and 3) are provided explanation prompts to develop metacognitive skills, which will further develop a student's lexicon.

Second, this study makes an important contribution to researchers in the French immersion community as it provides empirical evidence about lexical qualities of FI student writing. As such, this work describes a tool for FI programs that can inform instructional practices including vocabulary acquisition, synonymy, spelling and writing practices. Teachers are provided with lexical data including frequency tables of high and low frequency words and the scope of vocabulary employed by learners, which could help tailor lessons and alleviate some forms of writing assessment since the tool completes this type of assessment of lexical richness.

Third, the tool provides a classroom resource specifically tailored to the needs of FI learners. Much of what exists is for native speakers of French or beginner language learners and misses this unique group of L2 learners. In addition, Vexique helps FI students with vocabulary review in authentic and personalized written contexts to enhance their L2 education.

Finally, it provides evidence in support of applying Hulstijn and Laufer's (2001) Involvement Load Hypothesis to L2 vocabulary acquisition and retention tasks originally intended for new words. Vexique's features were founded and rated using the involvement load index developed by these authors.

5.4. Limitations

5.4.1. Technical Limitations

Feature 1: Text Input Field

Keyboarding in French was a challenge for participants in this study due to lack of practice and the configuration of the Anglophone QWERTY keyboard which increases cognitive load when keyboarding in French (Gondree, 2013). The keyboard on the computers used in this study could have been reconfigured to a French keyboard, but this would have only decreased cognitive load if learners were familiar with it, which they were not. All participants used the Anglophone QWERTY keyboard.

As mentioned in the Methods chapter, participants were asked to draft their essays on paper due to their slow typing speed. Even with the help of a hand-written draft, I observed learners were still quite slow typists. It took them almost half the

session (45 min) to type out the essays previously written by hand. This may have affected how long participants had to review their first essays.

Future iterations and uses of the tool could involve more in-class French typing practice to aid learners in developing their typing speed. Despite their lack of speed, it was essential that participants practice this skill prior to their online Provincial exam.

Feature 2: Word Frequency Count and revision output:

Vexique's algorithm misclassified several pronouns and prepositions as *unknown*. Some that did appear in the output frequency table for students were not intended. Nonetheless, learners reviewed them per instructions. This did not have a negative impact on the study results. However, Vexique could improve POS tagging in future iterations of the tool.

Feature 3: Replacement and Prompted Explanations

The replacement and explanation window did not require learners to generate explanations, known as self-explanations, (their own reasons for replacing a particular word or not), which have been effective in knowledge building (Conati & Vanlehn, 2000). Future iterations of Vexique could scaffold learners to generate self-explanations after multiple logins. However, without the prompts in early sessions using Vexique, they would not yet have acquired metalanguage to produce succinct and helpful self-explanations without causing extraneous cognitive load.

Other technical limitations with revision display

All words highlighted by Vexique were able to be edited and reviewed. But, words that were not highlighted could not be edited. This was an issue in some cases where sentence structure and grammar needed adjustment when words were replaced, e.g., requiring different grammatical markers such as masculine / feminine articles before certain nouns or pluralization. To address this limitation, learners were instructed to make necessary grammatical changes in parentheses in the pop-up replacement window to indicate that they understood that their new word choice required a change to other elements of the sentence. Further iterations of Vexique would enable all text in the document to be edited.

Vexique did not track clickstream data when participants clicked on the dictionary or thesaurus link for the purpose of review. The researcher took observational notes during the study and carefully indicated which students used these links. A future version of the software could track these data automatically.

5.4.2. Other limitations

The notion of metacognition is at the crux of this webtool. The aim was to prompt participants' metacognitive skills regarding lexical richness in French, which presupposes that they do not possess these. However, it was unclear if metacognition about lexical richness was already active for these participants when writing compositions in their L1, English.

The study was conducted for doctoral research in a public secondary school environment. The school district in which the study was conducted follows a semester system where the school year is divided into two semesters. Each semester is comprised of 5 months of instruction in the course every day. Conducting doctoral research, obtaining the appropriate permissions and working around National and Provincial Exam schedules within a tight timeframe was a challenge to the study. In addition, the school in which the research was conducted only had two Grade 12 groups of students offered in the first semester. Neighbouring FI schools within the same district did have multiple Grade 12 classes but did not have access to the computer equipment needed for the study.

5.5. Future iterations of the tool

Future improvements to Vexique would optimize its use for the FI L2 classroom. Making changes to the technical limitations outlined above would be the first wave of improvements. In addition to these changes, other aspects of the tool could be adjusted. For example, detailed definitions of each explanation prompt could be available to users. Since research indicates that L2 learners frequently employ common and basic words, it is understandable that when given the chance to review and replace a word choice they will qualify their choice by explaining that the new word or synonym is more precise or sophisticated, but whether the word they chose is more sophisticated or precise may not be the case. Providing detailed definitions of the explanation prompts could help them

better understand the prompt to aid in selecting the most appropriate explanation and help learners develop the metacognitive skills to improve their lexical richness on other writing activities. Moreover, since lexical sophistication was not measured, it may be beneficial to build this into the tool. Incorporating a lexical sophistication scale where students could verify or compare vocabulary revisions and replacements may impact metacognition and aligns with the Involvement Load Hypothesis' evaluation factor. Testing the notion of evaluating word choice for its sophistication and for context could provide different results. This addition would also make a greater case for evaluating lexical sophistication if learners are given the opportunity to review it.

In addition, after conducting this research, it was evident that the extent to which Vexique exhibited involvement load needed modification. *Search* was adjusted from strong to moderate since learners had access to lexical language tools but exclusively used the thesaurus rather than dictionary. Future iterations of this webtool could require use of the dictionary by only allowing participants to advance if they have accessed the dictionary or provide access to a better language resource that incorporates a dictionary and thesaurus such as Antidote.

5.6. Future research, practice and theory

Based on the results of this study, further research is recommended to test whether the features of this software tool are effective in helping improve FI students' lexical richness in L2 productive writing activities. It would be useful in future research with Vexique to span writing activities across an entire semester or school year. Using the tool over this longer time period may improve lexical richness. This tool should also be tested with younger students and perhaps in different L2 language contexts.

In addition, some elements of the vocabulary task listed in Vexique could be altered. For instance, students were instructed to review and replace vocabulary repeated four times or more. This could have been problematic since some terms accurately describe intentions or content and have few synonyms or other words that can meaningfully replace them. Changing such words could have a negative impact on meaning. Moreover, perhaps the term that was repeated was, in fact, a sophisticated term. Different instructions such as asking students to review lexical richness, without giving them a specific target to attain, may yield different results. As well, having an

analogous writing sample in participants' L1, English, could provide insight into metacognitive skills they already have in their L1 and if these are deficient in French due to increased cognitive load in writing in their L2.

Future studies should also test in what ways learning analytics produced by Vexique can be used to inform teaching practice and vocabulary acquisition. The frequency lists could be used to generate semantic fields used by teachers to provide more tailored vocabulary lessons on synonyms and word choice to aid learners to vary their lexicon and provide more precise lexical choices keyed to their writing. Vexique could generate a list of replacement words selected by students that teachers could employ in extension activities. Teachers could have students work with this vocabulary by looking up definitions, and using them in productive writing tasks such as sentence and paragraph writing. Each use of Vexique could produce a new list of terms to be used in the classroom.

Vexique was designed to be useable by secondary students and teachers to facilitate identifying repetitive vocabulary, and develop metacognition and lexical richness. As such, it would be pertinent in future work to survey adolescent participants and their instructors about how they utilized the software's features. Questionnaires, focus groups and interviews could reveal in what ways Vexique was used and how it could be enhanced. To engage students, some elements of gamification could be introduced. Points, rewards or progress graphics could be added to encourage revisions and make it more entertaining and motivating to use the tool.

Other software exists to help L2 French learners with correcting productive writing. Examples include a free webtool, le Bon Patron, and a paid subscription software available online and mobile devices, Antidote (10, +, Mobile, Web) by Druide. Le Bon Patron allows users to input text and receive grammatical feedback including highlighting errors, corrections and explanations. The system effectively corrects French text and can provide insight into grammatical revisions if the user is motivated to complete the corrections and read the explanations. The system, however, will provide an accurate correction without effort from the user. Antidote is a software resource for English and French writing. It provides a multitude of features including a dictionary for definitions, grammar, and spelling, a thesaurus, word rarity, and vocabulary occurrences in the language (i.e. an aspect of lexical sophistication), repetition, to name a few. While

these tools can correct L2 French writing and provide language supports, they do not require the learner to develop metacognitive skills needed to improve writing over time independently. Vexique is not meant to replace such resources. It was created to focus solely on lexical richness and incorporated features grounded in the Involvement Load Hypothesis (Hulstijn & Laufer, 2001). Its aim was to support an investigation into results of drawing the FI learner's attention to repetitive lexical usage, using data visualizations, and encouraging the development of metacognition in service of improving lexical proficiency.

Vexique could also be used by FI teachers to improve their lexical richness. There have been concerns, for several decades, about the French language competency of FI teachers (Veilleux & Bournot-Trites, 2005; Kline-Martin, 2018). There is some research suggesting that, as the FI teacher shortage continues across Canada, and in British Columbia, so does the risk of employing instructors with deficiencies in language skills (Paradis, 2018). Some studies have found that one factor in FI teacher attrition rates is attributed to a lack of confidence in their French language skills (Carr, 1999; Kline-Martin, 2018). Vexique could encourage FI teachers to develop their language proficiency autonomously.

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Appendix A.

Vexique code

Vexique was coded by Mathew Hill in two parts using Javascript and a database handled by MongoDB, a source-available document database used to store participant essays and changes. Node.js (nodejs.org) provides Javascript open-source package management for server-scripting. Vexique itself is an unpublished node.js package that uses the following packages: <nlp-js-tools-french> - French language natural language processing used to parse user essays. <mongodb> - official Mongo driver. <express> - minimalist web framework handles HTTP requests. <express-session> - user sessions for session authentication. <session-file-store> - file storage for express sessions. <body-parser> - middleware to get the DOM from express. <dom-parser> middleware to get HTML from the DOM.

Vexique requires a Mongo database containing a collection with the name "mydb". This database can be local or remote, but the address is hardcoded as a global variable in the first dozen lines of server.js.

Vexique is comprised of four webpages: login, administration, essay entry, and essay review. The login page consists of a single field. Once a user ID is submitted, they are redirected to essay entry or review. The admin ID redirects to the administration page, where essay topics and users can be added or removed and where submitted essays are viewed with word counts. Running Vexique consists of two files: package.json and server.js. The current active deployment is hosted, both server and database, at nodechef.com. The domain Vexique.com points at the nodechef deployment. Database Install MongoDB from mongodb.com. Web Server Install NodeJS and NPM (node package manager) from nodejs.org. At the filepath of package.json and server.js execute "npm install". NPM will install the packages provided by name in package.json. Execute "node vexique". Node will read server.js and launch Vexique.

Upon launch, Vexique connects to the local database on default MongoDB port 27017 and prints a message stating so to the web console. Then Vexique opens the default web traffic port 80 and listens for incoming HTTP. An instance of the natural language processing tools is then created during which a French parts-of-speech

tagger** is unpacked. Vexique filters the POS tagger to only display nouns, verbs, adjectives and adverbs to the user, rather than all parts of speech. At this point another message is printed to the web console and the website is accessible. The administrator then adds topics and user ids from the administration page. The first time a user logs in, they are presented with all the topics. They select a topic and submit an essay. The user is then redirected to the essay review page, where they make changes and submit the revised essay and log out. When the user ID is next entered, the user is presented with the topics they did not choose and they submit a second essay and are logged out. Subsequent use of the user ID will redirect to a message that the user has already completed the task.

****TreeTagger:** developed by Helmut Schmid in the TC project at the Institute for Computational Linguistics of the University of Stuttgart. Uses a Markov model that uses a decision tree to predict sequences of words. His final version was 97% accurate. <https://www.cis.uni-muenchen.de/~schmid/tools/TreeTagger/>

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Appendix B.

Data table

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
1	Participant	Gender	Age	Program type	Total words	Total content	Percent content	Repetition coefficient	Percent repetition	Replacement	percent replacement	E1 a variety	E1 b variety	increase	percent increase	E1 a TTR content	E1 b TTR content	revisions	percent revisions	revisions on	E1 b Percent	E2 total words	E2 content	E2 percent content	E2 repetition	E2 percent repetition	E2 variety	E2 TTR content
2	788	2	17	2	524	290	0.55	96	0.33	11	0.11	127	136	9	0.07	0.44	0.47	13	0.14	2.00	0.02	383	213	0.56	90	0.42	97.00	0.46
3	1087	2	18	1	334	207	0.62	62	0.30	10	0.16	105	105	0	0.00	0.51	0.51	15	0.24	5.00	0.08	335	170	0.51	50	0.29	86.00	0.51
4	1114	2	17	1	405	215	0.53	33	0.15	18	0.55	127	137	10	0.08	0.59	0.64	48	1.45	30.00	0.91	365	184	0.50	23	0.13	119.00	0.65
5	1328	1	17	1	342	190	0.56	56	0.29	22	0.39	102	111	9	0.09	0.54	0.58	45	0.80	23.00	0.41	272	127	0.47	17	0.06	79.00	0.62
6	1338	2	17	1	374	202	0.54	62	0.31	20	0.32	108	114	6	0.06	0.53	0.56	43	0.69	23.00	0.37	295	167	0.57	58	0.35	75.00	0.45
7	1793	2	17	1	417	218	0.52	68	0.31	33	0.49	109	137	28	0.26	0.50	0.63	45	0.66	12.00	0.18	379	187	0.49	60	0.32	84.00	0.45
8	1911	1	17	3	359	210	0.58	38	0.18	15	0.39	91	127	36	0.40	0.43	0.60	19	0.50	4.00	0.11	346	178	0.51	17	0.10	123.00	0.69
9	2075	1	17	2	453	245	0.54	55	0.22	9	0.16	128	136	8	0.06	0.52	0.56	8	0.15	-1.00	-0.02	405	200	0.49	51	0.26	108.00	0.54
10	2489	2	17	1	416	226	0.54	21	0.09	28	1.33	160	170	10	0.10	0.71	0.75	83	3.95	55.00	2.62	391	198	0.51	22	0.11	138.00	0.70
11	3210	2	17	1	269	138	0.51	26	0.19	2	0.08	82	83	1	0.02	0.59	0.60	13	0.50	11.00	0.42	257	134	0.52	20	0.15	91.00	0.68
12	3240	2	17	1	437	247	0.57	88	0.36	42	0.48	119	121	2	0.16	0.48	0.49	87	0.99	45.00	0.51	383	236	0.62	40	0.17	140.00	0.59
13	3317	1	17	1	416	259	0.62	55	0.21	15	0.27	107	110	3	0.04	0.41	0.42	27	0.49	12.00	0.22	513	264	0.51	77	0.29	122.00	0.46
14	3432	1	17	1	301	162	0.54	42	0.26	5	0.12	87	87	0	0.02	0.54	0.54	8	0.19	3.00	0.07	385	197	0.51	52	0.26	108.00	0.55
15	3520	2	17	1	514	270	0.53	61	0.23	39	0.64	165	189	24	0.14	0.61	0.70	70	1.15	31.00	0.51	424	237	0.56	53	0.22	40.00	0.17
16	4176	2	17	1	493	264	0.54	57	0.22	19	0.33	151	168	17	0.10	0.57	0.64	46	0.94	27.00	0.47	398	212	0.53	37	0.17	139.00	0.66
17	4181	1	17	1	349	181	0.52	44	0.24	21	0.48	97	107	10	0.07	0.54	0.59	29	0.66	8.00	0.18	387	181	0.47	73	0.40	87.00	0.48
18	4212	2	17	1	378	199	0.53	30	0.15	2	0.07	102	102	0	0.00	0.51	0.51	7	0.23	5.00	0.17	422	215	0.51	78	0.36	92.00	0.43
19	4345	2	17	1	422	248	0.59	49	0.20	21	0.43	114	127	13	0.11	0.46	0.51	36	0.73	15.00	0.31	371	194	0.52	42	0.22	96.00	0.49
20	4388	2	18	2	545	301	0.55	56	0.19	23	0.41	168	174	6	0.04	0.56	0.58	29	0.52	6.00	0.11	531	277	0.52	89	0.32	141.00	0.51
21	4423	2	17	1	386	196	0.51	24	0.12	13	0.54	109	119	10	0.09	0.56	0.61	14	0.58	1.00	0.04	282	154	0.55	27	0.18	85.00	0.55
22	4751	2	17	1	267	156	0.58	5	0.03	8	1.60	114	128	14	0.12	0.73	0.82	11	2.20	3.00	0.60	368	201	0.55	34	0.17	127.00	0.63
23	5257	2	17	2	444	226	0.51	67	0.30	28	0.42	110	124	14	0.13	0.49	0.55	33	0.49	5.00	0.07	357	180	0.50	21	0.12	115.00	0.64
24	5487	2	17	1	483	291	0.60	127	0.44	50	0.39	105	126	21	0.20	0.36	0.43	73	0.57	23.00	0.18	446	226	0.51	73	0.32	114.00	0.50
25	5499	1	17	2	380	195	0.51	48	0.25	11	0.23	101	104	3	0.03	0.52	0.53	16	0.33	5.00	0.10	271	127	0.47	11	0.09	86.00	0.68
26	6247	1	17	1	362	182	0.50	46	0.25	5	0.11	89	90	1	0.01	0.49	0.49	10	0.22	5.00	0.11	303	132	0.44	30	0.23	75.00	0.57
27	6482	2	17	1	472	273	0.58	54	0.20	31	0.57	158	176	18	0.11	0.58	0.64	34	0.63	3.00	0.06	304	164	0.54	25	0.15	106.00	0.65
28	6912/7178	3	17	1	344	198	0.58	33	0.17	24	0.73	129	144	15	0.12	0.65	0.73	35	1.06	11.00	0.33	312	172	0.55	36	0.21	100.00	0.58
29	7198	2	17	1	420	234	0.56	43	0.18	22	0.51	153	168	15	0.10	0.65	0.72	35	0.81	13.00	0.30	350	168	0.48	20	0.12	121.00	0.72
30	7432	2	17	2	343	197	0.57	33	0.17	28	0.85	133	148	15	0.11	0.68	0.75	39	1.18	11.00	0.33	365	185	0.51	26	0.14	123.00	0.66
31	7521	2	17	2	327	167	0.51	31	0.19	14	0.45	76	83	7	0.09	0.46	0.50	27	0.87	13.00	0.42	308	176	0.57	65	0.37	87.00	0.49
32	7669	2	17	1	419	244	0.58	77	0.32	34	0.44	108	119	11	0.30	0.44	0.49	88	1.14	54.00	0.70	449	224	0.50	75	0.33	111.00	0.50
33	8021	2	17	1	486	275	0.57	97	0.35	3	0.03	110	113	3	0.03	0.40	0.41	8	0.08	5.00	0.05	451	211	0.47	26	0.12	117.00	0.55
34	8227	1	17	1	473	246	0.52	50	0.20	35	0.70	134	146	12	0.09	0.54	0.59	35	0.70	0.00	0.00	354	175	0.49	37	0.21	104.00	0.59
35	8584	2	17	1	379	210	0.55	54	0.26	12	0.22	115	118	3	0.03	0.55	0.56	13	0.24	1.00	0.02	348	181	0.52	19	0.10	127.00	0.70
36	8651	1	17	2	265	141	0.53	12	0.09	13	1.08	90	97	7	0.08	0.64	0.69	29	2.42	16.00	1.33	277	141	0.51	17	0.12	95.00	0.67
37	8723	1	17	1	313	177	0.57	19	0.11	14	0.74	103	102	-1	-0.01	0.58	0.58	17	0.89	3.00	0.16	312	140	0.45	4	0.03	102.00	0.73
38	8743	1	17	1	482	266	0.55	115	0.43	54	0.47	115	145	30	0.26	0.43	0.55	86	0.75	32.00	0.28	398	209	0.53	101	0.48	83.00	0.40
39	9056	1	17	2	442	238	0.54	87	0.37	27	0.31	96	116	20	0.21	0.40	0.49	51	0.59	24.00	0.28	388	181	0.47	30	0.17	108.00	0.60
40	9103	1	17	1	235	132	0.56	23	0.17	6	0.26	83	88	5	0.06	0.63	0.67	17	0.74	11.00	0.48	259	130	0.50	15	0.12	85.00	0.65
41	9550	1	17	1	359	189	0.53	40	0.21	6	0.15	112	116	4	0.04	0.59	0.61	6	0.15	0.00	0.00	402	204	0.51	52	0.25	102.00	0.50
42	9725	1	17	1	361	191	0.53	25	0.13	6	0.24	112	116	4	0.04	0.59	0.61	10	0.40	4.00	0.16	375	170	0.45	23	0.14	96.00	0.56
43	9794	2	17	1	256	190	0.74	36	0.19	24	0.67	66	80	14	0.21	0.35	0.42	49	1.36	25.00	0.69	256	126	0.49	36	0.29	106.00	0.84
44	9876	1	16	1	391	214	0.55	54	0.25	33	0.61	104	118	14	0.13	0.49	0.55	81	1.50	48.00	0.89	303	162	0.53	36	0.22	81.00	0.50

AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU
El bmostcha	El bcountmo	El bmostcha	El bsecondn	El bcountsec	El bdecrease	El bthirdmos	El bthimost	El bthirdeci	Dictionary Y	Thesaurus	Ex 1	Ex2	Ex3	Ex4	Ex5	Ex6	Essay 1 topi	Essay 2 topic
Pour	12	8	Parceque	10	8	Tout	9	6	0	1	1	9	1	0	2	0	1	2
Pour	10	10	Société	9	4	Avec	8	5	0	1	0	10	0	2	3	0	1	2
Mais	7	2	Paroles	6	6	Grand	4	1	0	1	0	14	5	23	6	0	2	1
Nous	6	3	Beaucoup	5	3	Société	5	3	0	1	5	11	6	8	13	2	1	2
Dans	7	3	Proverbe	6	4	Fusils	5	3	0	1	11	7	2	18	5	0	2	3
Dans	10	2	Actions	7	2	Plus	7	2	0	1	1	28	4	6	3	3	2	3
Société	11	2	Vivons	4	2	Vraiment	4	2	0	0	4	8	3	3	1	0	1	3
Société	8	5	Pour	8	7	Technologie	5	4	0	0	0	0	0	0	8	0	1	3
Avec	8	2	Pour	8	2	Sont	5	4	0	1	9	19	0	28	27	0	2	1
Paroles	5	4	Bien	2	1	-	-	-	0	0	0	1	1	5	6	0	2	1
Gens	12	3	Société	11	4	Plus	10	5	1	1	9	19	14	33	11	1	1	3
Plus	9	5	Faire	7	3	Problèmes	6	3	0	1	6	9	0	12	0	0	2	3
Société	7	3	Sera	5	4	-	-	-	0	1	2	1	1	1	1	2	1	2
Mais	8	2	Mots	7	2	Avec	7	2	0	1	4	27	8	18	10	3	2	3
proverbe	7	3	mais	7	3	dans	7	5	0	1	1	16	2	19	8	0	2	1
Société	8	3	Pour	7	3	Mais	6	3	0	1	4	17	0	4	4	0	1	2
-	-	-	-	-	-	-	-	-	0	0	0	1	1	0	5	0	2	1
Société	9	2	Pour	7	3	Jugements	6	3	0	1	2	19	0	7	8	0	1	2
Cultures	8	5	Monde	8	5	Culture	8	6	0	1	12	11	3	3	0	0	3	1
Actions	8	6	Gens	8	3	Société	7	3	0	1	1	10	2	1	0	0	3	1
Société	5	1	même	3	2	technologie	3	2	0	0	1	4	3	3	0	0	1	2
gens	7	3	choses	6	3	phrase	6	3	0	1	2	23	3	0	5	0	2	1
cultures	12	3	monde	12	4	quelques	9	5	0	1	9	23	18	15	8	0	3	2
gens	9	1	quelques	6	5	plus	6	4	0	0	4	3	4	2	3	0	1	2
Dans	9	4	Notre	4	3	-	-	-	0	0	2	2	1	2	3	0	1	2
Plus	11	6	Société	10	3	Pour	9	2	0	1	12	11	8	0	3	0	1	2
Pour	8	3	Plus	7	2	Mots	5	3	0	1	1	22	1	4	7	0	2	1
Pour	9	2	Avec	7	3	Plus	6	2	0	1	12	3	7	3	8	2	2	3
Pour	8	3	Plus	7	3	Mots	5	2	0	1	1	25	2	4	7	0	2	3
Culture	8	3	Pense	5	3	cultures	5	3	0	1	1	9	4	4	8	1	3	2
tolérante	11	3	société	9	4	pour	8	4	0	1	6	12	16	38	7	9	1	2
dans	14	12	personne	10	8	-	-	-	0	0	0	3	0	5	0	0	2	1
monde	14	3	dans	7	2	cultures	6	3	0	1	8	19	8	0	0	0	3	2
culture	9	4	cultures	6	4	plus	7	6	1	1	0	9	3	0	1	0	3	2
aujourd'hui	6	2	pour	6	3	monde	3	2	0	0	0	11	2	16	0	0	2	1
pour	7	3	mais	4	3	plus	4	3	0	0	2	8	4	1	2	0	2	1
personnes	10	2	mais	9	3	être	7	5	0	1	13	40	1	27	5	0	1	3
pour	13	4	société	8	3	actions	8	4	0	1	11	11	5	13	8	3	2	1
sont	9	5	peut	5	3	être	5	4	0	0	1	2	3	3	6	2	2	3
beaucoup	5	2	plus	6	5	choses	6	5	0	0	4	1	1	0	0	0	1	2
mais	5	3	aussi	4	2	personnes	4	3	0	0	2	1	3	0	4	0	2	3
cultures	9	4	culture	6	3	monde	5	2	0	1	3	5	16	16	9	0	3	2
beaucoup	7	3	plus	7	3	société	6	3	1	1	4	27	2	47	1	0	1	2

Appendix C.

Classroom score on Essay 2

	PARTICIPANT	PROVINCIAL PRACTICE ESSAY 2 SCORE /6	ESSAY 2 Topic
1	6912/7178	4.0	1
2	0788	4.0	2
3	1087	4.0	2
4	1114	5.0	1
5	1328	3.0	2
6	1338	5.0	3
7	1793	3.5	3
8	1911	5.5	3
9	2075	3.0	3
10	2489	5.5	1
11	3210	4.5	1
12	3240	5.0	3
13	3317	4.0	3
14	3432	2.0	2
15	3520	5.0	3
16	4176	5.5	1
17	4181	2.0	2
18	4212	3.0	1
19	4345	5.0	2
20	4388	5.5	1
21	4423	3.5	1
22	4751	4.0	2
23	4967*	4.0	2 Excluded from data set
24	5257	4.5	1
25	5487	4.5	2
26	5499	4.0	2
27	6247	3.0	2
28	6482	5.0	2
29	7198	4.5	3
30	7432	5.0	3
31	7521	3.0	2
32	7669	5.0	2
33	8021	4.5	1
34	8227	4.5	2
35	8584	5.5	2
36	8607*	4.0	Only completed Essay 1 a/b
37	8651	4.0	1
38	8723	4.0	1
39	8743	3.0	3
40	9056	3.0	1
41	9103	4.5	3
42	9550	4.0	2
43	9725	4.0	3
44	9794	5.5	2
45	9876	4.0	2