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Adolescent word reading in English as a foreign language

Anat Prior

Faculty of Education, University of Haifa, Haifa, Israel and Department of Learning Disabilities, Edmond J. Safra Brain Research Center for the Study of Learning Disabilities, University of Haifa, HaifaIsrael

Rita Zeltsman-Kulick

Faculty of Humanities and Social Sciences, Kibbutzim College of Education, Technology and the Arts, Tel Aviv, Israel and Department of Learning Disabilities, Edmond J. Safra Brain Research Center for the Study of Learning Disabilities, University of Haifa, HaifaIsrael

Tami Katzir

Department of Learning Disabilities, Edmond J. Safra Brain Research Center for the Study of Learning Disabilities, University of Haifa, HaifaIsrael

The current study examined the proficiency of Israeli adolescents in reading single words in English, which is taught as a foreign language, and what language skills predict individual variability. Parallel measures of word reading, phonology, decoding, morpho-syntax and vocabulary in Hebrew and English were administered to 217 adolescents in 8th and 11th grade. Following 5–8 years of English as a foreign language instruction, participants achieved reading levels commensurate with those of third to fourth grade native English-speaking children. Decoding and vocabulary knowledge were significant predictors of single word reading across both orthographies. Morpho-syntactic knowledge predicted word reading only in Hebrew. Further, there was pronounced variability in the extent to which phonological awareness and vocabulary predicted word reading across languages. Low levels of reading performance underline the inherent challenge in achieving reading proficiency in the complex English orthography in a foreign language setting, with limited instruction time and suboptimal pedagogy. Decoding and vocabulary are identified as important universal processes in reading, whereas differences in other predictors support script-dependent processes in reading as well.

Keywords: adolescence, EFL, script dependence, word reading accuracy

Highlights

What is already known about the topic

- Trajectories of reading acquisition and some predictors of skilled performance have been shown to be script dependent.
- The development of single word reading accuracy in English of young non-L1 immersed learners is highly similar to that of native speakers.
- In older foreign language learners, structural similarity between the L1 and English influences literacy acquisition.

What this paper adds

- Adolescents studying English as a foreign language showed accuracy levels of reading single words comparable with those of native speakers who were 6–8 years younger.
- Decoding and vocabulary knowledge were significant predictors of single word reading across both orthographies; morpho-syntactic knowledge predicted word reading only in Hebrew. In addition, there was pronounced variability in the extent to which phonological awareness and vocabulary predicted word reading across languages.

Implications for theory, policy or practice

- Lower levels of exposure in a foreign language setting, in addition to the complex nature of the English orthography, lead to a delay in learning to read single words.
- In support of script-dependent hypotheses of the reading process, results showed that the very same individuals recruit different underlying skills for accurately reading words in Hebrew and in English.
- These findings, combined with the central predictive role of both vocabulary knowledge and decoding in explaining EFL word reading accuracy, indicate that explicit instruction of grapheme–phoneme correspondences in English could improve students' accurate reading.

English as a foreign language (EFL) is of utmost importance in the Israeli educational system. It is a prerequisite for entry into higher education and increases prospects for gainful employment and travel (Kahn-Horwitz, 2016). EFL is studied in elementary school and throughout high school and holds high status in Israeli society. The challenging task of EFL literacy instruction begins in elementary school with the goal of completion of literacy acquisition by sixth grade (Fuchs, Kahn-Horwitz & Katzir, 2019; State of Israel Ministry of Education Revised English curriculum, 2018). However, it seems that many middle school EFL teachers in Israel are faced, year after year, with students who display reading difficulties. These difficulties may be caused by inadequate early literacy instruction in elementary

school (Fuchs et al., 2019; Goldfus, 2012; Vaisman & Kahn-Horwitz, 2019; Vellutino & Scanlon, 2001). A further source of difficulty might be the typological distance between Hebrew and English and the pronounced differences between the two writing systems (Frost, 2012), which might limit the ability of Israeli learners of EFL to capitalise on their L1 literacy skills. Thus, even though most adolescents are proficient readers in their L1 Hebrew, we cannot make direct assumptions about transfer of knowledge from Hebrew word reading to English word reading.

In the current study, we examine the actual performance of English word reading in 8th and 11th grade students in Israel and compare it with the norms of native English-speaking children to assess the impact of 5–8 years of EFL instruction. The second goal of the study was to investigate the underlying skills supporting word reading accuracy in English in comparison with the native language of the study population, Hebrew, which is typologically and orthographically very different.

Learning to read in Hebrew and in English

In the Hebrew orthography, letters represent mostly consonants while vowels are represented mostly by diacritic marks placed below, within and above the letter. The fully vowelised script is considered a shallow and consistent orthography and is used for reading instruction. Decoding proficiency of this script is usually attained by the end of first grade (Share & Levin, 1999). The unvowelised version of the Hebrew orthography does not include diacritics and is thus considered a deep orthography (Frost, 2009; Ravid, 2005). The transition to the unvowelised script starts at the beginning of third grade, and by the end of fourth grade, children are expected to have achieved decoding proficiency of the unvowelised script. This deep unvowelised orthography creates a challenge for the reader because several possible sound correspondences can be applied to most strings of consonant letters (Schiff, 2003). Specifically, between 25% and 40% of Hebrew words in a regular text are homographic (Share & Bar-On, 2018; Shimron & Sivan, 1994). Resolution of this homographic ambiguity and reconstructing the missing vowel information require the Hebrew reader to rely on morpho-syntactic information as well as lexical and pragmatic clues from the context (Share & Bar-On, 2018). The unvowelised script is used universally beyond the early elementary school years. Finally, English is written from left to right, whereas Hebrew is written in the opposite direction.

Phonological awareness is a significant predictor of single word reading in beginning readers of Hebrew (Levin & Korat, 1993) and remains so through Grades 3–5 as well (Bar-Kochva & Breznitz, 2014; Katzir, Schiff & Kim, 2012; Shahar-Yames & Prior, 2017), although these more mature readers also rely to a greater degree on morphological knowledge (Share & Bar-On, 2018). We were unable to identify studies documenting the factors that support word reading in Hebrew in middle and high-school students. However, in light of the prominent role of morphological knowledge in skilled Hebrew reading (Prior & Markus, 2014; Vaknin-Nusbaum, Sarid, & Shimron, 2016), we hypothesize that morphological abilities might emerge as a strong predictor of performance for this age group, beyond phonological awareness.

Among alphabetic orthographies, English is one of the most complex systems due to the constant trade-off between phonological and morphological spelling (Coulmas, 1999; Share, 2008). English is considered to be a deep orthography, in which there are many-

to-many correspondences between graphemes and phonemes (McGuinness, 2004; Moats, 2014; Share, 2008), increasing the difficulty of acquisition.

Studies of beginning readers of English identify phonological awareness (National Reading Panel, 2000) and vocabulary knowledge as the strongest predictors of word reading accuracy (Dickinson, McCabe, Anastasopoulos, Peisner-Feinberg, & Poe, 2003; Snow, Burns, & Griffin, 1998; Verhoeven, van Leeuwe, & Vermeer, 2011). Ehri (1994, 2005), adopting a developmental perspective, also adds decoding, defined as the ability to correctly pronounce pseudowords (Gough & Tunmer, 1986) as a significant, although partial at times, predictor of single word reading in native readers of English (e.g., Talcott et al., 2000).

Whereas phonological awareness has also been identified as a significant predictor of word reading for young second language learners of English, the contribution of vocabulary knowledge to word reading is less consistent in this population. Some studies observed no significant relationship between word reading and vocabulary knowledge in L2 readers (e.g., Geva, Yaghoub-Zadeh, & Schuster, 2000; Gottardo et al., 2001), whereas others found a small but significant relationship (Gottardo, 2002; Muter & Diethelm, 2001).

However, models of L1 word reading, which tend to focus on younger or struggling readers (Ehri, 2005; Rumelhart & McClelland, 1986; Seidenberg & McClelland, 1989), provide little guidance regarding the additional skills that might support English word reading in middle school and high school. By middle school, most L1 readers no longer sound out words letter by letter or sound by sound, but instead use larger units, such as rhymes, syllables and morphemes, to support their reading of the morphologically complex words found in academic texts (Ehri, 2005). Several studies have found that morphological awareness explained significant additional variance in L1 word reading after controlling for phonological awareness and vocabulary knowledge in sixth to eighth grade students (McCutchen, Logan & Biangardi-Orpe, 2009; Siegel, 2008; Singson, Mahony & Mann, 2000). Investigating the skills that support English word reading in adolescent learners of EFL can illuminate their developmental trajectory in this important skill.

The pedagogical context of learning EFL by Hebrew-speaking students

Foreign language instruction settings normally provide the learner with markedly reduced exposure and input in the language. Indeed, Israeli students receive between two and five weekly hours of EFL instruction from third grade through high school (Revised English Curriculum, 2018). The teaching program is designed around the following four domains: social interaction, access to information, presentation and appreciation of language, literature and culture. Thus, EFL instruction time is not devoted exclusively to literacy acquisition.

Although EFL students usually have experience with reading in their first language, acquiring the content knowledge necessary for reading and spelling in English is a long and difficult process because of the orthographic depth of the English writing system (Seymour, Aro & Erskine, 2003). The inherent difficulty of English literacy acquisition is compounded for Hebrew speakers, who do not have a familiar alphabet nor common shared linguistic roots (e.g., Latin words) to rely on. In addition, EFL students spend much less time acquiring literacy in English than do students in English-speaking countries (Kahn-Horwitz, 2016). Importantly, the National Literacy Panel on Language-Minority Children and Youth (August, & Shanahan, 2006) has reported that explicit instruction of

the five pillars of literacy, initially identified by the National Reading Panel (2000), benefits literacy acquisition in non-native English-speaking students who were immersed in English-speaking schools. A reasonable assumption would be, therefore, that these should also be beneficial to EFL students, including specifically phonemic awareness, phonics and fluency.

According to the recently updated national English Curriculum for EFL in Israel (Revised English Curriculum, 2018) elementary school students are explicitly taught only the basic orthographic code of the English sound–symbol correspondence (Grades 3–4) and are expected to have completed the acquisition of basic literacy skills (be able to decode phonetically spelled lexical items and read items they have learned orally) at the end of the fourth year of instruction (sixth grade) although this is not directly assessed. No further formal decoding or reading instruction is available in middle school or high school.

A recent study by Fuchs and her colleagues (2019) of EFL instruction in elementary school in Israel identified several challenges to effective EFL instruction: insufficient teacher training (Joshi et al. 2009), unsuitable textbooks (Joshi et al., 2009) and a lack of awareness of the theoretically based teaching components needed for effective literacy instruction (Goldfus, 2012; Kahn-Horwitz, 2015; Moats, 2014; Vaisman & Kahn-Horwitz, 2019). An important component that was found lacking both in teacher training and in textbooks is the systematic teaching of word decoding in English. In fact, and in concord with the official curriculum, phonological awareness, phonics and word reading were scarcely found in textbooks for this age group. Further, elementary school teachers report spending only a small percent of instruction time on these topics, advocate for methods of literacy instruction that have not been supported by research (e.g., whole word memorization), and had unrealistic expectations regarding how long basic literacy acquisition should take, in light of research (Vaisman & Kahn-Horwitz, 2019). The lack of systematic instruction is bound to effect later reading abilities of EFL in adolescence.

The relationship between L1 and EFL word reading

The linguistic coding differences hypothesis proposes that proficiency in native language skills such as phonological awareness, syntactic awareness, orthographic knowledge and semantics provide the foundation for foreign language learning (Ganschow, Sparks & Javorsky, 1998). There are linguistic skills and insights related to literacy that are developed in L1, which can transfer to the foreign language, because there is a shared linguistic basis for reading (Saiegh-Haddad & Geva, 2010). In this vein, Kahn-Horwitz, Shimron, and Sparks (2005) found that for fourth grade native Hebrew speakers, Hebrew morphological awareness predicted English word reading accuracy. Further, Hebrew phonological awareness and Hebrew word reading measured in fourth grade accounted for 42% of the variance in English word reading in ninth grade students (Kahn-Horwitz, Sparks, & Goldstein 2012; see also Kahn-Horwitz, Shimron & Sparks, 2006).

The idea that reading in different scripts recruits some common processes is also expressed in universal models of reading (e.g., Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001; Seidenberg, & McClelland, 1989). However, these models were mainly developed in the context of Anglocentric English orthography research (Share, 2008), and their universal applicability across writing systems has been questioned (e.g., Frost, 2012).

Thus, recent research has also revealed important differences in trajectories of reading acquisition and predictors of skilled performance that are script-dependent (Frost, 2012; Geva & Siegel, 2000; Hutzler, Ziegler, Perry, Wimmer, & Zorzi, 2004; Nag, & Snowling, 2012; Share, 2008). To illustrate, in a direct comparison of native speaking children reading Hebrew in both pointed and unpointed versions or English in the fourth grade, Katzir, Schiff and Kim (2012) found that in both groups phonological awareness was a significant predictor of word reading accuracy, but only in readers of English did vocabulary knowledge make a significant independent contribution (the study did not include a measure of morphological awareness). A second highly relevant study investigated predictors of decoding and simple and complex word reading in English–Arabic bilingual children and found that the contributions of phonological and morphological awareness in the two languages differed across the tasks examined, suggesting cross-linguistic differences in the subtle contributions of the two skills (Saiegh-Haddad & Geva, 2008). Taken together, these studies reinforce the script-dependent notion that reading in different orthographies may recruit different underlying processes (Geva & Siegel, 2000; Ziegler et al., 2010).

Importantly, studies supporting the script-dependent hypothesis rely mostly on investigations of native speakers reading in their L1, and thus are a result of cross-linguistic comparisons across populations. An important additional perspective on this issue can come from investigating non-native readers (e.g., Saiegh-Haddad & Geva, 2008), in two complementary ways. First, to the extent that indeed characteristics of a given orthography are driving the predictors of word reading in that language, we would expect similar patterns in native and non-native readers of the orthography. Second, we would also expect that an individual reading in two typologically and orthographically distant languages would exhibit different patterns.

The current study

The current study addresses two questions of theoretical and practical importance. First, in light of the recognised challenge of acquiring literacy in English as a first language, we ask what levels of word reading achievement do Israeli EFL learners reach? This is especially relevant as the instructional methods of EFL in Israel do not highlight phonics. To this end, we investigated students in middle school (younger adolescents) and high school (older adolescents) to track the impact of additional years of instruction on the ability to read single words. Theoretically, this question will add to the currently insufficient knowledge about the difference between the L1 and FL learners in their word reading development trajectories. Practically, the results could guide instructional decisions and the setting of realistic educational expectations.

Based on the complex orthography of English, the typological distance between Hebrew and English and the limited instruction in an EFL setting, our prediction is that word reading accuracy in EFL would be significantly lower than in L1 Hebrew. However, as there is no previous evidence regarding the performance of EFL learners as compared with L1 English readers, we were unable to make a specific prediction regarding the equivalent grade level.

The second goal of the current study is to contribute to the ongoing debate in the literature regarding the universal versus script-dependent approaches. To this end, we investigated the within-language predictors of accurate word reading in the two languages, within

the same individuals, across two age groups. Theoretically, findings will advance our cross-linguistic understanding of reading acquisition and potentially broaden the scope of existing models. Practically, results can identify areas of similarity and difference in reading Hebrew and English and allow for tailoring instruction to capitalise on similarities and use explicit instruction to support acquisition of differences.

We hypothesize that results will reveal both universal and script dependent mechanisms. We expect to replicate previous findings of the role of phonological awareness and decoding in predicting word reading in both Hebrew and EFL. We further expect to find morphological awareness to be a stronger predictor of Hebrew word reading and vocabulary knowledge to be a stronger predictor of English word reading.

Method

Participants

One hundred eighth grade and 117 eleventh grade native Hebrew speakers who have been studying English since third grade participated in the study. The study was conducted in two schools, which serve a wide range of students in a town in central Israel. EFL instruction in these schools followed the official Israeli curriculum, using approved textbooks.

The study was approved by the principals of both schools, by the Ministry of Education and by the Chief Inspector for English instruction. Informed consent was obtained from participants and their parents. Students who were identified as native speakers of English or those with severe learning impairment (such as special education) were not included in the sample. The sample included 18 students (eight in middle school and 10 in high school) who spoke an additional language at home (including Russian, Spanish, French or Turkish). Due to the small size of this group, their data were not analysed separately.

Of the original sample of 217 participants, 2 eighth graders and 16 eleventh graders failed to complete all experimental measures, for a final sample of 97 eighth grade students and 101 eleventh grade students.

Study measures

Assessing literacy skills in different languages is challenging, especially languages that are typologically distant, such as Hebrew and English. The theoretical and methodological rationale for developing the comparable measures that were used in the current study is described in detail in Katzir et al. (2012).

Phonological awareness

Phonological awareness (PA) was assessed in both languages. In English, the Elision subtest of the comprehensive test of phonological processing (Wagner, Torgesen, & Rashotte, 1999) was used. In this task, participants are required to say a word produced by the experimenter and then repeat the word after deleting either a syllable or a phoneme specified by the experimenter, with the correct response forming a real word. Hebrew phonological awareness and processing was measured by a Hebrew version of the English test. Reliabilities in the current sample were satisfactory (Cronbach's alpha 0.76 for English and 0.71 for Hebrew). The task included 20 items in each language, and participants completed

all items, and received one point for each correct item. A previous study suggests that difficulty level is well matched across languages (Katzir et al., 2012).

Nonword decoding

In English, the word attack subtest of the *Woodcock Reading Mastery-Revised* (Woodcock, 1987) was used to assess participants' ability to apply grapheme–phoneme rules and word analysis skills to pronounce unfamiliar printed words. Hebrew nonword decoding was measured by a Hebrew version of the English test (Katzir et al., 2012; Cronbach's alpha in the current sample was 0.87 for English and 0.95 for Hebrew). The task includes 45 items, and testing was terminated after six consecutive errors. The score is the number of correctly read items. A previous study suggests that the difficulty level is well matched across languages (Katzir et al., 2012).

Morpho-syntactic awareness

In English, we used the morphological choice task from the PAL-II (Berninger, 2007). Participants completed a sentence by choosing one of four possible nonsense words with an appropriate affix. By employing nonsense words, this task taps students' morphological awareness, independent of their knowledge of specific base forms. The original task consisted of 10 items, and we added four items to make the test more appropriate for the current population. The score is the number of correct responses. To measure Hebrew morpho-syntactic awareness, we constructed an analogous task in Hebrew, also including 14 items (Cronbach's alpha in the current sample was 0.73 for English and 0.74 for Hebrew).

Vocabulary knowledge

We used the Peabody Picture Vocabulary Test-III (in English: Dunn & Dunn, 1997; in Hebrew: Nevo, 1979). This is a receptive vocabulary test, in which the experimenter names a word and the participant must select the appropriate picture among an array of four possibilities. The task included 110 items in each language. Testing was terminated when participants committed six consecutive errors. Split-half reliability in the current sample was 0.82 for English and 0.84 for Hebrew.

Single word reading accuracy

Single word reading was the outcome measure assessed in both languages. In English the word identification subtest of the *Woodcock Reading Mastery-Revised* (Woodcock, 1987) was used. This test requires the participant to read aloud regular and irregular words with increasing difficulty. We used a parallel Hebrew version of the English test, in which words were presented without diacritics (Katzir et al., 2012). The version in each language included 112 items, and testing was terminated after six consecutive errors. Split-half reliability in the current sample was 0.96 for English and 0.83 for Hebrew.

When scoring the EFL word reading task, we adopted lenient pronunciation criteria, such that a range of Hebrew accented productions were accepted as correct. All

performance was recorded, and raters were trained on the rating criteria. Thus, in unclear cases, coders returned to the recording, and any differences were resolved by consultation.

Procedure

All measures were administered by trained graduate student research assistants. The study was conducted in two parts: a group session and an individual session. Two members of the research team administered tasks in the group setting during an English lesson with the English teacher present. The morphological tasks were administered during this group session, which also included additional tasks (such as reading comprehension tests), which are not discussed here. The remaining measures (phonological awareness, vocabulary, non-word decoding and word identification, in both languages) were administered individually.

Results

Before data were analysed, they were inspected for outliers. Observations deviating from their respective group mean (8th or 11th grade) by three standard deviations or more were removed and treated as missing values.

Hebrew L1 and EFL word reading

Single word reading accuracy is presented in Table 1. Accuracy rates were analysed in a two-way repeated measures ANOVA, with language (L1, EFL) as a within-subject variable and grade (8th or 11th) as a between-subject variable. As expected, students read single words more accurately in Hebrew (L1) than in English (FL), as evident by a significant main effect of language, $F(1,194) = 2256.6$, $p < .001$, $\eta^2 = .92$. The main effect of grade was also significant, $F(1,194) = 41.8$, $p < .001$, $\eta^2 = .18$, because 11th grade students were overall more accurate than eighth grade students. These main effects were qualified by a significant two-way interaction, $F(1,194) = 17.3$, $p < .001$, $\eta^2 = .08$, because the grade effect was much larger in EFL word reading (an improvement of 11% from 8th to 11th grade) than in L1 word reading accuracy (an improvement of 4%; see Table 1).

As can be seen in Table 1, we also compared the performance of the current participants with the standardised grade equivalent native-speaker norms of the original test (Woodcock, 1987; see also Flippo, 2014 and Lewandowski & Martens, 1990, for considerations for using grade vs age equivalent scores). Following 5 years of instruction in English, the

Table 1. Raw scores (mean percent correct [standard deviation]) for Hebrew and English Word Reading, by grade.

	Hebrew L1 word reading accuracy	English FL word reading accuracy	English L1 word reading accuracy grade equivalent[a]
8th grade ($N = 95$)	83.8 (5.4)	46.8 (8.6)	3rd grade
11th grade ($N = 101$)	87.4 (4.8)	56.3 (13.1)	4th grade

[a]Based on the WRMT test norms.
*$p \leq .05$, **$p \leq .01$.

word reading accuracy scores of middle school children in EFL matched those of native English-speaking children in third grade (Woodcock, 1987). After three additional years of EFL instruction, word reading accuracy of high schoolers in the current sample was comparable with that of fourth grade native English-speaking children. These comparisons underscore the significant gap in EFL reading accuracy when compared with L1, a gap of five to seven grade levels.

Hebrew L1 and EFL reading related skills

Performance on the language and reading-related skills was also analysed using a series of two-way repeated measures ANOVAs, using grade level (8th or 11th) as a between-subjects variable and language (L1, EFL) as a within-subject variable (see Table 2A). The main effect of language was significant in the analyses of nonword decoding, $F(1,196) = 12.9$, $p < .001$, $\eta^2 = .06$, morpho-syntax, $F(1,209) = 185$, $p < .001$, $\eta^2 = .47$, and vocabulary, $F(1,187) = 1182$, $p < .001$, $\eta^2 = .86$, because performance was higher in L1 than in EFL. In the analysis of phonological awareness, on the other hand, the main effect of language, although significant, was reversed, $F(1,193) = 13.4$, $p <= .001$, $\eta^2 = .06$, such that students exhibited better elision skills in EFL than in L1. We attribute this pattern to the difference in writing system between Hebrew (where most vowel information is not presented in writing) and English (where all sounds are represented by letters). Age/grade equivalents of the standardised tests are presented in Table 2B.

As far as grade differences, 11th graders outperformed eighth graders in nonword decoding, $F(1,196) = 12.2$, $p = .00$, $\eta^2 = .06$, morpho-syntax, $F(1,209) = 63.4$, $p < .001$, $\eta^2 = .23$, and vocabulary, $F(1,187) = 33.6$, $p < .001$, $\eta^2 = .15$. The main effect of grade level in phonological awareness was not significant ($p = .22$).

Finally, the differences between the 8th and 11th graders were similar in the two languages. Specifically, the two-way interactions were nonsignificant in the analyses of phonological awareness, nonword decoding and morpho-syntax (all ps $> .08$). In the analysis of vocabulary, the two-way interaction was significant, $F(1,187) = 5.99$, $p = .015$, $\eta^2 = .03$, suggesting larger vocabulary gains from 8th to 11th grade in EFL than in L1.

These patterns lay the ground for examining the within language predictors of word reading accuracy in L1 and EFL across the two grade levels.

Predictors of word reading in L1 and EFL

In order to address this question, Pearson correlations between language and reading measures within each language (Tables 3 and 4) are first presented.

Results show that correlations among the language and reading skills were mostly moderate to high and statistically significant. In middle school, L1 single word reading accuracy was highly correlated with morpho-syntax and moderately correlated with PA, decoding and vocabulary. In high school, this pattern changes somewhat, and L1 single word reading was most strongly correlated with vocabulary and moderately correlated with PA, decoding and morph-syntax. In contrast, EFL single word reading accuracy in middle school was highly correlated with vocabulary and decoding but only moderately correlated with morpho-syntax and PA. In high school, single word reading accuracy in EFL was highly correlated with vocabulary, morpho-syntax and decoding and only moderately but still significantly correlated with PA.

Table 2A. Mean percent correct (standard deviation) for L1 Hebrew and EFL linguistic variables, by grade.

	PA		Decoding		Morpho-Syntax		Vocabulary	
	L1	EFL	L1	EFL	L1	EFL	L1	EFL
8th grade	86.4 (12.5)	88 (11.5)	51.2 (25.7)	45.3 (16.2)	62.3 (21.7)	39.9 (20)	80.8 (7.8)	47.2 (11.8)
11th grade	86.9 (12)	91.8 (9.5)	59.4 (4.16)	55.3 (15.8)	79.8 (14.6)	58.5 (22.8)	85.9 (5.4)	56.5 (14.9)

EFL, English as a foreign language; PA, Phonological awareness.

Table 2B. *Native English Speakers' Age/Grade Equivalents for English Tasks*

	PA		Decoding		Vocabulary	
	Raw	Age/Grade	Raw	Age/Grade	Raw	Age/Grade
8th Grade	17.6	10th grade to adult	10.4	Age 7:6, 2nd grade	51.9	Age 4:1
11th Grade	18.4	10th grade to adult	11.9	Age 8:0, 3rd grade	62.2	Age 4:10

Table 3. Pearson correlations for EFL language and reading skill.

	8th grade				11th grade			
	1	2	3	4	1	3	3	4
1. Phonological awareness								
2. Nonword decoding	.409**				.409**			
3. Morpho-syntax	.288**	.526**			.541**	.562**		
4. Vocabulary	.152	.254*	.406**		.423**	.521**	.686**	
5. Word reading accuracy	.227*	.534**	.465**	.557**	.462**	.648**	.696**	.758**

*$p \leq .05$
**$p \leq .01$.

Table 4. Pearson correlations for Hebrew language and reading skills.

	8th grade				11th grade			
	1	2	3	4	1	2	3	4
1. Phonological awareness								
2. Nonword decoding	.178				.210**			
3. Morpho-syntax	.261**	.480**			.186	.374**		
4. Vocabulary	.227*	.126*	.253**		.102	.247*	.373**	
5. Word reading accuracy	.425**	.466**	.531**	.339**	.250*	.462*	.428**	.662**

*$p \leq .05$
**$p \leq .01$.

Based on these first order correlations, our next step was to conduct hierarchical regression analyses to determine the amount of variance in single word reading accuracy explained by the linguistic measures for each grade level and each language separately. We only entered within-language predictors in these regression models. The order of variable entry into the model was theoretically motivated. Phonological awareness was entered on the first step, as a lower level reading-related skill, and was followed by nonword decoding accuracy. Vocabulary knowledge was entered on the third step of the model, as a known contributor to single word reading ability. Finally, we entered morpho-syntactic knowledge on the final step of the model to investigate whether it made a significant contribution to word reading after accounting for the variance of the other predictors. This order of variables was specifically selected in order to allow us to test the prediction that morpho-syntactic knowledge would be a stronger predictor in Hebrew than in English reading (Tables 5–8).

The hierarchical regression for EFL word reading in both age groups (Tables 5 & 6) showed mostly similar patterns. PA significantly predicted word reading accuracy in both 8th and 11th graders (explaining 6% and 21% variance, respectively), although the contribution was much stronger in the older adolescents, suggesting a developmental trend such that the older adolescents recruit phonological skills to a greater extent than the younger

Table 5. A hierarchical regression model for English foreign language word reading, 8th grade (N = 93).

Predictors		B	β	R^2	ΔR^2
Step 1	PA English	1.179	.250*	.063	.063*
Step 2	PA English	.283	.06	.290	.228**
	Decoding English	.678	.521*		
Step 3	PA English	.319	.068**	.494	.204**
	Decoding English	.544	.412**		
	Vocabulary English	.350	.463*		
Step 4	PA English	.303	.064	.499	.005
	Decoding English	.494	.374**		
	Vocabulary English	.329	.435**		
	Morphology English	.302	.086		

PA, Phonological awareness.
*$p \leq .05$
**$p \leq .01$.

Table 6. A hierarchical regression model for English foreign language word reading, 11th grade (N = 97).

Predictors		B	β	R^2	ΔR^2
Step 1	PA English	3.423	.462**	.213	.213**
Step 2	PA English	1.802	.243**	.450	.237**
	Decoding English	1.096	.534**		
Step 3	PA English	.733	.099	.663	.213**
	Decoding English	.651	.317**		
	Vocabulary English	.493	.553**		
Step 4	PA English	.395	.053	.677	.014
	Decoding English	.575	.280**		
	Vocabulary English	.420	.471**		
	Morphology English	.822	.178		

PA, Phonological awareness.
*$p \leq .05$
**$p \leq .01$.

adolescents. After accounting for PA skills, nonword decoding and vocabulary knowledge also significantly explained additional variance in both age groups, of a similar magnitude (across the two variables and across the two age groups, range 20.4–23.7%). Importantly, in neither adolescent group did morpho-syntactic knowledge explain additional significant variance in single word reading accuracy (in both groups, less than 1.5%). Both models explain variability in word reading accuracy in EFL well – the eighth grade model accounted for almost 50% of the variance, and the 11th grade model accounted for 68% of the variance.

The models predicting single word reading accuracy in Hebrew, the L1, are both different from the EFL models and are also quite different from each other, suggesting that the skills contributing to word reading accuracy continue to undergo change even within the age range of the tested adolescent population. Thus, in the eighth grade model, PA significantly predicted single word reading, explaining 21% of the variance and was the single

Table 7. A hierarchical regression model for Hebrew word reading, eighth grade ($N = 90$).

Predictors		B	β	R^2	ΔR^2
Step 1	PA Hebrew	1.126	.461**	.213	.213**
Step 2	PA Hebrew	.958	.392**	.363	.150**
	Decoding Hebrew	.205	.393**		
Step 3	PA Hebrew	.844	.346**	.407	.044**
	Decoding Hebrew	.196	.376**		
	Vocabulary Hebrew	.153	.217*		
Step 4	PA Hebrew	.741	.303**	.474	.067**
	Decoding Hebrew	.129	.248*		
	Vocabulary Hebrew	.119	.168*		
	Morphology Hebrew	.606	.303**		

PA, Phonological awareness.
*$p \leq .05$
**$p \leq .01$.

Table 8. A hierarchical regression model for Hebrew word reading, 11th grade ($N = 93$).

Predictors		B	β	R^2	ΔR^2
Step 1	PA Hebrew	.526	.221*	.049	.049*
Step 2	PA Hebrew	.307	.129	.233	.184**
	Decoding Hebrew	.226	.439**		
Step 3	PA Hebrew	.195	.082	.548	.315**
	Decoding Hebrew	.159	.309**		
	Vocabulary Hebrew	.530	.580*		
Step 4	PA Hebrew	.191	.081	.558	.01
	Decoding Hebrew	.142	.276**		
	Vocabulary Hebrew	.497	.544**		
	Morphology Hebrew	.314	.115		

PA, Phonological awareness.
*$p \leq .05$
**$p \leq .01$.

strongest predictor. Decoding significantly explained 15% of additional variance. Vocabulary knowledge accounted for less of 5% of the variance in single word reading in Hebrew in this age group. Critically, morphological knowledge, entered after accounting for the previous predictors, also contributed significantly to the model, explaining an additional 7% of the variability, notably more than did vocabulary knowledge.

The 11th grade model is quite different – PA no longer predicts variability in word reading accuracy. The contribution of nonword decoding remains stable across the two age groups (15% in eighth grade and 18% in eleventh grade). However, for the older adolescents, vocabulary knowledge is clearly the strongest predictor of single word reading accuracy, explaining 32% of the variance. Finally, after accounting for the variance explained by the previous predictors, morpho-syntactic knowledge does not significantly improve the

prediction model. Thus, for these older readers, neither lower level phonological skills nor morpho-syntactic linguistic knowledge is significantly related to single word reading ability.

Discussion

In the past decade, increasing prevalence of EFL learning in adolescents has led to growing interest on reading in this population and the role of L1 knowledge and skills in EFL reading (e.g., Chuang, Joshi, & Dixon, 2012; Goldfus, 2014; Van Gelderen et al., 2007). The current study investigated two aspects of EFL reading in Israeli Hebrew-speaking adolescents. First, we demonstrated relatively low single word reading abilities in this population. Second, we found that partially overlapping as well as distinct patterns of underlying language and reading abilities predicted accurate word reading in L1 and in EFL, lending support to both universal and script-dependent theories of reading.

EFL word reading among Hebrew-speaking students

Participants in the current study had mastered word reading in their L1, as would be expected from adolescents. In contrast, even after 8 years of EFL instruction, they still demonstrate only a low level in reading EFL single words. Specifically, eighth graders performed at levels expected of native English-speaking third graders, and 11th graders had only advanced by one grade equivalent, to reach the level expected of native English-speaking fourth graders. Grade equivalents of nonword decoding ability were similar (second and third grade, respectively). These findings are especially striking in comparison with studies demonstrating that immersed learners develop word reading skills in English as a second language following the same time lines as those evident for native speaking peers (Geva, Wade-Wolley & Shany, 1997; Lipka & Siegel, 2007).

We suggest several explanations for this disparity. First, the unique characteristics of foreign language instruction settings outlined in the introduction are highly relevant – namely, reduced input and a pedagogical emphasis on vocabulary, grammar and communication, with insufficient attention to decoding and phonics (Fuchs et al., 2019). Within these constraints, the pedagogy of EFL in the Israeli setting might not provide enough support for developing critical word reading abilities. Indeed, the curricular expectation that children will have mastered letter–sound correspondences within 2 years of instruction, with 2–4 h of weekly instruction is perhaps unrealistic. This is especially striking when compared with the low native English word reading success rate (less than 50% accuracy) after a full year of 10 weekly hours of instruction (Seymour et al., 2003). Thus, although English word reading relies both on decoding regular words and on recognising irregular words, we suggest that strengthening phonics instruction will help advance the EFL reading abilities of Israeli students. Thus, it might be prudent for educational policymakers in Israel to reconsider this aspect of the curriculum.

The second contributing reason to low EFL word reading accuracy of Israeli student is most likely the specific nature of English as a target language. Thus, the current findings differ markedly from a recent study, which found that following only 2 years of instruction, native English-speaking adolescents reached fifth grade word reading levels in Spanish. Specifically, students learning to read in Spanish as a foreign language, a relatively shallow orthography, can make much more rapid gains than students learning to read in EFL. Thus, we suggest that the impact of limited instruction is magnified in the case of learning to read

in English, in light of the depth and complexity of the English orthography (Share, 2008). This pattern replicates findings for native-speaking children acquiring reading in shallow versus deep orthographies (e.g., Seymour et al., 2003).

The above comparison with Sparks et al. (2017) highlights the third important factor arguably contributing to the current findings – namely, the distance in writing system between the L1 and the foreign language. Thus, native English-speaking students learning to read in Spanish as a foreign language are confronted with familiar letters, many overlapping grapheme–phoneme correspondences and a fair amount of shared word stems (of Latin origin). These are all mostly unavailable to Hebrew-speaking students learning to read in English.

Because accurate reading is a basic skill on which more advanced literacy abilities are based, a possible conclusion of the current results would be that it is advisable to allocate greater instruction time and resources to basic reading instruction in EFL settings.

Reading and language skills in L1 and EFL

In addition to word level reading, we also examined which within-language skills in L1 and EFL predicted word reading. Again, as could be expected, participants showed better performance and knowledge in Hebrew, L1, than in EFL across decoding, vocabulary and morpho-syntax (e.g., Saiegh-Haddad & Geva, 2008). As these skills are all rooted in language specific knowledge, participants' vastly wider exposure to L1 than to EFL most likely underlies these findings. Performance on the phonological awareness task revealed a different pattern, as students received higher scores in the EFL phonological awareness task than in the Hebrew L1 phonological awareness task. In fact, the adolescents in the current sample had reached the average expected performance in English phonological awareness. This pattern suggests that phonological awareness might be less language-dependent and more easily shared or transferred across L1 and a foreign language (Saeigh-Haddad & Geva, 2008; Sparks et al., 2009). In addition, the higher phonological awareness in English, as compared with Hebrew, might be ascribed to the difference between the Hebrew and the English writing systems. This pattern has been previously reported under certain conditions in adult Hebrew readers (Russak & Saeigh-Haddad, 2017). Specifically, in Hebrew, most vowel information is not presented in writing, thus somewhat obscuring the distinction between consonants and vowels and negatively impacting participant's performance on a single phoneme elision task (Ben-Dror, Frost & Bentin, 1995). This is also expressed in the cohesion of the consonant-vowel (CV) unit in Hebrew (Saiegh-Haddad, 2007). In English, in contrast, all phonemes are represented by at least one grapheme, thus supporting successful elision. This finding supports the notion of typological contingencies (Caravolas et al., 2013; Duncan et al., 2013; Share, 2008; Wimmer & Goswami, 1994), in which the features of orthography and the language specific grain size (Ziegler and Goswami, 2006) contribute to the development of phonological awareness.

Predicting single word reading in L1 and EFL: Universal or script dependent?

In accordance with previous work establishing that the predictors of reading vary across orthographies (Geva & Siegel, 2000; Frost, 2012; Saiegh-Haddad & Geva, 2008; Seymour, Aro, & Erskine, 2003; Ziegler & Goswami, 2006), the current study examined the predictors of word reading in Hebrew L1 and EFL.

The pattern found for English word reading was mostly stable across the groups. In eighth grade, word reading was predicted by PA, decoding and vocabulary knowledge, all together explaining 50% of the variance. Notably, the contribution of PA was the weakest and of vocabulary knowledge was the strongest. After three more years of instruction, in 11th grade, single word reading was still predicted by the same variables (PA, decoding and vocabulary knowledge). However, at this point, all three variables made similar contributions, and the model explained 66% of variance in EFL word reading. Importantly, morpho-syntactic knowledge in English did not predict single word reading accuracy at either grade level.

The models predicting word reading accuracy in Hebrew L1 were quite different. In the eighth grade, all four variables predicted unique variance in single word reading accuracy. Notably, the contribution of vocabulary knowledge was rather weak, and morpho-syntactic awareness made a significant contribution even after accounting for all other variables. In the older adolescents, in the 11th grade, the strongest predictor was vocabulary knowledge, PA made only a very small contribution, and morpho-syntactic awareness no longer contributed to the model. The current study was the first to investigate the predictors of word reading in adolescent Hebrew readers, and consistent with research on younger native Hebrew readers, it supports the continuation of a developmental trajectory. Katzir et al. (2012) found that for fourth grade Hebrew readers, PA was the strongest predictor of word reading, and the present study shows that by eighth grade, its contribution is reduced and is almost eliminated by the 11th grade. We also found that the predictive role of vocabulary for single word reading increased from the eighth to the 11th grade, suggesting that at this age, adolescents recruit their wider linguistic knowledge to support word identification.

The significant role of morphology in predicting reading in the eighth grade is in line with the model put forth by Share and Bar-On (2018) and with the important role of morphology in organisation of the mental lexicon in Hebrew speakers (Frost, 2012; Prior & Markus, 2014). However, in light of these models and previous results, the current finding that the morpho-syntax measure used in the current study was not a significant predictor of word reading in the older adolescents is surprising and unexpected. Because the possible contribution of morphological knowledge to word reading has not been investigated in this age group to date, further research is needed to clarify whether this result will be generalised or whether it is a result of the specific tools and population of the current study.

A comparison of the predictive models across the two languages reveals both cross linguistic commonalities and differences in the language and reading skills, predicting single word reading. Nonword decoding ability significantly predicted word reading accuracy in both languages for both age groups, most likely because of the great similarity between the two tasks. Further, phonological awareness significantly predicted single word reading accuracy in all models, as did vocabulary knowledge. These common patterns support the notion of universal processes in reading that apply to a wide variety of orthographies and to first and second language readers (Coltheart et al., 2001; Ganschow et al., 1998).

However, a close examination of the models also reveals important cross-linguistic differences, especially in the degree to which the variables predicted single word reading, mostly in the younger group. The two most important differences were the contribution of morpho-syntactic knowledge only to reading in Hebrew, and the stronger role of vocabulary in predicting EFL than L1 reading. These findings lend support to proposals of script-dependent processes in word reading (Frost, 2012; Geva & Siegel,

2000; Hutzler et al., 2004). Thus, the current findings do not support full overlap in the underlying skills supporting single word reading in L1 and EFL, even within the same reader, perhaps because of the great typological distance between the two languages and orthographies.

However, it is also important to restate here that there were significant differences in participants' proficiency in the two languages – they were all more proficient in the L1. Thus, to some extent, the findings of different predictive models across the two languages might also be influenced by proficiency differences. It is, therefore, important to conduct future research both on monolingual and on bilingual readers in order to achieve a full understanding of the cross-linguistic commonalities and differences in the underlying skills supporting single word reading.

Pedagogical implications for EFL instruction

The current study identified three significant predictors of single word reading in EFL: phonological awareness, decoding and vocabulary. The roles of decoding and vocabulary might be understood through the "division of labor" necessary for accurately reading English (Seymour et al., 2003). Thus, English as an opaque irregular orthography (e.g., McGuinness, 2004) requires readers to rely both on orthographic code knowledge (in the form of decoding non-words) and on their familiarity with lexical whole-word units (Nation and Snowling, 2004, Ricketts et al., 2008; Share, 2008). Because both groups of learners examined in the current study were far from reaching ceiling effects in word reading and decoding and based on a close examination of the EFL curriculum (State of Israel Ministry of Education English Inspectorate, 2018), we suggest that the Israeli adolescents examined here might not go through the developmental sequence of progressing from the grapheme-to-phoneme phonological route, relying on decoding, to the lexical semantic route, relying on whole-word identification (as per dual-route models of reading, Coltheart et al., 2001). Rather, we propose that the lack of sufficient instruction in complex orthographic–phonological correspondence patterns might drive learners to mainly depend on the lexical route without ever fully achieving proficient decoding skills. If this is the case, some of these learners might then face great difficulty in learning new words to further expand their vocabulary, which would lead to ongoing difficulties in EFL oral and written comprehension (Prior et al., 2014).

Phonological awareness was found to be a weak predictor of EFL word reading in the eighth grade, but was a moderate predictor in the eleventh grade, whereas most studies of native English word reading found a consistent role for PA across age groups (National Reading Panel, 2000). We suggest that this finding as well might be related to the insufficient instruction of phonemic awareness in the early grades of EFL in Israel. Thus, the fact that PA predicts single word reading only in the older adolescents might be ascribed to the very late adoption of phonetic reading strategies in this population, mostly through independent discovery and self-teaching (Share, 1995).

Finally, morphological knowledge was not found to predict single word reading in the current study, although there is evidence that supports its recruitment in readers of English as an L2 (Casalis, Comissaire & Duncan, 2015; Diependaele, Duñabeitia, Morris & Keuleers, 2011, though see Silva & Clahsen, 2008, for conflicting results). In addition, morphological awareness and knowledge have also been linked to successful vocabulary acquisition in first (Sparks & Deacon, 2015) and second language (Shahar-Yames, Eviatar

& Prior, 2018). Therefore, it might also be advisable to increase attention to morphological patterns, and specifically as they relate to accurate reading, within the EFL curriculum.

Limitations of the study and future directions

In order to assess English language skills among EFL learners, the current study used tasks that had been standardised and have accepted norms for native English speakers. The tasks assessing Hebrew language skills were developed in earlier studies and tested on younger learners or developed specifically for this study. In any case, additional investigation of both the original English tasks and their Hebrew versions, in the Israeli population, will further validate results of this study. Additionally, developmental aspects of word reading were addressed by a cross-sectional paradigm. A longitudinal investigation of EFL single word reading development from early instruction to late adolescence will allow a clear overview of the process and could serve as a valuable basis for curriculum development and intervention design.

Finally, the suggested conclusions regarding the links between instruction practices and EFL word reading skill in Israel are tentative at this point. Future studies should further investigate this issue, by testing the utility of various instructional interventions.

Conclusions

The current study supports the notion that the complex nature of the English orthography leads to a protracted process of learning to read single words (Seymour et al., 2003), in comparison with shallower orthographies. This is especially evident in a foreign language context, which is characterised by lower levels of exposure, which seem to strongly impact the acquisition of reading in English (cf. Sparks et al., 2017). Further, the current curricular and instructional practices of EFL teaching in Israel might not offer students sufficient support for achieving word reading proficiency in this complex writing system (English Curriculum, 2018; Fuchs et al., 2019; Vaisman & Kahn-Horwitz, 2018).

Our results reveal some universality for decoding and vocabulary knowledge as predictors of single word reading across ages and languages, though to various degrees. Importantly, the current findings also support the script-dependent hypotheses of word reading (Frost, 2012; Hutzler et al., 2004; Nag, & Snowling, 2012; Share, 2008), by demonstrating that the very same individuals recruit different constellations of underlying skills for accurately reading words in Hebrew and in English. This finding aligns with previous cross-linguistic investigations (Ziegler et al., 2010).

In conclusion, it seems that not only characteristics of the language and of the writing system, but also developmental stages of learners as well as instructional settings can interact to influence the course by which phonology and meaning are extracted from print (Pitchford, van Heuven, Kelly, Zhang & Ledgeway, 2012; Prior, 2012).

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Dr. Anat Prior is a Senior Lecturer in the Faculty of Education at the University of Haifa in Israel. Her research focuses on the interactions between two or more languages within individuals, and on identifying underlying mechanisms leading to individual differences in language learning and processing. She is particularly interested in fostering the development of effective instruction and intervention programs in the domain of foreign language, as well as programs targeted at minority language students in mainstream education.

Dr. Rita Zeltsman-Kulick is a Lecturer in the Faculty of Humanities and Social Sciences at the Kibbutzim College of Education, Technology and the Arts. Her PhD dissertation focused on reading related aspects of English foreign language learners. She is a specialist in remedial EFL teaching and teacher training. She is particularly interested in the English orthography and promoting effective reading programs in the foreign language setting.

Dr. Tami Katzir is an Associate Professor at the Edmond J. Safra Brain Research for Learning Disabilities at the University of Haifa. Her research focuses on the links between mind, brain, emotions and reading. She is particularly interested in the role of self-concept and anxiety in reading fluency and comprehension in diverse populations. She also studies the effects of reading interventions linking cognition, emotion, and technology.

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Address for correspondence: Anat Prior, PhD, Faculty of Education University of Haifa 199 Abba Hushi Haifa, Haifa 31905, Israel. E-mail: *aprior@edu.haifa.ac.il*