EMPIRICAL STUDY

The Impact of Instruction and Out-of-School Exposure to Foreign Language Input on Learners' Vocabulary Knowledge in Two Languages

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This cross-sectional study investigated the impact of length of instruction, out-of-school exposure to foreign language input, and gender on learners' receptive vocabulary knowledge in two foreign languages: French (first foreign language) and English (second foreign language). The findings suggest that, although length of instruction correlated positively with vocabulary knowledge in English and French, the gains remained modest when out-of-school exposure to the foreign language input was limited. Despite fewer years of English instruction, participants' vocabulary knowledge in English was considerably larger than their French vocabulary knowledge, which can be explained by their large amounts of out-of-school exposure to English language input. Participants' online activities in particular had a positive effect on their vocabulary knowledge in English. Although gender influenced participants' engagement with online activities in English, gender did not have a direct effect on their vocabulary knowledge, as the structural equation modeling analysis showed.

Introduction

Research has demonstrated that English language learners need to know the meaning of the most frequent 8,000 to 9,000 word families to reach 98% coverage in authentic written discourse (Nation, 2006), 750 to 3,000 word families to understand 90–95% of the words in informal spoken passages (Noreillie, Kestemont, Heylen, Desmet, & Peters, 2018; van Zeeland & Schmitt, 2013), and 3,000 word families to understand TV programs and movies (95% coverage) (Webb & Rodgers, 2009a, 2009b). For learners' vocabulary size to increase, researchers have repeatedly advocated contact with the foreign language (i.e., the target language that is not used widely in the community) outside of the classroom, for example, through extensive reading (Nation, 2015), extensive TV viewing (Webb, 2015), or gaming (Coxhead & Bytheway, 2015; Sylvén & Sundqvist, 2012). As a result, research into out-of-school exposure to foreign language input has been growing steadily (González-Fernández & Schmitt, 2015; Peters, 2018; Sockett & Kusyk, 2015). The goal of our study was to identify foreign language learners' out-of-school activities in two foreign languages (French and English) and to unravel the relationships between learners' receptive vocabulary knowledge in these two foreign languages and input (operationalized as length of instruction and out-of-school exposure to the foreign language) as well as between their receptive vocabulary knowledge and gender in order to enhance the understanding of the input–acquisition relationship.

Background
Length of Instruction

Evidence has been growing that it is not an early start but length and amount of instruction (i.e., hours per week) that are determinant variables in foreign language learning (Graham, Courtney, Marinis, & Tonkyn, 2017; Muñoz, 2011, 2014; Webb & Chang, 2012). In two studies, Muñoz showed that it was length of instruction and exposure to foreign language input and not an early start that were determinant predictors for learners' speaking performance (Muñoz, 2014), on the one hand, and for their general language proficiency and vocabulary knowledge (Muñoz, 2011), on the other. However, input (i.e., informal contact with a foreign language and hours of immersion abroad) explained more variance than length of instruction. Two recent studies corroborated this

finding. Learners' knowledge of collocations and of single words correlated positively with length of instruction and with out-of-school language contact, but language contact explained more variance than length of instruction (González-Fernández & Schmitt, 2015; Peters, 2018). Finally, amount of instruction calculated as hours per week has also been shown to affect language learning positively (Graham et al., 2017). Following Taiwanese English foreign language learners for 5 years, Webb and Chang (2012) showed how both length and amount of instruction were related to vocabulary growth, although the gains remained very modest and only few students mastered the 2,000 most frequent words in English after nine years of instruction. Their findings seemed to mirror those of Milton (2008), who found similar results for French foreign language learners in the United Kingdom. It therefore seems that length of instruction—one type of input and not to be confounded with starting age—is beneficial for foreign language learners' vocabulary development. However, research so far has focused on learners' vocabulary knowledge in one foreign language only, which has mainly been English. To develop a more complete picture of the effect of length of instruction on vocabulary knowledge and of its interaction with other types of exposure, additional studies focusing on more than one language are needed.

Out-of-School Exposure

Several researchers have argued that given the limited classroom time available, learners should engage with the foreign language outside of the classroom if they want to build a large vocabulary (Nation, 2015; Schmitt, 2008; Webb, 2015). Previous research has established that the most important out-of-school activities are watching TV, using a computer, reading books and magazines, and listening to songs (De Wilde, Brysbaert, & Eyckmans, 2019; González-Fernández & Schmitt, 2015; Kuppens, 2010; Lindgren & Muñoz, 2013; Muñoz, 2011, 2014; Peters, 2018; Sundqvist & Sylvén, 2014). The European Survey on Language Competences (ESLC; European Commission, 2012), using self-reported contact and use data, showed that secondary school students had more out-of-school contact with English than with other foreign languages. This was also the case in Flanders—the research context of our study—where English is learners' second foreign language after French. However, the ESLC Flemish data for English and French were collected with different age groups (13–14-year-olds for French and 15–16-year-olds for English), not making it easy to directly compare learners' foreign language contact. Additionally, although Flemish learners' performance in their second foreign language (English) was generally better than their performance in their first foreign language (French),

the ESLC did not focus on the relationship between language contact in these two languages and learners' performance in the reading, listening, and writing tests. As a result, the precise relationship between out-of-school exposure to foreign language input and learners' foreign language performance remained unclear. Our study aimed to fill this gap.

TV Viewing

Recently, Webb (2015) put forward extensive TV viewing, that is, the regular viewing of second language (L2) television, as a potentially effective method to fuel a learner's vocabulary size. Webb (2015) argued that watching TV extensively "could fill the need for greater L2 input" (p. 159) that is lacking in many foreign language learning contexts. Recent studies have shown that learners can indeed pick up the meaning of new words when watching TV without subtitles (Peters & Webb, 2018) and with subtitles (Montero Perez, Peters, Clarebout, & Desmet, 2014; Peters, Heynen, & Puimège, 2016).

Data from several studies have suggested that learners of English as a foreign language frequently watch TV outside of the classroom, especially in countries where foreign language TV programs and movies are subtitled (De Wilde et al., 2019; Kuppens, 2010; Lindgren & Muñoz, 2013; Peters, 2018; Sundqvist & Sylvén, 2014). These studies have also shown that language learning correlated positively with out-of-school TV viewing. For instance, Lindgren and Muñoz (2013) found that out of three types of out-of-school language activities, watching (subtitled) movies was a better predictor of young learners' reading and listening proficiency than listening to songs and playing computer games.

Studies specifically addressing vocabulary knowledge have consistently revealed positive findings for out-of-school TV viewing. Kuppens (2010), who collected data with Flemish 12-year-old learners who had not yet received any formal instruction, showed that watching subtitled TV and movies clearly had an impact on these learners' English vocabulary knowledge measured in two translation tests. Similarly, studies using vocabulary tests have shown that learners who frequently watched English language TV and movies knew more single words (Peters, 2018), collocations (González-Fernández & Schmitt, 2015), and phrasal verbs (Schmitt & Redwood, 2011) than learners who did this less often. Finally, Sockett and Kusyk (2015) found a positive effect of regularly watching TV series on learners' comprehension of phrases (four-gram chunks) as well as on their use of idiomatic language, which was similar to the frequency of the structures in the input materials.

Computer Use

A second important source of out-of-school exposure to English is learners' computer use and online activities (De Wilde et al., 2019; González-Fernández & Schmitt, 2015; Hannibal Jensen, 2017; Lindgren & Muñoz, 2013; Peters, 2018; Sundqvist & Sylvén, 2014; Sundqvist, 2019). Such activities entail the use of social media (e.g., Facebook, Twitter, Skype, etc.), playing computer games, or visiting English language websites. Playing computer games in particular has been advocated as a means to foster learners' vocabulary knowledge (Coxhead & Bytheway, 2015; Sylvén & Sundqvist, 2012). Most research into learners' out-of-school computer use has been conducted with young learners.

In a number of empirical studies with young Swedish learners of English as a foreign language (aged 10–11 years and 15–16 years), Sundqvist and her colleagues investigated the relationship between playing computer games and vocabulary knowledge (Sundqvist, 2019; Sundqvist & Sylvén, 2014; Sundqvist & Wikström, 2015; Sylvén & Sundqvist, 2012). They found that frequent gamers—those involved in more than 5 hours of gaming per week—knew more words and used more advanced vocabulary than nongamers. In a recent study with young Danish learners (aged 7 or 9 years), Hannibal Jensen (2017) also found that these young learners frequently played computer games and that gaming with spoken and written English input correlated positively with learners' vocabulary knowledge. Playing computer games was also positively correlated with learners' reading and listening proficiency in Lindgren and Muñoz's (2013) study with young learners, but it explained less variance than TV viewing and listening to songs. This smaller effect of gaming might be explained in two ways. First, Lindgren and Muñoz (2013) investigated more variables in their study. Second, they used regression analyses and not analyses of variance in order not to lose any of the underlying information, which happens as a result of grouping learners for analysis of variance (Muñoz, 2011). In line with Lindgren and Muñoz, Kuppens (2010) also found that watching TV had a bigger impact on 12-year-old Flemish learners' vocabulary knowledge than playing computer games, although care should be taken given the limited number of lexical items that was tested. However, in a study with 16- and 19-year-old learners of English as a foreign language, Peters (2018) did not find a relationship between gaming and vocabulary knowledge, which could be attributed to the participants' older age because university learners might play games less often than younger learners.

Finally, in addition to gaming, visiting English language websites (González-Fernández & Schmitt, 2015; Peters, 2018) has also been shown to positively affect learners' vocabulary knowledge, whereas the findings for

the relationship between social networking and vocabulary have been mixed (De Wilde et al., 2019; González-Fernández & Schmitt, 2015; Schmitt & Redwood, 2011). The positive effect of gaming has seemed to be less pronounced in studies in which gaming was but one variable in addition to reading, TV viewing, or listening to songs. Further research into the role of computer games in vocabulary learning seemed to be needed.

Reading

Research has also proposed reading—and particularly extensive reading—as a method for increasing learners' vocabulary size (Nation, 2015). Moreover, extensive reading has the potential to boost vocabulary learning, especially with more advanced learners (Webb & Chang, 2015). However, research into the effect of out-of-school reading on learners' language proficiency and vocabulary knowledge has revealed mixed findings (Briggs, 2015; González-Fernández & Schmitt, 2015; Lindgren & Muñoz, 2013; Peters, 2018; Schmitt & Redwood, 2011). Peters's (2018) study showed that although 16- and 19-year-old learners of English as a foreign language in Flanders do not often read books or magazines, there was a positive correlation between the reading that they did do outside the classroom and their vocabulary knowledge. Two other studies corroborated these findings for learners' knowledge of English collocations (González-Fernández & Schmitt, 2015) and learners' knowledge of English phrasal verbs (Schmitt & Redwood, 2011). However, two studies with young learners (aged 10–12 years) showed that these learners had engaged in very few reading activities outside of the classroom (Lindgren & Muñoz, 2013; Sylvén & Sundqvist, 2012), making it difficult to study its effect on their vocabulary learning. The fact that young learners engage in fewer foreign language literacy-based activities could be explained by their lower proficiency that does not yet meet the vocabulary demands for reading in a foreign language.

Listening to Songs

Studies have shown that learners of English as a foreign language frequently listen to English language songs (Briggs, 2015; González-Fernández & Schmitt, 2015; Lindgren & Muñoz, 2013; Peters, 2018). However, these studies have produced contradictory findings regarding its effect on language proficiency. Although Lindgren and Muñoz (2013) found a positive relationship between listening to songs and young learners' reading and listening comprehension, other studies with older learners (Briggs, 2015; González-Fernández & Schmitt, 2015; Peters, 2018; Schmitt & Redwood, 2011) did not reveal any relationship between listening to songs and vocabulary knowledge.

Gender

There seems to be a widespread belief that female learners are more motivated to learn languages and are also better at learning foreign languages than male learners (Saville-Troike, 2005). However, it is only recently that a number of studies have explicitly addressed the gender effect in language learning. Most findings have seemed to suggest that female learners obtain higher scores on language tests than male learners. In a large-scale study with Dutch foreign language learners, van der Slik, van Hout, and Schepens (2015) analyzed test results of 27,119 adult language learners. Taking a number of learner-related variables into account—first language (L1), education, hours of instruction, age of arrival, length of residence—van der Slik et al. showed that female learners outperformed males in speaking and writing skills but not in reading and listening. Two studies with younger learners (Courtney, Graham, Tonkyn, & Marinis, 2017; Jaekel, Schurig, Florian, & Ritter, 2017) also found better scores for girls than for boys. However, when Courtney et al. (2017) controlled for L1 literacy and prior learning experience, the differences between girls and boys disappeared, suggesting that it was not gender but L1 literacy and prior learning experience that were the determinant variables. The ESLC (European Commission, 2012) also addressed gender, but the findings related to the Flemish dataset did not reveal a difference between male and female secondary students for the reading, listening, and writing tests.

Studies investigating the relationship between learners' out-of-school exposure to English and vocabulary knowledge have also addressed the role of gender. One consistent finding has been that males are more frequently engaged in playing English language computer games than females (Hannibal Jensen, 2017; Peters, 2018; Sundqvist & Sylvén, 2014; Sundqvist & Wikström, 2014). Sundqvist and Wikström found significant correlations between the frequency of gaming and males' vocabulary knowledge, but this was not true for females. However, compared to the males, most females were just not frequent gamers. Looking at length of instruction, out-of-school exposure, and gender, both Hannibal Jensen (2017) and Peters (2018) did not find an effect of gender on their participants' vocabulary knowledge in spite of more frequent gaming by males than by females. Finally, Schmitt and Redwood (2011) did not find a difference between female and male participants' knowledge of phrasal verbs. Although more studies have taken gender into account, the evidence regarding its effect on vocabulary knowledge has remained inconclusive. More research into how female and male learners differ in their out-of-school language activities and how this could affect their vocabulary knowledge thus seemed warranted.

The Present Study

Although some evidence for the positive effects of length of instruction and out-of-school exposure on learners' vocabulary knowledge in English exists, no single study has focused on the relationship between learners' vocabulary knowledge in two foreign languages and length of instruction, different types of out-of-school exposure, and gender. Further, little is known about how learners at different education levels might differ in their out-of-school activities and how this could affect their vocabulary knowledge. Moreover, research into languages other than English is needed in order to generalize across languages. Given the typically small learning gains in instructed settings, research into learners' out-of-school exposure to foreign languages is needed in order to determine how to best fuel vocabulary knowledge. The aim of our study was therefore to investigate the relationships between gender, out-of-school exposure, length of instruction, and vocabulary knowledge in two foreign languages. This is important if scholars want to shed more light on how different types of language input might contribute to lexical development. To that end, we addressed the following research questions:

1. Does Flemish foreign language learners' out-of-school exposure differ for French and English and for males and females?

With regard to learners' receptive vocabulary knowledge in English and French,

2.1. Do learners differ in their receptive knowledge of English and French, and is their vocabulary knowledge related to length of instruction and/or gender?
2.2. Do learners differ in their knowledge of English and French high- and mid-frequency vocabulary?
3. What impact do length of instruction, different types of out-of-school exposure, and gender have on learners' receptive vocabulary knowledge in English, on the one hand, and French, on the other?

To answer these questions, we adopted a cross-sectional within-participants design in which participants took an English and a French vocabulary test and completed a questionnaire about their use of and exposure to English and French. A within-participants design allowed us to directly compare participants' exposure and vocabulary knowledge in their two foreign languages. We use the term "out-of-school exposure" to refer to both exposure to foreign language input (e.g., reading books, watching TV) and use of the foreign language (e.g., using the foreign language in computer games).

Method

Research Context

We collected the data for this study in Flanders, the Dutch-speaking part of Belgium. Belgium has three official languages: (a) Dutch, which is spoken in the north of the country, (b) French, being spoken in the southern part of the country, and (c) German, which is spoken by a minority in the eastern part of the country. The capital Brussels is officially bilingual but is in reality a predominantly French-speaking city. Unlike in other European countries, French is the first foreign language in Flemish schools, and English is the second foreign language. Although French is an official language in Belgium, it is a foreign language in Flanders, which is officially a monolingual region. This means that, in Flanders, French is generally not encountered in people's daily lives because Belgian language laws, which are based on the territoriality principle, allow only the use of Dutch in public administration, schools, and courts in Flanders (see van der Jeught, 2017, for an overview of Belgian language laws).

Normally, learners begin receiving French instruction in the fifth year of primary education at the age of 10 to 11 years, which is relatively late compared to most European countries, and begin receiving English instruction in the second year of secondary education at the age of 13 to 14 years, although some schools introduce English or French earlier. In primary education, generalist teachers teach French (two to three hours per week), whereas in secondary education, specialist teachers teach French and English. Both French and English are compulsory subjects until the end of secondary education (age 18 years). Learners typically have two to three 50-minute lessons of English, depending on the curriculum they choose, and three to four 50-minute lessons of French. This means that Flemish learners receive at least eight years of French instruction and five years of English instruction by the end of their secondary education. Additionally, they have more hours of French than English instruction per year. Further, the teaching approach to English and French is very similar, as the questionnaire that we gave to the participants also revealed.[1]

Participants

We recruited participants for this study from a convenience sample in two secondary schools and one university. Specifically, we collected data from three independent samples of Flemish learners of English and French as foreign languages ($N = 145$) from the second year and from the fourth year of secondary education and from the first year of university (business administration and law). We removed the data of seven participants because they spoke either French or

Table 1 Participants' distribution, gender, age, and language instruction profiles by education level

Education level	Participants		Age		Mean of formal instruction (years)		Range of formal instruction (hours)	
	n	Female–Male	*M*	Range	English	French	English	French
2nd year secondary	48	22–26	13.22	12–14	1.02	4.31	33	343–481
4th year secondary	43	19–24	15.90	14–16	2.98	6.20	167–200	560–747
1st year university	47	31–16	18.38	18–21	5.23	9.09	335–462	790–1,060
Total	138	72–66						

English at home, bringing the total number of participants to 138. The L1 of the other participants was Dutch, except for three participants whose L1 was Vietnamese, Cantonese, or Georgian. Each participant took part in the English as well as in the French data collection (see Table 1).

Table 1 presents the average length of instruction for each education level as well as the range of hours of instruction that participants received. We used ranges because the number of hours of instruction that participants had received might not be the same for all participants given that the number of hours of French or English per week depended on the curriculum, the education level, and the school. Learners in the second year of secondary education are typically in their first year of English instruction, receiving two hours of instruction per week—one hour equals 50 minutes class time—and in their fourth year of French instruction, receiving four hours of instruction per week. Five participants reported having had more years of French (six to eight years). Learners in the fourth year of secondary education are in their third year of English instruction, receiving two hours of instruction per week, and in their sixth year of French instruction, receiving three to four hours of instruction per week.[2] Six participants had received more years of French instruction than this (7–10 years). Finally, business students in their first year at university (aged 18–19 years) are in their sixth year of English and their ninth year of French instruction with two compulsory hours of English and French every week. Law students (aged 18–21 years) have only one compulsory French course (legal

French) in the first year (two hours every two weeks) because English (legal English) is only taught in the second year. Three university participants reported having started French instruction earlier.

Instruments
Vocabulary Tests

We measured participants' vocabulary knowledge by means of a written English and a written French frequency-based vocabulary test—the English and French VocabLab tests (see Peters, Velghe, & Van Rompaey, 2019, for a detailed description of the corpus, item selection, and test format). We selected these two tests for reasons of comparability. First, the English and French VocabLab tests have the same counting unit, the lemma, which was essential for us to be able to compare the results of the English and the French vocabulary tests. Second, the tests do not target cognates. This was important because we were interested in testing participants' real vocabulary knowledge and not their potential vocabulary (Berman et al., 1968, as cited in Palmberg, 1987, p. 201). Real vocabulary refers to words that learners recognize because they have been exposed to these words, whereas potential vocabulary knowledge refers to words, such as cognates, that learners recognize even without having been exposed to them. Cognates (words that are similar in form and meaning in the L1 and L2), such as the Dutch word *straat* and the English word *street*, have been shown to inflate test scores (Cobb, 2000; Laufer & McLean, 2016). In a study with French-speaking Canadians, Cobb (2000) showed that participants were able to answer about half of the test items in the Vocabulary Levels Test correctly on the basis of knowing French–English cognates and guessing. His results suggested that French-speaking test takers can answer certain test items on the English Vocabulary Levels Test correctly without having been exposed to those items in English. Given the smaller cognate linguistic distance between Dutch and English, especially for the high(er)-frequency items that belong to the basic vocabulary of Germanic origin, than between Dutch and French, scores on the English vocabulary test might be higher in the presence of a higher number of cognates. Cognates in a test could thus be a confounding variable, which is why we decided to use vocabulary tests without cognates.

Third, both tests were developed according to the same principles (Peters et al., 2019). The VocabLab tests provide an estimate of learners' vocabulary knowledge at four frequency bands: 0–2,000 (2K), 2,001–3,000 (3K), 3,001–4,000 (4K), and 4,001–5,000 (5K). The 2K and 3K bands focus on high-frequency vocabulary while the 4K and 5K bands focus on mid-frequency vocabulary (Schmitt & Schmitt, 2014). For each frequency band, 30 items were

Sample English item:	Sample French item:
talk	goût (m)
o to speak	o morceau long et fin
o to remove something	o période de cent ans
o to give in return for money	o terre entourée d'eau
o to start an important activity	o impression laissée dans la bouche
o I don't know the answer	o je ne connais pas la réponse

Figure 1 Sample test items from the English and French vocabulary tests.

sampled from a lemmatized frequency list. For the English test, the frequency list was sampled from the Corpus of Contemporary American English (Davies, 2008),[3] and for French the frequency list by Lonsdale and Le Bras (2009) was used. The corpora used for these frequency lists are both recent corpora consisting of spoken and written materials as well as different genres and can thus be considered fairly comparable. Both tests have a written multiple-choice format in which test items are presented in isolation. Each item is accompanied by four definitions in the foreign language (i.e., one correct answer and three distractors), consisting of three definitions using higher-frequency words than the word being tested and one "I don't know" option to discourage guessing. Both tests had good internal consistency for our 138 participants (English test Cronbach's $\alpha = .98$; French test Cronbach's $\alpha = .96$). Further, both tests showed an implicational scale, which indicated that participants tended to score better on test sections sampling from high-frequency bands than on items sampled from lower-frequency bands, indicating that high-frequency words tended to be learned before mid-frequency words, which is generally considered evidence of construct validity. Figure 1 provides a sample test item from the English and from the French VocabLab tests.

Questionnaire
To investigate participants' current out-of-school contact with English and French, we used the questionnaire of the ESLC (European Commission, 2012).[4] This meant that we asked participants to complete two identical questionnaires: one about English and one about French. In this study, the analysis focused on those questions that related to participants' exposure to the foreign language

outside of the classroom (see Appendix S1 in the Supporting Information online). The questions targeted (a) contact with and use of a foreign language with friends and family, (b) contact with and use of a foreign language in other contexts (e.g., on holiday, with tourists), (c) contact with a foreign language through subtitled media, (d) contact with a foreign language through nonsubtitled media, (e) contact with a foreign language through written input, (f) contact with and use of a foreign language in online activities, and (g) contact with a foreign language during language camps.[5] The questionnaire consisted of seven yes/no questions, 15 Likert-scale questions with five response items (*never*, *a few times a year*, *about once every month*, *a few times a month*, *a few times a week*), and six Likert-scale questions with four response items (*never*, *once*, *twice*, *three times or more*).

Procedure

We collected all the data in February at the start of the second semester of the academic year. Participants needed about 40 minutes to complete one vocabulary test and 20 minutes to complete one questionnaire. The participants from secondary education completed the written vocabulary test and the questionnaire in two different sessions for each language separately during their regular French and English classes because a single class session is only 50 minutes long. The university students completed the test as well as the questionnaire for each language separately in one class session (1.5 hours). We collected data for English and French either in the same week or in two consecutive weeks.

Data Analysis

Scoring

The scoring system for the vocabulary tests was straightforward: We attributed a score of 1 for a correct response and a score of 0 for an incorrect response. We converted the raw scores (maximum = 120 for full test, 30 items per subsection) into percentages to facilitate interpretation of the analyses.

Statistical Modeling

Before we turn to the specific statistical models for each research question, four more general comments are in order. First, the dataset only included complete cases, meaning there were no missing data, and consequently there was no associated loss of statistical power and increase in bias. Second, we included the categorical variable education level rather than the continuous variable length of instruction in the models because, due to the sampling process (i.e., data collection in the second and fourth year of secondary education and

in the first year of university education), the number of years of instruction clustered around three values for both English and French, with only very limited variation around these values (e.g., out of 47 university students, 44 reported having received nine years of French instruction, two 10 years, and one 11 years). We judged that the small loss of information caused by the reduction to three categories was largely compensated by the ability to model nonlinear relationships for this trichotomous variable. Third, we used dummy coding in all analyses involving categorical variables, and we have indicated reference categories in the presentation of the results. Finally, in choosing the statistical models, we aimed for parsimony and generally favored simpler models over more complex ones.

To answer the first research question about differences in learners' out-of-school exposure, we used SPSS (IBM SPSS Statistics, Version 24) to calculate generalized estimating equations. Generalized estimating equations offer a flexible alternative to generalized linear models and allow for the analysis of repeated measures (i.e., they include a correlation structure) as well as for nonnormally distributed data. The models included the following variables: language (i.e., within-participants variable: English or French), gender, and the interaction between language and gender.

For the second research question, consisting of two sub-questions dealing with differences in learners' receptive vocabulary knowledge in English and French, we ran multivariate linear mixed-effects models in SPSS with (a) participants' vocabulary test scores as the dependent variable, (b) language (English, French), gender, and education level as fixed main effects, (c) the two-way interactions between these aforementioned effects, and (d) participants as a random effect. We fitted one model for the total vocabulary score as well as separate models for the four test sections that corresponded to different frequency bands. We opted for models with a simple correlation structure consisting of a single variance component (or random intercepts). We checked the normality of data in each subgroup through skewness and kurtosis (between –2 and 2). For the total scores, only one group showed a nonnormal distribution (females in second year of secondary school, English, skewness = 2.15). The normality assumption was not met in five out of 24 groups (4 test sections × 2 languages × 3 education levels) for the test sections. However, with more than 40 participants per group, the analysis of fixed effects should have been fairly robust to violations of normality.

To answer the third and final research question about the impact of length of instruction, out-of-school exposure, and gender on vocabulary knowledge in English and French, we used structural equation modeling. With

structural equation modeling, it is possible to combine a measurement model in which indicator variables are seen as reflections of underlying latent variables (similar to factor analysis) with a structural model in which direct and indirect relationships between latent and observed variables are modeled, similar to path analysis (Brown, 2006). In our analysis, the individual questionnaire items could be considered indicators of the different latent factors related to out-of-school exposure. Compared to a regression analysis, structural equation modeling has the added advantage that it allows for the simultaneous analysis of multiple variables and relationships in one model, making it possible to compute a model in which a dependent variable can be the independent variable or predictor for another dependent variable. Structural equation modeling analysis, thus, allows researchers to study the relationship between, for instance, gender (predictor) and amount of gaming (dependent variable) as well as between gaming (predictor) and vocabulary knowledge (dependent variable) in one model.

We used the open source software R (R Core Team, 2012) and the package lavaan (Rosseel, 2012) to fit two structural equation models, one for English and one for French. The structure of our models was both theoretically motivated and based on the findings of previous research. Each model had one observed outcome variable, the vocabulary knowledge test score, as well as two observed exogenous variables, gender and education level, which were both categorical. Out-of-school exposure was represented by a number of latent variables that we measured by means of the items in the questionnaire. Because the indicators (i.e., the questionnaire items) were binary or ordinal, we used diagonally weighted least squares to estimate the model parameters, and we computed robust standard errors using the full weight matrix. We fixed factor loadings of the first indicators of latent variables to 1 in order to fix the scale of the latent variables.

With 138 participants per structural equation model and a considerable number of path coefficients to be estimated, one could argue that there was a lack of statistical power, given that a minimum of five to 10 participants per estimated parameter is sometimes recommended (Bentler & Chou, 1987), but this rule of thumb has recently been questioned (Sideridis, Simos, Papanicolaou, & Fletcher, 2014; Wolf, Harrington, Clark, & Miller, 2013). As of yet, there is no agreed-upon way to calculate power in structural equation modeling because it is influenced by a complex interplay of variables, such as the number of indicators per latent variable, the intercorrelations between the latent variables, and the degree of missingness in the data (Wolf et al., 2013). The number of participants in this study was not very high, but no data were missing,

and all latent variables had between two and six indicators. Moreover, the intercorrelations between the various latent variables were reasonably high. Bearing in mind all these issues, we believed that our sample size was sufficient to answer the research question, even though statistical power is something to consider in the interpretation of the results.

The sample size also influenced our modeling approach, which was confirmatory, but not strictly so. Rather than rejecting a model based on a significant chi-square statistic, we looked at different indices to evaluate model fit: the root mean square error of approximation, the comparative fit index, and the Tucker-Lewis index. We allowed for minor modifications to the initial model if modification indices and expected parameter changes pointed in this direction and if the modifications could be theoretically motivated. Moreover, we only included paths between the two observed exogenous variables (gender and education level) and the latent variables in case modification indices and expected parameter changes pointed in this direction. We also excluded questionnaire items that did not display enough variation. Because of this partly data-driven modeling approach, the English and French models were not exactly the same.

Results

Research Question 1: Learners' Exposure to English and French

In this section, we have summarized the main findings of the generalized estimating equation analyses regarding differences in exposure to English and French (see Appendix S2 in the Supporting Information online for descriptive statistics and Appendix S3 for detailed results by research question). First, participants were significantly more exposed to English language media (i.e., audiovisual input with and without subtitles and written media) compared to French language media. Significantly higher exposure to English was found on all questionnaire items (seven in total) related to these three types of exposure, and for all education levels, meaning that participants were more exposed to TV programs, films, songs, books, and magazines/comics in English than in French. A second distinct difference concerned participants' online use of both languages. Also here, results for the four questionnaire items related to this type of exposure showed that participants from the three education levels were significantly more exposed to English than to French, which meant that they more frequently played English language computer games than French games, visited English language websites more often than French ones, and used English more often online than French. The results also revealed a significant interaction between language and gender (in 11 out of 12 analyses): Males were considerably more often engaged in online activities (games, Internet)

Table 2 Descriptive statistics (percent) for the English and French vocabulary tests by education level and by gender

Education level	English		French	
	M (*SD*)	95% CI	*M* (*SD*)	95% CI
2nd year secondary				
Females (*n* = 22)	39.94 (19.24)	[30.41, 47.47]	23.49 (8.44)	[19.74, 27.23]
Males (*n* = 26)	53.19 (21.50)	[44.81, 62.18]	25.15 (10.42)	[21.95, 30.36]
4th year secondary				
Females (*n* = 19)	60.35 (15.75)	[52.76, 67,94]	43.11 (12.81)	[36.94, 49.29]
Males (*n* = 24)	73.61 (15.33)	[67.14, 80.09]	46.39 (10.65)	[41.89, 50.89]
1st year university				
Females (*n* = 31)	83.17 (9.63)	[79.64, 86.70]	63.63 (11.28)	[59.49, 67.77]
Males (*n* = 16)	81.41 (12.84)	[74,56, 88.25]	60.83 (13.42)	[53.69, 67.98]

Note. CI = confidence interval.

in English than females, but not in French. Third, participants used English more often than French when communicating with friends, both in spoken and written interaction. Finally, for only two questionnaire items, significantly more contact with French than with English was found, that is, for participants' attending language camps (for older participants) and for number of visits to countries in which the target language is spoken (for younger participants); however, even for French, the average amount of this kind of exposure that was reported was still very low.

Research Question 2: Learners' Vocabulary Knowledge in English and French

As Table 2 shows, participants' total score on the English vocabulary test was consistently higher than on the French vocabulary test. This finding held for the three groups in spite of three more years of formal French instruction at each education level. It is interesting to note the difference in vocabulary knowledge between participants in their sixth year of English (university students) and participants in their sixth year of French (fourth year of secondary education) because the mean English test scores (81–83%) was nearly double the mean French scores (43–46%). The results for gender were less straightforward. Although females and males did not seem to differ much in their knowledge of French vocabulary, a different picture emerged for English. Both in the second and the fourth year of secondary education, males obtained higher scores on

Table 3 Parameter estimates (*b*) of linear mixed-effects analysis for English and French vocabulary knowledge

Parameter	*b*	*SE*	*t*	*p*	95% CI
Fixed effects					
Intercept	45.79	2.24	20.43	.001	[41.36, 50.21]
Language = English	25.66	1.53	16.72	.001	[22.62, 28.69]
Language = French	0.00				
Education level = 2nd year secondary	−20.52	2.58	−7.94	.001	[−25.63, −15.42]
Education level = 4th year secondary	0.00				
Education level = 1st year university	17.40	2.65	6.58	.001	[12.17, 22.63]
Gender = female	−1.15	2.39	−0.48	.630	[−5.86, 3.57]
Gender = male	0.00				
Language (English) × gender (female)	−7.98	2.13	−3.75	.001	[−12.19, −3.77]
Random effects					
Residual	77.73	9.38		.001	[61.36, 98.48]
Intercept (participant)	113.37	18.89		.001	[81.78, 157.16]
−2 log-likelihood ratio	2,173.61				

the English vocabulary test than females, whereas in the first year at university, females performed slightly better than males.

In the linear mixed-effects model, three parameters were positively related to participants' vocabulary knowledge (see Table 3). Participants' vocabulary was significantly larger in English than in French ($p < .001$), with an average difference of 25 percentage points. Further, education level (length of instruction) was positively related to participants' vocabulary knowledge in English and French, that is, participants in the second year of secondary school knew fewer words (difference of 20 points) than participants in the fourth year of secondary school ($p < .001$), and participants in the fourth year of secondary school knew fewer words (difference of 17 points) than the university participants ($p < .001$). Finally, we found a significant interaction between gender and language, showing that females tended to know fewer English words than males.

Table 4 shows the descriptive statistics by frequency band, education level, and language. The mixed-effects analyses (see Appendix S4 in the Supporting Information online) showed that language as well as education level were significant predictors of participants' vocabulary knowledge at the 3K band:

Table 4 Descriptive statistics for the English and French vocabulary tests (based on percentage scores) by frequency band, by education level, and by language

Education level	2K band M (SD) 95% CI	3K band M (SD) 95% CI	4K band M (SD) 95% CI	5K band M (SD) 95% CI
2nd year secondary ($n = 48$)				
English	64.72 (22.72) [58.12, 71.32]	49.86 (24.13) [42.86, 56.87]	41.60 (19.71) [35.87, 47.32]	32.11 (23.82) [24.19, 38.03]
French	40.00 (12.17) [36.47, 43.53]	24.31 (9.10) [21.66, 26.95]	15.97 (11.13) [12.74, 19.20]	19.44 (12.25) [15.89, 23.01]
4th year secondary ($n = 43$)				
English	87.05 (10.06) [84.00, 90.15]	73.26 (18.03) [67.71, 78.81]	60.85 (18.93) [55.02, 66.68]	49.85 (23.07) [42.75, 56.95]
French	67.21 (12.02) [63.51, 70.91]	43.02 (12.74) [39.10, 46.94]	34.57 (11.93) [30.90, 38.25]	34.96 (15.00) [30.34, 39.58]
1st year university ($n = 47$)				
English	95.32 (5.50) [93.70, 96.94]	87.80 (9.79) [84.93, 90.68]	77.02 (13.96) [72.92, 81.11]	70.15 (18.20) [64.70, 75.49]
French	82.73 (8.67) [79.58, 84.67]	62.98 (13.77) [58.94, 67.02]	57.38 (17.33) [52.29, 62.47]	48.23 (14.90) [43.85, 52.60]

language, $F(1, 138.24) = 354.36$, $p < .001$, education level, $F(2, 139.00)$ 3D; 106.06, $p < .001$; and at the 4K band: language, $F(1, 138.16) = 351.15$, $p < .001$, education level, $F(2, 139.22) = 92.03$, $p < .001$. Further, we found a significant interaction between language and education level for the 2K band, showing that the gap between English and French becomes narrower with education level, with a difference of 24.7 points in the second year of secondary school and a difference of 12.6 points in university, $F(2, 137.47) = 9.47$, $p < .001$, and for the 5K band, in which the difference between English and French became larger, with a difference of 12.7 points in the second year of secondary school and a difference of 21.9 points in university, $F(2, 137.79) = 3.92$, $p = .022$.

Research Question 3: Predictors of Learners' Vocabulary Knowledge
English
Figure 2 provides a graphical representation of the structural equation model for English, including indicators (i.e., the questionnaire items listed in Appendix S1), latent variables, and relationships between latent variables and exogenous variables (gender and education level). We theorized that all latent variables
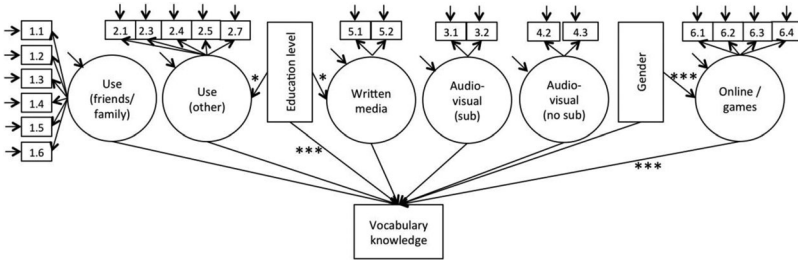
Figure 2 Structural equation model for English. Significant paths are indicated with *p < .05 and ***p < .001.

would have a direct effect on vocabulary knowledge. The model also included covariances between the latent variables; however, for the sake of interpretability, we have not shown them in Figure 2. We also have not included covariances between residuals. Based on the descriptive statistics (i.e., lack of variation), we omitted two indicators (Items 2.2 and 4.1 of the questionnaire) from the measurement model.[6] We also omitted one indicator (Item 2.6) because of its low factor loading. Additionally, based on an inspection of modification indices and expected parameter changes and in line with the results of the analyses of the first research question, we included a direct link between gender and the online/games factor in the model as well as a direct link between education level and both the use (other) and written media factors. Previous research has shown that including these links is theoretically justified (González-Fernández & Schmitt, 2015; Hannibal Jensen, 2017; Peters, 2018; Sundqvist & Sylvén, 2014; Sundqvist & Wikström, 2014). In our model, the effect of gender and length of instruction (education level) on the outcome variable was thus mediated by these links with latent variables.

The chi-square statistic of the model, which was based on 138 observations, was significant, $\chi^2(249) = 362.61$, $p < .001$. However, both the comparative fit index (.966) and the Tucker-Lewis index (.960) were considerably higher than the recommended threshold of .90, and the root mean square error of approximation (.058) approached the recommended lower bound of .05 (Brown, 2006; Browne & Cudeck, 1992; Hooper, Coughlan, & Mullen, 2008; Hu & Bentler, 1999). In addition, all standardized factor loadings were higher than .55 (see Appendix S5 in the Supporting Information online). We thus concluded that the measurement model yielded an acceptable fit of the observed data.

Table 5 presents the estimated standardized and unstandardized regression parameters for the structural model as well as the associated *p* values of the

Table 5 Estimated unstandardized path coefficients (b) and standardized path coefficients (b^*) from the structural equation modeling analysis for the English vocabulary test

Parameter	b	SE	b^*	z	p
Vocabulary knowledge					
Use (friends/family)	−5.764	3.630	−.163	−1.588	.112
Use (other)	−0.044	3.901	−.001	−0.011	.991
Audiovisual (no subtitles)	3.598	4.904	.116	0.732	.464
Audiovisual (subtitles)	−0.212	2.425	−.007	−0.087	.930
Written media	8.237	5.871	.230	1.403	.161
Online/games	9.234	2.490	.393	3.708	.001
Gender = male	−1.695	3.989	−.031	−0.425	.671
Gender = female	0.000				
Education level = 2nd year secondary	−24.938	3.994	−.442	−6.244	.001
Education level = 4th year secondary	0.000				
Education level = 1st year university	16.376	5.517	.289	2.968	.003
Online/games					
Gender = male	1.344	0.220	.587	6.119	.001
Use (other)					
Education level = 1st year university	0.414	0.207	.294	2.006	.045
Written media					
Education level = 1st year university	0.456	0.221	.288	2.068	.039

Wald tests. Of the six factors related to out-of-school contact, only online/games had a significant impact on the vocabulary test scores ($p < .001$). Also, education level significantly predicted vocabulary scores, with participants in the second year of secondary school scoring significantly lower than those in the fourth year ($p < .001$) and those in university scoring significantly higher ($p = .003$). All predictors combined explained 69.3% of the variance in vocabulary knowledge.[7] Gender had a highly significant effect on the factor online/games ($p < .001$, $R^2 = .345$) but not directly on vocabulary knowledge. The results also indicated that university participants made more use of written media in English compared to fourth year secondary school participants ($p = .039$, $R^2 = .083$) and that they used English more on holidays and/or with tourists ($p = .045$, $R^2 = .086$).

French
The model for the French data, shown in Figure 3, was similar to the English one, but there were some structural differences. We excluded four indicator variables
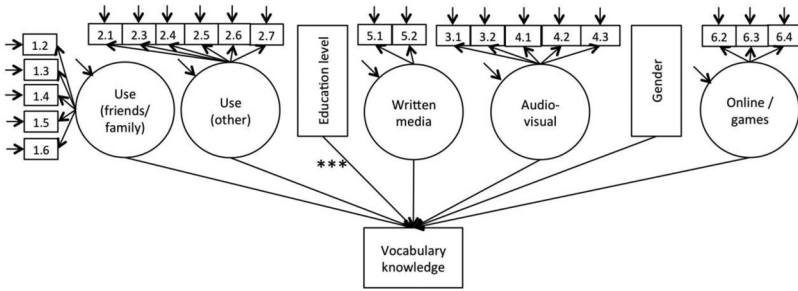
Figure 3 Structural equation model for French. Significant paths are indicated with ***$p < .001$.

from this model due to a lack of variation (Items 1.1, 1.3, 2.2, and 6.1 from the questionnaire).[8] Moreover, we merged the factors audiovisual (subtitles) and audiovisual (no subtitles) because their respective indicators were too highly intercorrelated. Based on data exploration and in line with our findings related to the first research question (i.e., no significant effect of gender on, for instance, online language use in French), we did not include any relationships between gender/education level and the latent variables in this model as we had done for the structural equation modeling for English. We did, however, add the covariance between Items 6.2 and 6.3 of the questionnaire due to the large modification index related to this parameter (the corresponding estimated correlation coefficient in the model was $r = .843$). This covariance made sense from a theoretical point of view because both of these items explicitly target gaming. Moreover, both loaded on the same factor, so no cross-loadings were introduced.

The chi-square statistic of this model was significant, $\chi^2(257) = 328.78$, $p = .002$. As was the case for the English model, both the comparative fit index (.968) and the Tucker-Lewis index (.963) were above the recommended threshold of .90, and the root mean square error of approximation (.045) was below the recommended lower bound of .050. The standardized factor loadings of this model were not so good as for the English data, even though all but one were higher than .40. Considering the low amount of variation in the French data in general and with a view to maximizing comparability with the English model, we decided to retain this indicator (i.e., Item 1.3 of the questionnaire with a standardized factor loading of .383). The resulting measurement model provided a reasonable fit of the data.

Table 6 Estimated unstandardized path coefficients (b) and standardized path coefficients (b^*) from the structural equation modeling analysis for the French vocabulary test

Parameter	b	SE	b^*	z	p
Vocabulary knowledge					
Use (friends/family)	7.242	9.453	.138	0.766	.444
Use (other)	−3.332	5.136	−.095	−0.649	.516
Audiovisual	8.266	11.874	.152	0.696	.486
Written media	6.540	7.024	.158	0.931	.352
Online/games	−7.569	15.494	−.160	−0.489	.625
Gender = male	1.344	2.301	.029	0.584	.559
Gender = female	0.00				
Education level = 2nd year secondary	−23.991	3.018	−.499	−7.949	.001
Education level = 4th year secondary	0.00				
Education level = 1st year university	21.575	2.648	.446	8.147	.001

    None of the latent variables related to out-of-school contact significantly influenced French vocabulary scores, and neither did gender (see Table 6). The two variables related to education level, however, had a highly significant effect on vocabulary knowledge ($p < .001$). The predictors in the model jointly explained 70.8% of the variance in vocabulary knowledge.

Discussion

Learners' Exposure to English and French

The questionnaire results confirmed previous research into out-of-school exposure to English (Kuppens, 2010; Lindgren & Muñoz, 2013; Peters, 2018) that had shown that learners' main sources of out-of-school exposure are listening to songs, watching TV and movies, playing computer games, and visiting websites. This was the case for our three different age groups. Reading, on the other hand, was an activity that our participants had not frequently engaged in, although the structural equation modeling analysis showed that the university participants had read more English books and magazines than the participants from secondary education. Needless to say, learners need a sufficiently large vocabulary size to be able to read authentic books, which might explain why the university participants had read more. Further, the structural equation modeling analysis suggested that the university participants used English more frequently than the participants from secondary education. Finally, in agreement

with Sundqvist's research into gaming (Sundqvist & Sylvén, 2014; Sylvén & Sundqvist, 2012), we found that males played more online games than females.

Even though English was the participants' second foreign language, it is clear that they were more exposed to English than to French. This is in agreement with the findings in the ESLC, but our study clarifies that this holds for all three different age groups. Unlike French, English is omnipresent in Flemish society (music, TV, online), especially because Flanders has a subtitling tradition (see Verspoor, de Bot, & van Rein, 2011). Given that many movies and TV programs are in English, Flemish learners have many opportunities to be exposed to English from a young age (De Wilde et al., 2019; Kuppens, 2010). Verspoor et al. (2011) estimated that Dutch TV viewers receive at least one hour of English input per day. Our study lends support to Muñoz's (2012) claim that in the case of English in particular, "it seems that classroom-based learning is less and less the sole path followed for learning the language and that out-of-class exposure offers increased learning opportunities" (p. 155).

Drawing on Muñoz (2008), we conclude that our participants' first foreign language, French, can be considered a language that is typically taught in a formal setting, which means that (a) formal instruction is limited to two or three 50-minute sessions per week, (b) out-of-school exposure to the foreign language is limited, (c) French is not spoken outside of the classroom (unless a learner lives in Brussels), and (d) French is not the language of communication between peers. The fact that French is one of the three official languages in Belgium and is introduced at an earlier age in school does not seem to have an effect on learners.

Learners' Vocabulary Knowledge in English and French
Even though our participants had started three years earlier with French instruction than with English instruction and had received hundreds of hours more of instruction in French, participants from all three education levels knew more English than French words. Further, the gap became larger for the 5K word band. This finding mirrors the results of the ESLC, which showed that Flemish learners' performance on the English tests was better than learners' performance on the French tests. It should be noted though that our participants' more limited vocabulary knowledge of French might have affected their comprehension of some of the response choices in the 4K- and 5K-band test sections and consequently also their test scores.

The large amounts of English language input to which the participants had been exposed seem to have outweighed the earlier start that they had with formal French instruction. As DeKeyser (2011) argued, instruction of one or

two hours per week does not suffice when there is no additional exposure to foreign language input. This applies to our study too because the participants had had only two to three hours of French per week in primary school. It seems that "traditional foreign language education in school can hardly provide the required contact time with a L2" (Jaekel et al., 2017, p. 635) to make large learning gains. Moreover, it should be pointed out that, although an earlier start for French has the potential to increase the length and amount of instruction and input, this potential is not always fully exploited because research has shown that only 2% of the teachers in primary school use only French as the medium of instruction and 21% mostly French (in addition to Dutch), limiting even further the exposure to French input (Vlaamse Overheid, 2018).

Predictors of Learners' Vocabulary Knowledge

We ran two separate structural equation modeling analyses to examine which variables were predictors of participants' vocabulary knowledge: one analysis for French and one for English. Even though we strove to maximize the comparability between the two structural equation models, there were some differences between the two models, so directly comparing the results for English and French requires caution. The analyses for French revealed that only length of instruction (education level) had an impact on participants' vocabulary knowledge in French. Participants' out-of-school exposure to French was probably too limited to have any effect on their vocabulary knowledge. The findings support previous research (González-Fernández & Schmitt, 2015; Muñoz, 2011; Peters, 2018; Webb & Chang, 2012) that has shown the positive effects of length of instruction on learners' vocabulary knowledge. Learners with more years of instruction tend to know more words. It seems that learners are capable of acquiring a considerable number of words through formal instruction, although it should be acknowledged that even after eight years of instruction, our French foreign language participants still seemed to fall short of meeting the vocabulary targets put forward for reading authentic texts and watching TV and movies, a finding that is in line with other studies on the effects of instruction (Milton, 2008; Webb & Chang, 2012). In contexts where learners are not exposed to large amounts of foreign language input, they often fail to meet "even moderate vocabulary learning goals" (Schmitt, 2008, p. 332). In our study, a majority of the university students, who had received 790 to 1,060 hours of French study, were not familiar with the 2,000 most frequent words in French (with 90% as the cutoff score). As Webb and Chang (2012) have argued, it seems that "some form of vocabulary learning plan at the institutional level"

(p. 121) is needed if so few learners know the high-frequency words after so many years of instruction.

The analyses for English revealed a different picture. In addition to length of instruction, participants' current engagement with online activities in English also contributed to their vocabulary knowledge, which corroborates previous research that has shown that visiting English language websites (González-Fernández & Schmitt, 2015; Peters, 2018), on the one hand, and playing English language computer games and using English while playing games (Hannibal Jensen, 2017; Sundqvist & Sylvén, 2014), on the other, have the potential to foster learners' vocabulary knowledge. Yet, it would be incorrect to conclude that the other variables are not beneficial for learners' vocabulary growth. The fact that no other variables had an impact on participants' vocabulary knowledge could be explained by participants' large amounts of out-of-school exposure to English and, consequently, by a lack of variance because of a ceiling effect for a number of questionnaire items. For instance, only one participant reported never watching subtitled TV programs; three participants reported never watching subtitled movies.

It is thus very likely that participants' larger exposure to English language audiovisual input and written input than to French language media also impacted their vocabulary knowledge. The results of the participants from the second year of secondary school illustrate this. Even though these participants had received only 33 hours of English compared to 343 to 481 hours of French, their vocabulary size was significantly larger in English than in French. Other studies (Kuppens, 2010; Puimège & Peters, 2019) have shown that Flemish children (9–12 years old) already know a considerable number of words (estimates range from 2,500 to 3,200 at the level of meaning recognition) before the start of formal English instruction. These findings have been explained by learners' TV viewing behavior because learners who frequently watch English language TV with subtitles tend to perform better (Kuppens, 2010). The results of the participants from the second year of secondary school and those of the studies by Kuppens (2010) and by Puimège and Peters (2019) also show that it is not only proficient learners who engage with English outside of the classroom but also learners at the beginning of their English trajectory.

Finally, we should address the lack of a gender effect. Although in secondary education male participants obtained higher scores on the English test than female participants, and the mixed-effects analysis revealed a significant interaction between gender and language, gender was no longer a significant predictor of vocabulary knowledge in English in the structural equation modeling analysis. This finding shows that great care should be taken when

investigating gender effects on language learning because gender differences may be mediated by other variables as was the case in our study (see Courtney et al., 2017, for another example). Gender had an effect on participants' online activities in English, which in turn had an impact on participants' vocabulary scores. The differences in English vocabulary knowledge between females and males in secondary education should thus not be attributed to gender differences but to males' more frequent gaming and online activities.

Pedagogical Implications

The findings of this study have a number of pedagogical implications. First, length of instruction had a positive impact on participants' vocabulary knowledge in English as well as French. The study shows that learners can acquire a considerable, albeit modest, number of words in an instructed setting. However, teachers and policymakers should not have unrealistic expectations with regard to learners' vocabulary size when exposure to the foreign language is limited to two to four hours per week, as is the case for French foreign language learners in Flanders. What this study shows is that teachers should strive for large amounts of foreign language input if they want learners to be able to operate in the foreign language. This means that teachers should encourage learners to engage with the foreign language outside of the foreign language classroom and should show learners how they can best do this.

Researchers have traditionally proposed reading as a means of enlarging learners' vocabulary size. However, our study shows that learners, and younger learners in particular, do not tend to read foreign language books or magazines very often. Given the vocabulary demands for reading authentic books, reading seems more suitable for older learners, such as university students, than for beginning learners. The reading figures are in sharp contrast with learners' TV viewing habits, which lends evidence to Webb's (2015) claim that extensive viewing has the potential to fill the need for more foreign language input and that "its greatest value lies in out-of-school viewing" (p. 160). Peters and Webb (2018) argued that, because people like watching TV and movies, it offers great potential for vocabulary learning in the long run. Finally, our study shows that learners' frequent contact with English in online activities (Internet, games) is beneficial for their vocabulary development. Because most learners now have easy access to foreign language audiovisual input and online games through the Internet (Webb, 2015) and most learners seem to prefer these activities over reading, more studies into these types of input would be a fruitful area for further vocabulary research.

Limitations and Future Work

Our study had a number of limitations. Research has shown that cognate linguistic distance has an impact on learners' language proficiency (Lindgren & Muñoz, 2013; Muñoz, Cadierno, & Casas, 2018). Even though we controlled for cognates in the vocabulary test, the smaller cognate linguistic distance between Dutch and English than between Dutch and French might still have played a role. Second, we only tapped into current out-of-school exposure. More research is warranted into learners' longitudinal out-of-school exposure to shed more light on the effects of accumulated exposure to foreign language input. Third, our sample was a convenience sample and may thus not be representative for all learners in Flanders. Moreover, because the sample size was not very large, the findings of the structural equation modeling analyses have to be considered with the necessary care, and it remains to be seen whether the results reported here will be replicated in future studies. Especially in the structural equation model for French, statistical power may have been an issue, given the relatively low factor loadings for a number of items (especially for the factor online/games). Even though our aim was to ensure comparability between the models for French and English, we allowed for certain differences in model structure (i.e., two merged factors in the French model; different items eliminated due to lack of variation), which makes a direct comparison less straightforward. Further, we did not account for learners' socioeconomic status or L1 literacy. Future research could investigate how these variables affect learners' out-of-school exposure to foreign languages. Finally, an issue that we did not address in our study was French teaching practices in primary school. More fine-grained analyses are needed to investigate the effect of teaching practices on language learning if researchers want to deepen their understanding of the effect of instruction. Although research is starting to show the impact that teachers' language proficiency can have on language learning outcomes (see Graham et al., 2017, for an example), little is actually known about teachers' "abilities, level of training, methodological knowledge and language proficiency" (Jaekel et al., 2017, p. 636).

Conclusion

This cross-sectional study investigated the relationships among out-of-school exposure, length of instruction, gender, and learners' vocabulary knowledge in two foreign languages. Unlike learners' experience with French (their first foreign language), learners were exposed to large amounts of English outside of the classroom, which provides learners with ample opportunities for informal learning. Consequently, our participants' vocabulary scores were consistently

higher in English than in French in spite of fewer years and hours of study. Further, participants with more years of instruction knew more words, in English as well as in French. In addition to length of instruction, participants' vocabulary knowledge in English was also affected by their online out-of-school activities in English (gaming, Internet). The findings suggest that, if learners want to develop a large vocabulary size, they need large amounts of foreign language input—most crucially, more input than they can typically receive in formal settings with two to four hours of instruction per week.

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Notes

1 We asked participants how often they engaged in the following activities in English and French classes: vocabulary, grammar, listening, writing, speaking, reading, and pronunciation. We also informed them about the importance of these activities for English and for French. We found no differences between English and French.

2 We collected data in the fourth year of secondary education in three different class groups with two groups having four hours of French per week and one group three hours of French. The group with three hours of French performed best (50.76%). An ANOVA indicated that one group with four hours of French had significantly lower French vocabulary scores (36.04%) than the other two groups (49.85% and 50.76%, respectively), who did not differ significantly from each other in spite of a different amount of instruction per week.

3 See https://www.wordfrequency.info/free.asp.

4 The complete questionnaire is available at https://crell.jrc.ec.europa.eu/sites/default/files/files/eslc/MS_SQ_EN.pdf.

5 We asked questions only about language camps and not about courses at private language institutes because the former tend to be more popular in Flanders.

6 Out of 138 participants, 130 claimed not to come into contact with English outside school through English-speaking people living in their place of residence (Item 2.2), and 134 (out of 138) participants indicated listening to songs in English a few times per week or more (Item 4.1).

7 Because of the correlations between the latent variables, it was not possible to decompose the total explained variance into the variance explained by the individual predictors.

8 For Items 1.1 and 2.2 of the questionnaire, only 14 participants (out of 138) replied "yes." For Item 1.3, there were 24 positive replies, and only eight participants replied "yes" to Item 6.1.

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Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's website:

Appendix S1. Questions Analyzed in the Present Study.
Appendix S2. Descriptive Statistics for Out-Of-School Exposure.
Appendix S3. Generalized Estimating Equations Analyses per Question.
Appendix S4. Results for Research Question 2.2.
Appendix S5. Factor Loadings of Structural Equation Modeling Analyses.

Appendix: Accessible Summary (also publicly available at https://oasis-database.org)

The Positive Relationship Between Out-of-School Exposure and Vocabulary Knowledge

What This Research Was About and Why It Is Important

Foreign language learners need to develop a large vocabulary to be able to read and understand the language they are learning. Given the limited classroom time available, researchers have repeatedly advocated contact with the foreign language outside the classroom to increase learners' vocabulary size. In this study, the researchers explored how out-of-school contact with a foreign language can contribute to learners' vocabulary knowledge. The researchers compared Flemish learners' vocabulary knowledge and out-of-school contact with two foreign languages—French and English. Flemish learners start learning French at school at the age of 10–11 and English at the age of 13–14. However, unlike French, English is omnipresent in Flemish society in terms of subtitled movies,

television, songs, and Internet content. The researchers found that instruction was beneficial for vocabulary learning, but that the earlier start for French at school could not compensate for the large amounts of out-of-school English input, which explained why learners' vocabulary in English was consistently larger than their vocabulary in French.

What the Researchers Did
- The researchers tested 138 Flemish speakers in Flanders (Belgium), testing these learners' vocabulary knowledge in French (their first foreign language) and English (their second foreign language). The three groups were:
  - 48 14-year-old learners in the second grade of secondary education;
  - 43 16-year-old learners in the fourth grade of secondary education; and
  - 47 19-year-old learners in their first year at university.
- The researchers also asked the learners how much they engaged with French and English outside the classroom.

What the Researchers Found
- The learners frequently engaged with English outside of the classroom, but only rarely with French, even though it is an official language in Belgium and their first foreign language at school.
- The learners mainly experienced out-of-school contact with English through television, the Internet, and computer games. They did not often engage in reading activities, although university learners read more in English than secondary school learners did.
- In the three age groups, the learners' vocabulary knowledge in English was consistently larger than in French in spite of fewer years of English instruction.
- Even after eight years of instruction, many learners were not familiar with the 2,000 most frequent words in French, which meant that they could do little with the language in terms of reading, listening, speaking, or writing.
- Although a larger vocabulary size was related to more years of instruction, both for French and for English, the learners' vocabulary knowledge in English was also positively related to their out-of-school online activities (gaming, Internet).

Things to Consider
- In spite of the beneficial effects of instruction, formal instruction of 2–4 hours per week was not enough to make large learning gains for the learners

in this study because the learners needed large amounts of language input to develop a large vocabulary size.
- These findings confirm the knowledge shared by many language teachers, namely, that foreign language learners need to be guided in engaging with the foreign language outside of the language classroom.
- The researchers propose a principled approach to foreign language vocabulary teaching, in which a vocabulary learning plan is included in foreign language curricula.

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