



The impact of instruction and out-of-school exposure to FL 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 (FL): French (first FL) and English (second FL). The findings suggest that although length of instruction is positively correlated with vocabulary knowledge in English and French, the gains remain modest when out-of-school exposure to FL input is limited. Despite fewer years of English instruction, learners' 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. Learners' current online activities in particular had a positive effect on their vocabulary knowledge in English. Although learners' engagement with online activities in English was

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influenced by gender, gender did not have a direct effect on learners' vocabulary knowledge, as was shown in the SEM analysis.

Keywords:

vocabulary, out-of-school exposure, out-of-school contact, extramural English, instruction, English, French

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Research has demonstrated that English language learners need to know the meaning of the most frequent 8,000-9,000 word families to reach 98% coverage in authentic written discourse (Nation, 2006), 750 to 3,000 word families to understand 90 to 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, b). To increase learners' vocabulary size, researchers have repeatedly advocated contact with the foreign language (FL) outside of the classroom, e.g. 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 FL language input has been growing steadily (González-Fernández & Schmitt, 2015; Peters, 2018; Sockett & Kusyk, 2015).

The goal of the present study is to identify FL learners' out-of-school activities in two FL (French and English) and to unravel the relationships between learners' receptive vocabulary knowledge in these two FL and input (operationalized as length of instruction and out-of-school exposure to the FL) as well as gender, in order to enhance our understanding of the input-acquisition relationship.

Background

Length of instruction

There is growing evidence that it is not an early start, but length of instruction and amount of instruction (= hours per week) that are determinant factors in FL learning (Graham, Courtney, Marinis, & Tonkyn, 2017; Muñoz, 2011, 2014; Webb & Chang, 2012). In two studies, Muñoz (2011, 2014) showed that it was length of instruction and exposure to FL input and not an early start that were determinant factors for oral performance on the one hand (Muñoz, 2014) and for general language proficiency and vocabulary knowledge on the other (Muñoz,

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2011). However, input (= informal contact with FL 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 was positively correlated with length of instruction and with out-of-school language contact, but the latter explained more variance than length of instruction (González-Fernández & Schmitt, 2015; Peters, 2018). Finally, amount of instruction (= hours per week) has also been shown to affect language learning positively (Graham et al., 2017). Following Taiwanese EFL learners for five 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 seem to mirror those of Milton (2008), who found similar results for French-as-a-foreign-language learners in the UK.

It seems that length of instruction, being one type of input and not to be confounded with starting age, is beneficial for FL learners' vocabulary development. However, research so far has focused on learners' vocabulary knowledge in one FL only, which was mainly English. To develop a more complete picture of the effect of length of instruction on vocabulary knowledge and how it interacts 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 FL outside of the classroom, if they want to build a large vocabulary size (Nation, 2015; Schmitt, 2008; Webb, 2015). Previous research has established that the most important out-of-school activities are watching TV, using the computer, reading books and magazines, and listening to songs (De Wilde, Brysbaert, & Eyckmans, 2019; González-

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Fernández & Schmitt, 2015; Kuppens, 2010; Lindgren & Muñoz, 2013; Muñoz, 2011, 2014; Peters, 2018; Sundqvist & Sylvén, 2014). The European Survey on Language Competences (henceforth ESLC) (European Commission, 2012), using self-reported contact and use data, showed that learners have more out-of-school contact with English than with other FL, also in Flanders (= the research context of the present study), where English is learners' second FL after French. However, the Flemish data for English and French were collected with different age groups (13-14 year old for French and 15-16 year old for English) making it not easy to directly compare learners' FL 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, it remains unclear what the precise relationship between out-of-school exposure to FL input and learners' FL performance is. The present study aims to fill this gap.

In the remainder of this section, different types of out-of-school exposure will be discussed.

TV viewing.

Recently, extensive viewing, i.e. the regular viewing of L2 television, has been put forward as a potentially effective method to fuel a learner's vocabulary size (Webb, 2015). Webb (2015) argues that watching FL 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).

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Data from several studies suggest that EFL learners frequently watch FL 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 out-of-school TV viewing is positively correlated with language learning. 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 of out-of-school TV viewing. Kuppens (2010), who collected data with Flemish 12-year old learners, who had not received any formal instruction yet, showed that watching subtitled TV and movies clearly had an impact on these learners' English vocabulary knowledge, as measured in two translation tests. Similarly, studies using vocabulary tests have shown that learners who frequently watch English language TV and movies know more single words (Peters, 2018), collocations (González-Fernández & Schmitt, 2015), and phrasal verbs (Schmitt & Redwood, 2011) than learners who do this less often. Finally, Sockett and Kusyk (2015) found a positive effect of regularly watching TV series on learners' comprehension of phrases (4-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,

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2019). Such activities entail the use of social media (e.g. Facebook, Twitter, Skype, ...), 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 EFL learners (aged 10-11 and 15-16), 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 (more than five hours of gaming per week) knew more words and used more advanced vocabulary than non-gamers. In a recent study with young Danish learners (7 or 9 years old), Hannibal Jensen (2017) also found that young Danish learners (7 or 9 years old) frequently play computer games and that gaming with spoken and written English input is positively correlated with learners' vocabulary knowledge. Playing computer games was also positively correlated with learners' reading and listening proficiency in Lindgren and Muñoz' (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, more factors were investigated in the study by Lindgren and Muñoz (2013). Secondly, 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 (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 EFL learners, Peters (2018) did not find a relationship between gaming and vocabulary knowledge, which could be attributed to the participants' older age, as university learners

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might game 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 are mixed (De Wilde et al., 2019; González-Fernández & Schmitt, 2015; Schmitt & Redwood, 2011).

It seems that the positive effect of gaming is less pronounced in studies in which gaming is but one factor in addition to reading, TV viewing or listening to songs. Further research into the role of computer games in vocabulary learning seems to be needed.

Reading.

Reading and extensive reading have also been proposed as a method for increasing learners' vocabulary size (Nation, 2015). Moreover, research has shown that 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 EFL learners in Flanders do not often read books or magazines, there was a positive correlation between the reading they did outside the classroom and their vocabulary knowledge. Two other studies corroborate 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 (10-12 years old) showed that these learners engaged in very few reading activities outside of the classroom (Lindgren & Muñoz, 2013; Sylvén & Sundqvist, 2012), making it difficult to study its effect on vocabulary learning. The fact that young learners engage in fewer FL literacy-based

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activities could be explained by their lower proficiency which does not meet the vocabulary demands for reading in a FL yet.

Listening to songs.

Studies have shown that EFL learners 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. Whereas Lindgren and Muñoz (2013) found a positive relationship between listening to music and young learners' reading and listening comprehension, three 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 for learning languages and are also better at learning foreign language 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 seem to suggest that female learners obtain higher scores on language tests than male learners. In a large-scale study with Dutch-as-a-foreign-language learners, test results of 27,119 adult language learners were analysed (van der Slik, van Hout, & Schepens, 2015). Taking a number of learner-related variables into account (L1, education, hours of instruction, age of arrival, length of residence), van der Slik et al. (2015) 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 et al., 2017) also found better scores for girls than for boys.

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However, when L1 literacy and prior learning experience were controlled for (Courtney et al., 2017), the differences between girls and boys disappeared, suggesting that it is not gender, but L1 literacy and prior learning experience that are the determinant factors. In the ESLC (European Commission, 2012), gender was also addressed, but the findings related to the Flemish data set did not reveal a difference between boys and girls in the reading, listening, and writing tests.

The role of gender has also been addressed in studies investigating the relationship between learners' out-of-school exposure to English and vocabulary knowledge. One consistent finding is that boys are more frequently engaged in playing English language computer games than girls (Hannibal Jensen, 2017; Peters, 2018; Sundqvist & Sylvén, 2014; Sundqvist & Wikström, 2014). Sundqvist and Wikström (2014) found significant correlations between the frequency of gaming and boys' vocabulary knowledge, but not with girls. However, compared to the boys, most girls 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 learners' vocabulary knowledge in spite of more frequent gaming by boys than girls. Finally, Schmitt and Redwood (2011) did not find a difference between female and male participants' knowledge of phrasal verbs.

Although more studies are taking gender into account, the evidence regarding its effect on vocabulary knowledge remains 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 seems warranted.

Rationale and research questions

Although there is some evidence for the positive effects of length of instruction and out-of-school exposure on learners' vocabulary knowledge in English, no single study has focused

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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 in different grades 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 FL is needed in order to determine how to best fuel vocabulary knowledge. The aim of the present study is to investigate the relationships between gender, out-of-school exposure, length of instruction and vocabulary knowledge in two foreign languages. This is important if we want to shed more light on how different types of language input might contribute to lexical development. The following research questions were addressed:

1. Does Flemish FL learners' out-of-school exposure differ for French and English and for boys and girls?

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 influenced by 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 those questions, a cross-sectional, within-participants design was adopted 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-subject design allows us to

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directly compare learners' exposure and vocabulary knowledge in two FL. Throughout this manuscript, we use the term out-of-school exposure to refer to both exposure to FL input (e.g. reading books, watching TV) and use of the FL (e.g. using the FL in computer games).

Method

Research context

The data for this study were collected in Flanders, the Dutch-speaking part of Belgium. Belgium has three official languages: (1) Dutch, which is spoken in the North, (2) French, being spoken in the southern part of the country, and (3) German, which is spoken by a minority in the east of Belgium. 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, whereas English is the second foreign language. It should be pointed out here that although French is an official language in Belgium, it is a FL 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, only allow for the use of Dutch in public administration, schools, and court (see van der Jeught, 2017, for an overview of Belgian language laws).

Normally, learners start with French instruction in the fifth year of primary education (at the age of 10-11), which is relatively late compared to most European countries, and with English instruction in the second year of secondary education (at the age of 13-14), although some schools introduce English or French earlier. In primary education, French is taught by generalist teachers (2 to 3 hours per week), whereas in secondary education French and English are taught by specialist teachers. Both French and English are compulsory subjects until the end of secondary education (age 18). Learners typically have two to three 50-minute lessons of English, depending on the curriculum chosen, and three to four 50-minute lessons

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of French. This means that Flemish learners will have had at least eight years of French instruction and five years of English instruction by the end of secondary education (age 18). Additionally, they have more hours of French than English instruction per year. Further, the teaching approach to English and French is very similar, as was also revealed in the questionnaire that was given to the participants¹.

Participants

Participants for this study were recruited from a convenience sample in two secondary schools and one university. Specifically, data were collected with three independent samples of Flemish English- and French-as-a-foreign language learners ($n = 145$) in the second year (SEC2) and in the fourth year of secondary education (SEC4) and learners in the first year at university (UNIV) (business administration, and law). Data of seven participants were removed because they spoke either French or 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).

The average length of instruction per grade is presented in Table 1 as well as the range of hours of instruction received. Ranges were used because the number of hours received might not be the same for all learners given that the number of hours of French or English per week depends on the curriculum, the grade, and the school. In Table 1, the actual hours (60') are given.

Table 1

Participants' profile

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	<i>n</i>	Girls <i>n</i>	Boys <i>n</i>	Age Mean (range)	Length of formal instruction (mean)		Number of hours (60') of formal instruction received (range)	
					English	French	English	French
SEC2	48	22	26	13.22 (12-14)	1.02	4.31	33	343 - 481
SEC4	43	19	24	15.9 (14-16)	2.98	6.20	167 - 200	560 - 747
UNIV	47	31	16	18.38 (18-21)	5.23	9.09	335 - 462	790 - 1,060
Total	138	72	66	/	/	/	/	/

Note. SEC2 = second grade of secondary education, SEC4 = fourth grade of secondary education, UNIV = university

Learners in the second year of secondary education would typically be in their first year of English instruction (2 hours per week; one hour = 50 minutes) and in their fourth year of French instruction (4 hours per week). Five learners reported to have had more years of French (six to eight years). Learners in the fourth year of secondary education would be in their third year of English instruction (2 hours per week) and in their sixth year of French instruction (3 or 4 hours per week², except for six learners who had received more years of French instruction, seven to ten years). Finally, business students in their first year at university (age 18-19) would be in their sixth year of English and their ninth year of French instruction with two compulsory hours of English and French every week. The law students (age 18-21) only have a compulsory French course (legal French) in the first year (two hours

every two weeks), as English (legal English) is taught in the second year. Three university students reported to have started earlier with French instruction.

Instruments

To collect our data, we used an English and a French vocabulary test and a questionnaire that tapped into learners' exposure to English and French outside of the classroom.

Vocabulary tests.

Learners' vocabulary knowledge was measured by means of a written English and French frequency-based vocabulary test, viz. the English and French VocabLab-tests (see Peters, Velghe, & Van Rompaey, 2019, for a detailed description of the corpus selection, item selection, and test format). We selected these two tests for reasons of comparability: they both have the lemma as counting unit; they do not contain cognate test items; and they are developed according the same principles

First, the English and French VocabLab-test have the same counting unit, the lemma, which is essential to be able to compare the results of the English and the French vocabulary test. Second, the tests did not target cognates because we were interested in testing learners' *real* vocabulary knowledge and not their *potential* vocabulary (Berman et al., 1968, as cited in Palmberg, 1987, p.201). The former refers to words learners recognize because they have been exposed to these words, whereas potential vocabulary knowledge refers to words learners recognize even without having been exposed to them, such as cognates. Cognates (words that are similar in form and meaning in the L1 and L2, e.g. 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 (VLT) correctly on the basis

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of knowing French-English cognates and guessing. His results suggest that French-speaking test takers can answer certain test items on the English VLT 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 because of a higher number of cognates. Cognates in the test could thus be a confounding variable, which is why we decided to use vocabulary tests without such items.

Third, both tests were developed according to the same principles. The VocabLab-tests provide an estimate of learners' vocabulary knowledge at four frequency levels, viz. 0-2,000 (2K), 2,001-3,000 (3K), 3,001-4,000 (4K), and 4,001-5,000 (5K). The 2K and 3K sections focus on high-frequency vocabulary, while the 4K and 5K sections focus on mid-frequency vocabulary (Schmitt & Schmitt, 2014). For each frequency level, 30 items were sampled from a lemmatized frequency list. For the English test, the frequency list was sampled from the *Corpus of Contemporary American English (COCA)* (Davies, 2008)³, whereas 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 higher-frequency words than the word tested, and one "I don't know"-option to discourage guessing. Both tests had good internal consistency (English test Cronbach's alpha = .98, French test Cronbach's alpha = .96, $n = 138$). Further, both tests show an implicational scale, whereby learners tend to score better on test sections sampling from high frequency bands than on items sampled from lower-frequency bands, indicating that high-frequency words tend to be learned before mid-frequency words, which is generally considered evidence of construct validity.

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Example of a test item in the English and French vocabulary test

talk	goût (m)
<input type="radio"/> to speak	<input type="radio"/> morceau long et fin
<input type="radio"/> to remove something	<input type="radio"/> période de cent ans
<input type="radio"/> to give in return for money	<input type="radio"/> terre entourée d'eau
<input type="radio"/> to start an important activity	<input type="radio"/> impression laissée dans la bouche
<input type="radio"/> I don't know the answer	<input type="radio"/> je ne connais pas la réponse

Questionnaire.

To investigate learners' current out-of-school contact with English and French, we used the questionnaire of the ESLC (European Commission, 2012)⁴. This means that learners were asked to complete two identical questionnaires: one about English and one about French. In this study, the analysis focuses on those questions that relate to learners' exposure to the foreign language outside of the classroom (see Appendix 1 in the Supporting Information). The questions target (1) contact with and use of FL language through friends and family, (2) contact with and use of FL language through other instances (e.g., holiday, tourists), (3) contact with FL through subtitled media, (4) contact with FL through non-subtitled media, (5) contact with FL through written input, (6) contact with and use of FL in online activities, and (7) contact with FL during language camps⁵. The questionnaire consists 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

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All data were collected at the start of the second semester (in February). Data for English and French were collected either in the same week or in two consecutive weeks. The participants from secondary education completed the written vocabulary test and the questionnaire in two separate sessions during their regular French and English classes. One class consists of 50 minutes, which is why two sessions were needed. Participants needed about 40 minutes to complete the vocabulary test and twenty minutes to complete the questionnaire. The university students did the test as well as the questionnaire in one session (1.5 hours).

Scoring and analyses

Scoring.

The scoring system for the vocabulary tests is straightforward: a correct response is attributed 1 point, an incorrect one zero. The raw scores (max=120 for full test, 30 per subsection) were converted into percentages to facilitate the interpretation of the analyses.

Analyses.

Before we turn to the specific statistical models per research question, four more general comments are in order. First, the dataset only includes *complete* cases, meaning there are no missing data, and consequently there is no associated loss of statistical power and increase in bias. Second, we included the categorical variable ‘grade’ 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 clusters around three values for both English and French, with only very limited variation around these values (e.g., out of 47 university students, 44 report having received 9 hours of French instruction, two 10 years, and one 11

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years). We are of the opinion that the small loss of information caused by the reduction to three categories is largely compensated by the ability to model non-linear relationships for this trichotomous variable. Third, dummy coding is used in all analyses involving categorical variables, and reference categories are indicated in the presentation of the results. Finally, in choosing the statistical models, we aim for parsimony, and generally favor simpler models over more complex ones.

To answer the first research question about differences in learners' out-of-school exposure, we used Generalized Estimating Equations (GEEs – calculated using SPSS version 24). GEEs 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 non-normally distributed data. The models include the following factors: language (= within-subject 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 the learners' receptive vocabulary knowledge in English and French, we ran multivariate linear mixed effects models (in SPSS 24) with (1) learners' vocabulary test scores as dependent variable, (2) language (English, French), gender and grade as fixed main factor, (3) the two-way interactions between the aforementioned factors and (4) participants as random effect. We fitted one model for the total vocabulary score as well as separate models for the four test sections which correspond to different frequency bands. We opted for models with a simple correlation structure consisting of a single variance component (or *random intercepts*). Normality of data in each subgroup was checked through skewness and kurtosis (between -2 and 2). For the total scores only one group (girls in SEC2, English, skewness = 2.15) showed a non-normal distribution. The normality assumption was not met in five out of 24 groups (= 4 test sections x 2 languages x 3 grades) for the test sections.

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However, with more than 40 participants per group the analysis of fixed effects should be 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 (SEM). With SEM 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 modelled (similar to path analysis) (Brown, 2006). In our analysis, the individual questionnaire items can be considered indicators of the different latent factors related to out-of-school exposure. Compared to a regression analysis, SEM 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. A SEM analysis, thus, allows us 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 is both theoretically motivated and based on the findings of previous research. In each model there is one observed outcome variable (the vocabulary knowledge test score), as well as two observed exogenous variables (gender and grade), which are both categorical. Out-of-school exposure is represented by a number of latent variables, which are measured by means of the items in the questionnaire. Since the indicators (i.e. the questionnaire items) are binary or ordinal, diagonally weighted least squares (DWLS) is used to estimate the model parameters, and robust standard errors are computed using the full

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weight matrix. Factor loadings of the first indicators of latent variables are fixed to 1, in order to fix the scale of the latent variables.

With 138 subjects per SEM and a considerable amount of path coefficients to be estimated, one could argue that there is a lack of statistical power, given that a minimum of 5 to 10 participants per estimated parameter is sometimes advised (Bentler & Chou, 1987), but this rule of thumb has recently been questioned (Sideridis et al., 2014; Wolf et al., 2013). As of yet, there is no agreed-upon way to calculate power in SEM, since it is influenced by a complex interplay of factors, 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 is not very high, but there are no missing data, and all latent variables have between two and six indicators. Moreover, the intercorrelations between the various latent variables are reasonably high. Considering all these factors, we believe that our sample size is sufficient to answer this research question, even though statistical power is something to be taken into account in the interpretation of the results.

The sample size also influenced our modeling approach, which is 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 (Root Mean Square Error of Approximation, RMSEA; Comparative Fit Index, CFI; Tucker-Lewis Index, TLI), and allowed for minor modifications to the initial model if modification indices (MIs) and expected parameter changes (EPCs) pointed in this direction, and in case the modifications could be theoretically motivated. Moreover, we only included paths between the two observed exogenous variables (gender and grade) and the latent variables in case MIs and EPCs pointed in this direction. We also exclude questionnaire items that did not display enough variation. Because of this

partly data-driven modeling approach, the English and French models are not exactly the same. The specificities of both models are discussed in the Results section.

Results

Research question 1: Learners' exposure to English and French

In this section, we summarize the main findings of the GEE analyses regarding differences in exposure to English and French (see Appendix 2 in the Supporting Information for descriptive statistics and Appendix 3 for detailed results per question). First, learners were significantly more exposed to English language media (= audio-visual input with and without subtitles and written media) compared to French language media. Significantly higher exposure to English was found on *all* questions (7 in total) related to these three types of exposure, and for *all* grades, meaning that learners were more exposed to TV programs, films, songs, books and magazines/comics in English than in French. A second distinct difference regards learners' online use of both languages. Also here, results for the four questions related to this type of exposure showed that learners from the three grades were significantly more exposed to English than to French, which means that they more frequently play English language computer games than French games, visit English language websites more often than French ones and use English more often online than French. The results also revealed a significant interaction between language and gender (in 11 out of 12 analyses): boys are considerably more often engaged in online activities (games, internet) in English than girls, but not in French. Third, learners use English more often than French when communicating with friends, both in spoken and written interaction. Finally, for only two questions, significantly more contact with French than with English was found, viz. learners' participation in language camps (for older learners) and number of visits to countries in

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which the target language is spoken (for younger learners), but even for French the average amount of this kind of exposure that is reported is still very low.

Research question 2: Learners' vocabulary knowledge in English and French

As can be seen in Table 2, participants' total score on the English vocabulary test was consistently higher than on the French vocabulary test. This finding holds for the three groups, in spite of three more years of French formal instruction in each grade. It is interesting to note the difference in vocabulary knowledge between learners in their sixth year of English (university students) and learners in their sixth year of French (fourth year of secondary education), as the English test score (81-83%) is nearly double the French score (43-46%).

The results for gender are less straightforward. Although girls and boys do not seem to differ much in their knowledge of French vocabulary, a different picture emerges for English. Both in the second and the fourth year of secondary education, boys obtained higher scores on the English vocabulary test than girls, whereas in the first year at university, girls performed slightly better than boys.

In the linear mixed effects model, three parameters were positively related to learners' vocabulary knowledge (see Table 3). Learners' vocabulary was significantly larger in English than in French ($p < .0001$), with an average difference of 25 percentage points. Further, grade (length of instruction) was positively related to learners' vocabulary knowledge in English and French, whereby learners in the second grade knew fewer words (difference of 20 points) than learners in the fourth grade ($p < .0001$), and learners in the fourth grade knew fewer words (difference of 17 points) than the university learners ($p < .0001$). Finally, we found a significant interaction between gender and language, showing that girls tended to know fewer words in English than boys.

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Table 2

Descriptive statistics of the English and French vocabulary test per grade and gender

Grade	Gender	English		French	
		Mean % (SD)	95% CI	Mean % (SD)	95% CI
SEC2	Girls (n = 22)	39.94 (19.24)	[30.41, 47.47]	23.49 (8.44)	[19.74, 27.23]
	Boys (n = 26)	53.19 (21.50)	[44.81, 62.18]	25.15 (10.42)	[21.95, 30.36]
SEC4	Girls (n = 19)	60.35 (15.75)	[52.76, 67.94]	43.11 (12.81)	[36.94, 49.29]
	Boys (n = 24)	73.61 (15.33)	[67.14, 80.09]	46.39 (10.65)	[41.89, 50.89]
UNIV	Girls (n = 31)	83.17 (9.63)	[79.64, 86.70]	63.63 (11.28)	[59.49, 67.77]
	Boys (n = 16)	81.41 (12.84)	[74.56, 88.25]	60.83 (13.42)	[53.69, 67.98]

Note. SEC2 = second year in secondary education, SEC4 = fourth year in secondary education, UNIV = first year university, SD = standard deviation, CI = confidence interval

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Table 3

Parameter estimates Linear Mixed Effects for English and French vocabulary knowledge

	Estimate	S.E.	<i>t</i>	<i>p</i>	95% confidence interval	
					Lower bound	Upper bound
Intercept	45.79	2.24	20.43	.000	41.36	50.21
Language=English	25.66	1.53	16.72	.000	22.62	28.69
Language=French	0	/				
Grade=Sec2	-20.52	2.58	-7.94	.000	-25.63	-15.42
Grade=Sec4	0					
Grade=Univ	17.40	2.65	6.58	.000	12.17	22.63
Gender (Female)	-1.15	2.39	-.48	.63	-5.86	3.57
Language (English) * Gender (Female)	-7.98	2.13	-3.75	.000	-12.19	-3.77
Residual	77.73	9.38		.000	61.36	98.48
Intercept (participant)	113.37	18.89		.000	81.78	157.16
-2LL	2173.61					

Note. S.E. = standard error, SEC2 = grade 2 in secondary school, SEC4 = grade 4 in secondary school, Univ = university

Table 4 shows the descriptive statistics per frequency band, per language, and per grade. The mixed effects analyses (see Appendix 4 in the Supporting Information) showed that language as well as grade were significant predictors of learners' vocabulary knowledge at the 3K (language, $F(1, 138.24) = 354.36, p < .0001$, grade $F(2, 139.00) = 106.06, p < .0001$) and 4K level (language, $F(1, 138.16) = 351.15, p < .0001$, grade $F(2, 139.22) = 92.03, p < .0001$). Further, a significant interaction between language and grade, was found for the 2K-level,

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showing that the gap between English and French becomes narrower with grade, with a difference of 24.7 points in SEC2 and 12.6 at university, $F(2, 137.47) = 9.47, p < .0001$, and for the 5K-level, in which the difference between English and French gets larger, with a difference of 12.7 points in SEC2 and 21.9 points at university, $F(2, 137.79) = 3.92, p = .022$.

Table 4

Descriptive statistics of the English and French vocabulary test, per frequency band and per grade

Grade		2K %	3K %	4K %	5K %
		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
		95% CI	95% CI	95% CI	95% CI
SEC2 <i>n</i> =48	English	64.72 (22.72)	49.86 (24.13)	41.60 (19.71)	32.11 (23.82)
		[58.12, 71.32]	[42.86, 56.87]	[35.87, 47.32]	[24.19, 38.03]
	French	40.00 (12.17)	24.31 (9.10)	15.97 (11.13)	19.44 (12.25)
		[36.47, 43.53]	[21.66, 26.95]	[12.74, 19.20]	[15.89, 23.01]
SEC4 <i>n</i> =43	English	87.05 (10.06)	73.26 (18.03)	60.85 (18.93)	49.85 (23.07)
		[84.00, 90.15]	[67.71, 78.81]	[55.02, 66.68]	[42.75, 56.95]
	French	67.21 (12.02)	43.02 (12.74)	34.57 (11.93)	34.96 (15.00)
		[63.51, 70.91]	[39.10, 46.94]	[30.90, 38.25]	[30.34, 39.58]
UNIV <i>n</i> =47	English	95.32 (5.50)	87.80 (9.79)	77.02 (13.96)	70.15 (18.20)
		[93.70, 96.94]	[84.93, 90.68]	[72.92, 81.11]	[64.70, 75.49]
	French	82.73 (8.67)	62.98 (13.77)	57.38 (17.33)	48.23 (14.90)
		[79.58, 84.67]	[58.94, 67.02]	[52.29, 62.47]	[43.85, 52.60]

Note. SEC2 = second year in secondary education, SEC4 = fourth year in secondary education, UNIV = first year university, SD = standard deviation, CI = confidence interval

Research question 3: Predictors of learners' vocabulary knowledge

Results for English.

Figure 1 provides a graphical representation of the structural equation model for English, including indicators (i.e. the questionnaire items listed in Appendix 1 in the Supporting Information), latent variables and relationships between latent variables and exogenous variables (gender and grade). All latent variables are theorized to have a direct effect on vocabulary knowledge. The model also includes covariances between the latent variables, but for the sake of interpretability these are not shown in Figure 1. No covariances between residuals are included. Based on descriptive statistics (i.e. lack of variation), two indicators (questions 2.2 and 4.1) were left out of the measurement model⁶. One indicator (2.6) was left out because of a 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 online/games in the model, as well as a direct link between grade and both use (other) and written media. Previous research has shown that the inclusion of these links is theoretically justified (Gonzalez-Fernandez & Schmitt, 2017; Hannibal Jensen, 2017; Peters, 2018; Sundqvist & Sylvén, 2014; Sundqvist & Wikström, 2014). In our model, the effect of gender and length of instruction (grade) on the outcome variable is thus mediated by these links with latent variables.

INSERT FIGURE 1 ABOUT HERE

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The *chi*-square statistic of the model (362.61), which was based on 138 observations, was significant with 249 degrees of freedom ($p < 0.001$). However, both CFI (0.966) and TLI (0.960) are considerably higher than the recommended threshold of 0.90, and the RMSEA (0.058) approaches the recommended lower bound of 0.05 (Brown, 2006; Browne & Cudeck, 1992; Hooper et al., 2008; Hu & Bentler, 1999). In addition, all standardized factor loadings were higher than 0.55 (see Appendix 5 in the Supporting Information). We can conclude that the measurement model yields an acceptable fit of the observed data.

Table 5

Estimated path coefficients SEM analysis English vocabulary test

	Estimate	Standard Error	Standardized coefficient	<i>p</i> -value
Vocabulary knowledge				
Use (friends/family)	-5.764	3.630	-0.163	0.112
Use (other)	-0.044	3.901	-0.001	0.991
Audio-visual (no sub)	3.598	4.904	0.116	0.464
Audio-visual (sub)	-0.212	2.425	-0.007	0.930
Written media	8.237	5.871	0.230	0.161
Online / games	9.234	2.490	0.393	0.000***
Gender=Male	-1.695	3.989	-0.031	0.671
Gender=Female	0	-	-	-
Grade=SEC2	-24.938	3.994	-0.442	0.000***
Grade=SEC4	0	-	-	-
Grade=University	16.376	5.517	0.289	0.003**
Online / games				
Gender=Male	1.344	0.220	0.587	0.000***
Use (other)				
Grade=University	0.414	0.207	0.294	0.045*
Written media				
Grade=University	0.456	0.221	0.288	0.039*

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Note: * < .05, ** < .01, *** < .001

Table 5 contains the estimated standardized and unstandardized regression parameters for the structural model, as well as the associated p -values of the significance tests. Of the six factors related to out-of-school contact, only ‘online/games’ had a significant impact on the vocabulary test scores ($p < 0.001$). Also grade significantly predicted vocabulary scores, with participants in the second year of secondary school scoring significantly lower than those in the fourth year ($p < 0.001$) and those at university scoring significantly higher ($p = 0.003$). All predictors combined explain 69.3% of the variance in vocabulary knowledge⁷. Gender had a highly significant effect on the factor online/games ($p < 0.001$; $R^2 = 0.345$), but not directly on vocabulary knowledge. The results also indicated that university students made more use of written media in English compared to fourth year secondary school learners ($p = 0.039$; $R^2 = 0.083$), and that they used English more on holidays and/or with tourists ($p = 0.045$; $R^2 = 0.086$).

Results for French.

The model for the French data, shown in Figure 2, is similar to the English one, but it is important to note that there are some structural differences. Four indicator variables are excluded from this model due to a lack of variation (questions 1.1, 1.3, 2.2 and 6.1)⁸. Moreover, the factors ‘audio-visual (subtitles)’ and ‘audio-visual (no subtitles)’ are merged, since their respective indicators were too highly inter-correlated. Based on data exploration, and in line with our findings related to research question 1 (i.e. no significant effect of gender on e.g. online language use in French), we did not include any relationships between gender/grade and the latent variables in this model, as was the case in the SEM for English. We did, however, add a covariance between items 6.2 and 6.3 due to the large modification

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index related to this parameter (the corresponding estimated correlation coefficient in the model is 0.843). This covariance makes sense from a theoretical point of view, since both of these items explicitly target gaming. Moreover, both load on the same factor, so no cross-loadings were introduced.

INSERT FIGURE 2 ABOUT HERE

The *chi*-square statistic of this model (328.276) was significant ($p=0.002$) with 257 degrees of freedom. As was the case for the English model, both CFI (0.968) and TLI (0.963) were above the recommended threshold of 0.90, and the RMSEA (0.045) was below the recommended lower bound of 0.050. The standardized factor loadings of this model were not as good as for the English data, even though all but one were higher than 0.40. 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 with a loading of 0.383). The resulting measurement model provides a reasonable fit of the data.

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 grade, however, had a highly significant effect on vocabulary knowledge ($p<0.001$). The predictors in the model jointly explain 70.8% of the variance in vocabulary knowledge.

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Table 6

Estimated path coefficients SEM analysis French vocabulary test

	Estimate	Standard Error	Standardized coefficient	P-value
Vocabulary knowledge				
Use (friends/family)	7.242	9.453	0.138	0.444
Use (other)	-3.332	5.136	-0.095	0.516
Audio-visual	8.266	11.874	0.152	0.486
Written media	6.540	7.024	0.158	0.352
Online / games	-7.569	15.494	-0.160	0.625
Gender=Male	1.344	2.301	0.029	0.559
Gender=Female	0	-	-	-
Grade=SEC2	-23.991	3.018	-0.499	0.000***
Grade=SEC4	0	-	-	-
Grade=University	21.575	2.648	0.446	0.000***

Note: *** < .001

Discussion

Learners' exposure to English and French

The questionnaire results confirm previous research into out-of-school exposure to English (Kuppens, 2010; Lindgren & Muñoz, 2013; Peters, 2018) that has 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 three different age groups.

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Reading, on the other hand, was an activity that learners did not frequently engage in, although the SEM analysis showed that university learners read more English books and magazines than learners in secondary education. Needless to say, learners need a sufficiently large vocabulary size to be able to read authentic books, which might explain why university learners read more. Further, the SEM analysis suggested that university learners use English more frequently than learners in secondary education. Finally, in agreement with Sundqvist's research into gaming (Sylvén & Sundqvist, 2012; Sundqvist & Sylvén, 2014), we found that boys play more online games than girls.

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 the current study adds that this holds for three different age groups. Unlike French, English is omnipresent in Flemish society (music, TV, online), especially since Flanders has a subtitling tradition (see also 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 onwards (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. The 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), learners' first foreign language, French, can be considered a language that is typically taught in a formal setting, which means that (1) formal instruction is limited to two or three 50' sessions per week; (2) out-of-school exposure to the foreign language is limited; (3) French is not spoken outside of the classroom (unless you live in Brussels), and (4) French is not the language of communication between peers. The fact that

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French is one of the three official languages in Belgium, and is introduced at an earlier age at school does not seem to change this.

Learners' vocabulary knowledge in English and French

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

The large amounts of English language input to which learners had been exposed seem to outweigh the earlier start they had with formal French instruction. As argued by DeKeyser (2011), instruction of one or two hours per week does not suffice when there is no additional exposure to FL input. This applies to the current study too, as learners only have 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, as 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 SEM analyses to examine which factors were predictors of learners' vocabulary knowledge: one analysis for French and one for English. Even though we strived to maximize the comparability between the two SEMs, it should be noted that there are some differences between the two models, so caution is needed when directly comparing the results for English and French. The analyses for French revealed that only length of instruction (grade) had an impact on learners' vocabulary knowledge in French. Learners' out-of-school exposure to French is 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 nine years of instruction, French-as-a-foreign language learners still seem to fall short of meeting the vocabulary targets put forward for reading authentic texts and watching TV and movies, a finding which is in line with other studies on the effects of instruction (Milton, 2008; Webb and Chang, 2012). In contexts where learners are not exposed to large amounts of FL input, they often fail to meet "even moderate vocabulary learning goals" (Schmitt, 2008, p.332). In the current study, a majority of the university students, who had received 790 to 1060 hours of French study, was not familiar with the 2,000 most frequent words in French (with 90% as cut-off score). As argued by Webb and Chang (2012), 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, learners' current engagement with online activities in English also contributed to

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their vocabulary knowledge, which corroborates previous research that has shown that visiting English language websites (Gonzalez-Fernandez & 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 factors are not beneficial for learners' vocabulary growth. The fact that no other factors had an impact on learners' vocabulary knowledge could be explained by learners' large amounts of out-of-school exposure to English and consequently by a lack of variance because of a ceiling effect in a number of questions. For instance, only one learner reported to never watch subtitled TV programs; three learners reported never to watch subtitled movies.

It is, thus, very likely that learners' larger exposure to English language audio-visual input and written input than to French language media will also have impacted their vocabulary knowledge. Let us illustrate this with the results of the SEC2 grade. Even though these learners had received only 33 hours of English compared to 343 to 481 hours of French, their vocabulary size was significantly larger in English than French. We know from other studies (Kuppens, 2010; Puimège & Peters, 2018) that Flemish children (9 – 12 years old) already know a considerable number of words (estimates range from 2500 to 3200 at the level of meaning recognition) before the start of formal English instruction. These findings have been explained by learners' TV viewing behavior, as learners who frequently watch English language TV with subtitles tend to perform better (Kuppens, 2010). The results of the SEC2 grade and of the studies by Kuppens (2010) and Puimège and Peters (2018) 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, the lack of a gender effect should be addressed. Although in secondary education boys obtained higher scores on the English test than girls and the mixed effects

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analysis revealed a significant interaction between gender and language, gender was no longer a significant predictor of vocabulary knowledge in English in the SEM analysis. This finding shows that great care should be taken when investigating gender effects on language learning, as gender differences might be mediated by other variables, as was the case in the present study (see Courtney et al., 2017 for another example). Gender had an effect on learners' online activities in English, which in turn had an impact on learners' vocabulary scores. The differences in English vocabulary knowledge between girls and boys in secondary education should thus not be attributed to gender differences, but to boys' more frequent gaming and online activities.

Pedagogical implications

The findings of this study have a number of pedagogical implications. First, length of instruction has a positive impact on learners' 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 policy makers 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-as-a-foreign language learners in Flanders. What this study shows is that we should strive for large amounts of FL input, if we want learners to be able to operate in the FL. This means that teachers should encourage learners to engage with the FL outside of the FL classroom and show them how they should best do this.

Researchers have traditionally proposed reading as a means of enlarging learners' vocabulary size. However, the present study shows that learners and younger learners in particular do not tend to read FL books or magazines very often. Given the vocabulary demands for reading authentic books, reading seems more suitable for older learners, such as

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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 FL input and that "its greatest value lies in out-of-school viewing" (p. 160). Peters and Webb (2018) argue that because people like watching TV and movies, it offers great potential for vocabulary learning in the long run. Finally, the current 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 FL audio-visual 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

The current study has a number of limitations. Research has shown that cognate linguistic distance has an impact on learners' language proficiency (Lindgren & Muñoz, 2013; Muñoz et al., 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 FL input. Third, our sample was a convenience sample and may thus not be representative for all learners in Flanders. Moreover, because the sample size is not very large, the findings of the SEM analyses have to be considered with the necessary care, and it remains to be seen whether the results reported on here will be replicated in future studies. Especially in the SEM for French, statistical power may be 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

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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' socio-economic status (SES) or L1 literacy. Future research could investigate how these factors affect learners' out-of-school exposure to foreign languages. Finally, an issue that was not addressed in the present 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 we want to deepen our 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 FL. Unlike for French (learners' first foreign language), learners are exposed to large amounts of English outside of the classroom, which provides learners with ample opportunities for informal learning. Consequently, learners' vocabulary scores were consistently higher in English than in French in spite of fewer years and hours of study. Further, learners with more years of instruction knew more words, in English as well as in French. In addition to length of instruction, learners' 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, large amounts of FL input are needed and more input than can typically be provided in formal settings with two to four hours per week.

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Endnotes

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 about the importance of these activities for English and for French. No differences between English and French were revealed.
2. Data in the fourth year of secondary education were collected 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 on https://crell.jrc.ec.europa.eu/sites/default/files/files/eslc/MS_SQ_EN.pdf.
5. We only asked questions about language camps and not about courses at private language institutes because the former tend to be more popular in Flanders.
6. 130 (out of 138) respondents 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) respondents indicated to listen to songs in English a few times per week or more (item 4.1).
7. Because of the correlations between the latent variables, it is not possible to decompose the total explained variance into the variance explained by the individual predictors.

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8. For items 1.1 and 2.2 only 14 respondents (out of 138) replied 'yes', for item 1.3 there were 24 positive replies, and only 8 respondents replied 'yes' to question 6.1.

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