



Supporting the development of the bilingual lexicon through translanguaging: a realist review integrating psycholinguistics with educational sciences

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Abstract

In this review, we evaluate the claim that translanguaging in the classroom supports the development of the bilingual lexicon by enhancing cross-linguistic transfer. To address this issue, we integrate findings from psycholinguistics and educational sciences in order to identify how effective pedagogical practices for monolingual children can be extended to pedagogical practices for bilingual children. We show that both monolingual and bilingual children benefit from teaching strategies that strengthen the mental connections between semantically and phonologically related words, and that for bilingual children, these strategies should support both within- and cross-language connections. We argue that by stimulating the use of the home language in the classroom, translanguaging strategies like multilingual label quests and multilingual reading and writing can strengthen cross-language connections and, thereby, facilitate cross-linguistic lexical transfer. For closely related languages, stimulation of the home language has the additional benefit of implicitly facilitating the transfer of cognate vocabulary. Explicit instruction about cognates could further stimulate the development of cognate awareness, but whether it also enhances vocabulary learning is still an open question.

Keywords Translanguaging · Bilingual lexicon · Cross-linguistic transfer · Psycholinguistics · Educational sciences

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Introduction

Within education, it has been mainstream pedagogical practice for decades to create a monolingual context in which the different languages of bilingual children are being kept apart under the assumption that this avoids confusion or cross-language contamination (e.g., Jacobson & Faltis, 1990; Ndhlovu, 2015; Petitto, 2009). This assumption, however, does not correspond with insights from psycholinguistics, a discipline that is concerned with the question of how language is processed in the brain. Psycholinguistic research, in fact, has shown that from a very young age, children have the capacity to differentiate between their languages (De Houwer, 1990; Meisel, 2010; Petitto et al., 2001) and to adapt their language and degree of mixing to the interlocutor and context (Köppe, 1996; Lanza, 1992; Petitto et al., 2001). Fears that using different languages in the classroom may confuse bilingual children seem therefore unwarranted. Furthermore, it has become clear that the two languages of bilingual children are interconnected in the brain, and that even in single-language contexts, the other language is activated and cannot be turned off selectively (for a review, see Van Hell, 2020). Taken together, these insights show that the socially and politically defined boundaries between languages do not correspond to the way in which they are processed in the brain, thus advocating against monolingual educational practices for bilingual children (Otheguy et al., 2019).

Building in part on these psycholinguistic findings, a new translanguaging pedagogy has emerged, which promotes the intentional mixing of languages in the classroom in order to exploit the full linguistic repertoire of bilingual children. The term ‘translanguaging’ first appeared in Welsh, as *trawsieithu* (Williams, 1994), and started to gain wider currency in the literature after Baker (2001) translated the concept to English. In the last 20 years, translanguaging has become a popular concept that is in the limelight of academic discussions on dual language and literacy learning (Cenoz & Gorter, 2020; Creese & Blackledge, 2010; García & Li, 2014, 2015; Li, 2018).

In the current review, we focus on the effect that the practice of translanguaging could have on language learning, one of the main objectives within the translanguaging pedagogy, next to subject learning and home-school cooperation (Baker, 2001: 281–2). More specifically, we evaluate to what extent translanguaging in the classroom could indeed support the development of the bilingual lexicon. In doing so, we examine the often recurring claim that translanguaging encourages cross-linguistic transfer, which refers to the process of using linguistic knowledge of one language to leverage the learning of another (García & Li, 2015; García & Lin, 2017; Günther-van der Meij et al., 2020). For some academics, the concept of translanguaging includes a wide range of linguistic performances, sociocultural resources, and multilingual spaces (e.g., Li, 2011). In this review, however, we limit ourselves to vocabulary because of its central role in language learning, its predictive value for educational outcomes (Bleses et al., 2016), and the clearly defined and large body of literature on the topic. We do, however, acknowledge that language acquisition and translanguaging comprise more than vocabulary alone.

One of the most influential and mostly cited hypotheses on cross-linguistic transfer is Cummins’ (1979) linguistic interdependence hypothesis, which proposes that the development of skills in the first (L1) and second language (L2) are related and that, through cross-linguistic transfer, a high level of development in the L1 will pave the way for a high level of development in the L2, provided that there is enough exposure and enough motivation to learn the L2. As such, Cummins’ interdependence hypothesis has been widely used by translanguaging researchers (García & Li, 2014; Günther-van der Meij et al., 2020;

Hornberger & Link, 2012; Lewis et al., 2012) as a basis ‘for advancing our understandings of bilingualism in ways that fit the exigencies of twenty-first century translanguaging’ (García, 2009: 70–71).

The empirical evidence that Cummins himself provided to support this hypothesis is, however, limited, especially with respect to the transfer of vocabulary (Genesee, 1984; Hulstijn, 2011; Verhoeven, 1994). Still, in the translanguaging literature, the interdependence hypothesis is often presented as a proven fact rather than as a hypothesis that can fuel empirical research (e.g., García, 2009). We consider this a missed opportunity, because in the 40 years since Cummins formulated the hypothesis, empirical psycholinguistic research has considerably expanded our knowledge about the development of the bilingual brain, offering much more understanding of the interconnectedness of a bilingual’s two languages. This means that there is a gap between recent psycholinguistic evidence for the interconnectedness of a bilingual child’s languages (Van Hell, 2020) and the practical question of how this insight can be exploited in the classroom.

Traditionally, psycholinguistics and educational sciences have been two separate fields of study, the first one focusing on the mechanisms of language processing in the brain and the second one focusing on the outcome of educational processes. Baker (2001: 132) pointed out that theories about psychology and linguistics give ideas and insights, but do not always provide answers that are practically translatable to educational settings. We do, however, believe that the translation from theory to practice can be facilitated by combining psycholinguistics with educational sciences, as the combination of these two fields could provide valuable insights about the underlying cognitive mechanisms of effective pedagogical practices. We could then use these insights to formulate hypotheses about the effectiveness of new pedagogical approaches.

In this respect, examining the similarities and differences between the cognitive mechanisms of the monolingual and the bilingual lexicon in combination with the pedagogical practices that have been proven to support the language development of monolingual children could serve as a useful basis to formulate hypotheses about the effectiveness of new pedagogical approaches for the language development of bilingual children. This may sound counterintuitive at first, but as we show in this review, the architecture of the bilingual lexicon is in certain ways very similar to the architecture of the monolingual lexicon, but with the difference that it comprises words from two languages instead of one in one integrated system. In a pedagogical sense, this means that the basis of what works for monolingual vocabulary development applies equally to bilingual vocabulary development, but that attention should be paid to the fact that bilingual children have two languages.

The goal of the current review is to evaluate to what extent translanguaging in the classroom could support the development of the bilingual lexicon. To achieve this goal, we adopt the methodological principles of a realist review (Paré et al., 2015; Rycroft-Malone et al., 2012). This means that we do not provide an exhaustive overview of the literature, but rather focus on understanding the mechanisms by which interventions work by integrating relevant findings from different disciplines, namely psycholinguistics and educational sciences. In what follows, we first sketch the development of the monolingual lexicon and the ways in which effective educational practices support this development. Subsequently, we explain the similarities and differences between the monolingual and the bilingual lexicon, paying special attention to the evidence for both conceptual and phonological cross-linguistic transfer in the case of the bilingual lexicon. Then, we discuss to what extent translanguaging practices could support the development of the bilingual lexicon. When discussing the effect of educational practices, we focus on intervention studies with a strong design. This means that when there are enough studies to discuss, as is the

case for educational research on conceptual transfer, we exclude case studies with a limited number of participants (e.g., Perozzi, 1985), studies that have no clearly defined treatment and control group (e.g., Spencer et al., 2019, 2020), and studies that have no pre-test post-test comparison for crucial results (e.g., White & Horst, 2012).

Supporting the development of the monolingual lexicon

Many psycholinguistic studies have shown that the adult mental lexicon is organized according to semantic and phonological relatedness: hearing a word (e.g., ‘cat’) activates other words that are semantically (e.g., ‘dog’) (for a review, see Lucas, 2000) or phonologically (e.g., ‘hat’) (Goldinger et al., 1989; Marslen-Wilson & Zwitserlood, 1989) related, influencing their subsequent recognition. The mental lexicon can thus be seen as a network of interconnected nodes that are accessed by spreading activation. The number of lexical (phonological) entries in the mental lexicon of an individual is also referred to as vocabulary breadth, while the extent of semantic representations is referred to as vocabulary depth (e.g., Ouellette, 2006).

There is some evidence that children begin to develop a network of semantically (Arias-Trejo & Plunkett, 2009; Styles & Plunkett, 2009) and phonologically (Mani & Plunkett, 2011) related nodes between 18 and 24 months. The development of this network is important, because dense semantic networks facilitate rapid vocabulary expansion: new words are learned more easily (Borovsky et al., 2016b; Dickinson et al., 2019) and are processed more efficiently (Borovsky et al., 2016a) when they are semantically related to words that are already known (but see Hills et al., 2009, who claim that it is not the semantic network of the child, but the semantic network of the environment that predicts vocabulary development). The effect that children with better developed vocabularies acquire new vocabulary more easily is also known as the Matthew effect (Stanovich, 1986). This effect can explain large differences between children in the long run (Hart & Risley, 1995; Hoff, 2013).

Eventually, the semantic network develops into a structure with strong local clustering and high global access. Strong local clustering means that neighboring nodes are densely connected to each other, while high global access means that it only takes a few steps to transverse between distant nodes. The latter is facilitated by words that act as bridges between semantically distant clusters (Bales & Johnson, 2006; Borodkin et al., 2016). Underdeveloped semantic networks have been associated with language delays: in a study with 15- to 36-month-olds, late talkers were found to have semantic networks with weaker local clustering and less global access than typically developing children (Beckage et al., 2011). In more accessible language, this means that their semantic networks are less cohesive and less efficiently structured.

The development of a cohesive and efficiently structured semantic network is also important for the development of reading comprehension (Cremer & Schoonen, 2013; Nation & Snowling, 1999; Ouellette, 2006; Proctor et al., 2009; Roth et al., 2002; Silverman et al., 2015; Tannenbaum et al., 2006; but see Spätgens & Schoonen, 2018, 2019), possibly because the spreading of activation in a rich semantic network helps the reader to connect related concepts in the text, which leads to a better understanding (Spätgens & Schoonen, 2018). Nation and Snowling (1999), for example, found differences in semantic priming effects between children with good and poor reading comprehension skills. Semantic priming refers to the phenomenon that a target word (e.g., ‘cat’) is recognized or produced faster when it is preceded by a semantically related priming word (e.g., ‘dog’)

compared to a semantically unrelated priming word (e.g., ‘fork’). The good and poor readers showed similar priming effects for primes that are functionally related to the target (e.g., ‘broom’- ‘floor’; ‘shampoo’- ‘hair’), but only the good readers also showed semantic priming effects for primes that belong to the same category as the target (e.g., ‘cat’- ‘dog’; ‘aeroplane’- ‘train’). As pairs of words that are related through functionality co-occur more often in the real world than pairs of words that belong to the same category, the semantic relationship between functionally related words is more concrete than that between category-related words. Therefore, Nation and Snowling’s (1999) findings suggest that poor readers are less sensitive to abstract semantic relations than good readers.

The finding that a rich network is important for continued vocabulary development and, subsequently, reading comprehension stresses the importance for teaching strategies that do not only focus on breadth of word knowledge, but also on depth of word knowledge and semantic organization (Ouellette, 2006). For preschoolers, kindergartners, and children in the lower grades of primary school, these include the teaching of word definitions (Biemiller & Boote, 2006; Coyne et al., 2007, 2009; Dickinson et al., 2019; Hadley et al., 2019; Penno et al., 2002) and word relations (Booth, 2009; Dickinson et al., 2019; Hadley et al., 2019; Nelson et al., 2008; Neuman & Dwyer, 2011; Neuman et al., 2011), and the use of vocabulary items in different contexts (Hills et al., 2010; McKeown & Beck, 2014). Furthermore, phonological representations could be strengthened by encouraging children to repeat words (Hadley et al., 2019). All these teaching strategies have been shown to improve vocabulary development.

Now that we have discussed how the mental lexicon of monolingual children is organized and how education can support the development of this lexicon, it is time to take a look at the organization of the mental lexicon of bilingual children and the teaching strategies that could be adopted to stimulate its development.

From the monolingual to the bilingual lexicon

Just like the monolingual lexicon, the bilingual mental lexicon is organized according to semantic and phonological relatedness. Like monolingual children (Arias-Trejo & Plunkett, 2009; Styles & Plunkett, 2009), bilingual children begin to develop a network of semantically related words between 18 and 24 months (DeAnda & Friend, 2020), and just like their monolingual peers (Borovsky et al., 2016b; Dickinson et al., 2019; Hills et al., 2009), they learn words with more associative relationships more easily (Bilson et al., 2015).

Bilson et al. (2015), however, found that the English semantic networks of 6-month to 7-year-old bilingual children showed similar local clustering, but lower global access than those of their monolingual peers. This means that neighboring nodes are as densely connected as in monolingual children, but that it takes more steps to transverse between distant nodes. With respect to the latter, the single-language semantic networks of bilingual children resemble those of late talkers (Beckage et al., 2011). The explanation that is given here is that bilingual children often use their two languages with different people in different contexts, which means that their lexicons may lack certain words that act as bridges between semantically distant clusters. This study, however, did not take into account the other language of the bilingual children, and thus only shows one half of the picture. As far as we know, it has not been investigated what the semantic networks of bilingual children look like when both languages are taken into account. It could, however, be the case

that the differences between monolingual and bilingual children disappear, as words in the other language may serve as bridges between distant clusters.

It is important to take both languages into account, because around 30 months, the mental lexicon of bilingual children has developed in such a way that it not only connects semantically (Floccia et al., 2020; Jardak & Byers-Heinlein, 2019; Singh, 2014) and phonologically (Von Holzen & Mani, 2012; Von Holzen et al., 2019) related words within, but also across languages. This means that hearing a word does not only activate semantically and phonologically related words from the same language, but also from the other language (Dijkstra & Van Heuven, 2002). In French–English bilinguals, for example, the French word *poule* ('hen') would activate both *oeuf* ('egg') and 'egg' through semantic relatedness and both *poubelle* ('bin') and 'pool' through phonological relatedness. This interconnectedness between the two languages has important implications for how the bilingual lexicon develops and, in extension thereof, the teaching strategies that may be most effective in providing support for this development. In this regard, what applies to monolingual vocabulary development applies equally to bilingual vocabulary development: there is a need for teaching strategies that do not only focus on breadth of word knowledge, but also on depth of word knowledge and semantic organization. In the case of bilingual development, the interconnectedness of the two languages in the bilingual lexicon suggests that these strategies should take into account both languages of a child.

In what follows, we explore to what extent this psycholinguistic insight is practically translatable to educational settings. In doing so, we first focus on the cross-linguistic connections between semantically related words and the ways in which these can be used to facilitate the transfer of conceptual vocabulary knowledge from one language to the other. This means that we evaluate whether knowing a word for a particular concept in one language (e.g., 'dog' in English) facilitates the learning of its translation in the other (e.g., *chien* 'dog' in French). We both examine to what extent this process happens automatically and to what extent it can be stimulated through translanguaging in the classroom. Subsequently, we discuss how the phonological overlap between languages can be employed to further facilitate cross-linguistic transfer of vocabulary knowledge. In doing so, we specifically focus on cognates, that is, words that overlap in meaning and form between languages (e.g., *Hund* 'dog' in German and *hond* 'dog' in Dutch). In this discussion, we start by describing the most recent findings from psycholinguistic research and then explore the effect of educational interventions.

The bilingual development of conceptual vocabulary

The interconnectedness of languages in the bilingual lexicon has been put forward as an important ground for the use of multiple languages in the classroom, as this would encourage conceptual transfer from the home to the school language (García & Li, 2015; García & Lin, 2017; Günther-van der Meij et al., 2020). Teaching strategies that are often mentioned in this respect in the translanguaging literature are multilingual label quests, in which the teacher elicits vocabulary items from students in multiple languages (Arthur & Martin, 2006; Creese & Blackledge, 2010; Duarte & Van der Meij, 2018; Martin, 1999; Ticheloven et al., 2020) and the use of multiple languages in book reading (Moody et al., 2021; Rowe, 2018) and in writing (Cummins, 2005; Rowe, 2018). In this section, we first explore recent psycholinguistic insights about the transfer of conceptual knowledge and, subsequently, examine to what extent conceptual transfer can be enhanced through educational interventions.

Conceptual transfer: psycholinguistic research

In their individual languages, bilingual children often have smaller vocabularies than monolingual children (Bialystok et al., 2010; Oller et al., 2007; Pearson et al., 1993; Poulin-Dubois et al., 2013; Scheele et al., 2010; Thordardottir et al., 2006; Vagh et al., 2009). When the two languages are combined, however, their conceptual vocabulary size, that is, the total number of concepts for which a child has a word in at least one language, often equals (Junker & Stockman, 2002; Legacy et al., 2016; Pearson et al., 1993; Poulin-Dubois et al., 2013) or exceeds (Oller et al., 2007) that of monolingual children. When examining the functioning of the bilingual lexicon, it becomes apparent that the lexical representations and the connections that spread from them may differ in strength across the two languages: those in the dominant language are stronger than those in the non-dominant language (Singh, 2014, but see Floccia et al., 2020; Jardak & Byers-Heinlein, 2019). As language dominance is the result of differences in the amount of input in and use of each language (Unsworth et al., 2018), this suggests that more exposure to and more use of a particular language lead to stronger lexical representations and connections in that language.

Several studies have shown that early in development, bilingual children begin to acquire translation equivalents, that is, different lexical representations in each language for the same concept (e.g., 'dog' in English and *chien* 'dog' in French). Around their second birthday, bilingual children's vocabularies consist for approximately 30% of translation equivalents (Bosch & Ramon-Casas, 2014; David & Li, 2008; Legacy et al., 2017; Pearson et al., 1995; Poulin-Dubois et al., 2013), which are processed more efficiently than words without a known translation equivalent (Poulin-Dubois et al., 2018). There is, however, quite some variation among children, and children with a larger proportion of translation equivalents show faster lexical access overall in their L1 (Poulin-Dubois et al., 2013). This means that they can more easily retrieve words from the mental lexicon compared to children with smaller proportions of translation equivalents. One potential explanation, we believe, is that translation equivalents improve global access within the integrated semantic network of bilingual children. That is, translation equivalents may serve as bridges between clusters of words in different languages (see also Bilson et al., 2015, who found that bilingual children have lower global access than monolingual children when only one of their languages is taken into account). As children become older, the proportion of translation equivalents gradually grows (David & Li, 2008; Legacy et al., 2017), a process that is facilitated by language balance: children with more balanced exposure, that is, more or less equal amounts of exposure to each language, usually develop more balanced vocabulary sizes across their two languages and, as a result, have more translation equivalents in their bilingual lexicon than children with clearly unbalanced exposure (Legacy et al., 2017; but see Poulin-Dubois et al., 2013).

An important question with respect to translation equivalents is whether the conceptual knowledge that is built up in the L1 can facilitate vocabulary learning in the L2. Melby-Lervåg and Lervåg's (2011) meta-analysis showed a significant, albeit weak, correlation between L1 and L2 oral language based on measures of vocabulary. Correlations, however, do not provide robust evidence of cross-linguistic transfer. In this respect, there are some other studies that provide better proof (Bilson et al., 2015; DeAnda & Friend, 2020; Goodrich et al., 2016).

In a study with Spanish–English bilingual toddlers, DeAnda and Friend (2020) showed that between 18 and 24 months, the proportion of known translation equivalents

increased in the non-dominant language, but stayed relatively stable in the dominant one, suggesting conceptual transfer from the dominant to the non-dominant language. In another study, Bilson et al. (2015) compared the English productive vocabularies of monolingual and bilingual children between the ages of 6 months to 7 years. They showed that the vocabularies of the bilingual children showed significantly more translation equivalents compared to the lexical overlap in the vocabularies of two randomly chosen monolingual children (but see Pearson et al., 1995), suggesting that the two vocabularies of bilingual children are not learned independently from one another. In yet another study, Goodrich et al. (2016) examined to what extent conceptual knowledge predicts bilingual vocabulary development in Spanish–English preschoolers. After statistically controlling for initial L2 vocabulary, unique L1 vocabulary did not predict L2 vocabulary 9 to 12 months later. The same pattern emerged in the opposite direction: after statistically controlling for initial L1 vocabulary, unique L2 vocabulary did not predict later L1 vocabulary. Additional analyses with translation equivalents, however, showed that children were more likely to acquire a word in their L2 if they already knew it in their L1 than if they did not know it in their L1, and vice versa. These findings show that although overall L1 vocabulary knowledge does not predict subsequent overall L2 vocabulary development, and vice versa, there is some cross-linguistic transfer of specific conceptual information.

Conceptual transfer: educational interventions

For educational practices, the psycholinguistic finding of conceptual transfer suggests that support of the L1 through a bilingual intervention can have a positive effect on L2 vocabulary development. Indeed, there are some studies that confirm this hypothesis. This concerns both interventions where the languages are kept separate (Armon-Lotem et al., 2021; Perozzi & Chavez Sanchez, 1992; Roberts, 2008) and interventions where the languages get mixed (Leacox & Jackson, 2014; Lugo-Neris et al., 2010; Méndez et al., 2015, 2018; Read et al., 2020). The latter could be seen as a typical translanguaging approach, but we discuss both kinds of interventions below, as the dividing line between what does and does not count as translanguaging is not so clear and both kinds of interventions are relevant in the discussion about how to stimulate cross-linguistic transfer of vocabulary.

In a study with 6-year-old bilingual children, Perozzi and Chavez Sanchez (1992) showed that prepositions and pronouns that were first taught in L1 Spanish and then in L2 English were learned faster in the L2 than prepositions and pronouns that were taught in the L2 only. This shows that instruction in the L1 facilitates learning in the L2. Comparable results have been found in a bilingual book (Roberts, 2008) and a bilingual narrative intervention (Armon-Lotem et al., 2021), where the two languages were also kept separate.

Roberts (2008) conducted a book reading intervention among 4-year-old bilingual children in which home reading in the L1 or home reading in the L2 was combined with subsequent classroom reading and vocabulary instruction in the L2. The intervention consisted of two 6-week sessions in which the languages of the home reading were counterbalanced. The results showed that for L2 vocabulary development, home reading in the L1 was at least as effective as home reading in the L2. In fact, after the first 6-week intervention period, children who had received the home reading in their L1 performed significantly better on L2 target vocabulary than children who had received the home reading in their L2. Weekly vocabulary tests furthermore showed that this effect was only visible after the combined home and classroom readings, not in between these two sessions, thus suggesting

that vocabulary learned in the L1 only boosts vocabulary in the L2 when the child gets a chance to pair the two in the mental lexicon.

In a bilingual narrative intervention study with 5-year-old English-Hebrew bilingual children, Armon-Lotem et al. (2021) also found evidence of cross-linguistic transfer from the home language (English) to the school language (Hebrew). The intervention used a block design with 2 blocks of 6 sessions, in which the two languages were addressed separately (first English, then Hebrew). In contrast to Roberts (2008), vocabulary was assessed in both the home and the school language. The results showed that the children not only improved their vocabulary in the language of the intervention, but also their vocabulary in Hebrew following the English intervention. Gains in English following the Hebrew intervention, in contrast, were limited to children with stronger English skills. These results show that the school language always gains from a cross-linguistic intervention, while the home language only does so when children's proficiency is already relatively high, thus underscoring the importance of a strong home language.

Méndez et al., (2015, 2018) investigated the effect of a bilingual shared book reading intervention that strategically combined the L1 and the L2 among 4-year-old Spanish-English bilingual children. The intervention consisted of 5 weekly cycles of 3 days, during which the two languages were presented in such a way that L2 learning would be facilitated through support of the L1: shared book reading was carried out in L1 Spanish on the first day, in both languages on the second day, and in L2 English on the third day. Children who had received this bilingual intervention acquired significantly more Spanish and English vocabulary than children who had received an English-only intervention. Similarly, Leacock and Jackson (2014) and Lugo-Neris et al. (2010) investigated the effect of vocabulary bridging in 4- to 6-year-old bilingual children, where definitions of L2 English words were provided in L1 Spanish during shared book reading. Both studies showed that this bridging strategy resulted in larger gains in English vocabulary compared to an English-only shared book reading strategy. Spanish vocabulary was not assessed.

In another study, Read et al. (2020) examined the effect of storybook reading on L2 vocabulary learning in 2- to 5-year-old bilingual children, comparing monolingual L2 books to code-switching books that predominantly used the child's L1, but highlighted target vocabulary in the L2. Both L1 Spanish speakers with English as their L2 and L1 English speakers with Spanish as their L2 were tested. Overall, the results of this study showed comparable L2 vocabulary gains for both types of books, but older children learned more L2 vocabulary from the code-switching books. The authors suggest that this may be due to the Matthew effect (Stanovich, 1986): older children probably have a higher proficiency in the L1, which makes it easier to further expand their vocabulary, both in the L1 and the L2.

The results of the studies described above show that both bilingual interventions in which the languages are kept separate and bilingual interventions in which the languages get mixed lead to larger improvements in both the L1 and the L2 than monolingual L2 interventions. This clearly shows that translanguaging strategies like multilingual label quests (Arthur & Martin, 2006; Creese & Blackledge, 2010; Duarte & Van der Meij, 2018; Ticheloven et al., 2020) and the use of multiple languages in book reading (Moody et al., 2021; Rowe, 2018) and in writing (Cummins, 2005; Rowe, 2018) can facilitate conceptual transfer from the L1 to the L2.

The cross-linguistic transfer effect of bilingual interventions may also explain why children in bilingual educational programs perform as well on the school language as children in monolingual educational programs, while at the same time gaining larger proficiency in the home language (Barnett et al., 2007; Durán et al., 2013; Restrepo et al., 2013). In these bilingual programs, the two languages are typically strictly separated. To our knowledge, it

has not been investigated whether translanguaging programs where the two languages get mixed yield similar results. Furthermore, as far as we know, it has not been investigated whether mixing leads to better results than strict language separation. Given the architecture of the bilingual lexicon, there are good reasons to believe this may be the case, as mixing might lead to stronger cross-language connections, but future research is needed to further investigate this.

Cognate facilitation

Depending on the combination of languages of a bilingual child, the transfer of conceptual knowledge from one language to the other can be further facilitated by phonological overlap between translation equivalents. This is the case for closely related languages such as Spanish/Catalan and German/Dutch, which share many cognates, that is, words that overlap in (phonological and/or orthographic) form and meaning between languages (e.g., *Hund* ‘dog’ in German and *hond* ‘dog’ in Dutch). In this regard, a teaching strategy that is often mentioned in the translanguaging literature is cognate comparison, where the teacher stimulates children to actively compare vocabulary from different languages (Celic & Seltzer, 2012; Cenoz & Gorter, 2017; Cummins, 2005, 2008; Duarte & Van der Meij, 2018; Leonet et al., 2020), which can subsequently be used as a stepping stone to explicit instruction about cognate relationships. The goal of this cognate comparison strategy is twofold: to enhance cognate awareness, that is, the skill to identify the cognate relationship between words in different languages, and, consequently, to enhance cross-linguistic transfer at the lexical level. The idea of this strategy stems from the observation that cognates are acquired and processed more easily than non-cognates, especially in the non-dominant language (e.g., Bosma & Nota, 2020; Kelley & Kohnert, 2012). In this section, we first explore the literature on this cognate facilitation effect in bilingual children and then examine to what extent cognate awareness and cross-linguistic transfer of vocabulary can be enhanced through educational interventions in which children are explicitly taught about cognates.

Cognate facilitation: psycholinguistic research

In order to understand how cognates could be used in education, it is important to know which factors influence the cognate facilitation effect. As we explain below, these include language proficiency, age, and metalinguistic awareness, that is, the ability to consciously reflect on the nature of language.

Cognate facilitation effects in children have been found both in vocabulary acquisition and in lexical processing. Most vocabulary acquisition studies have found cognate facilitation in the L2 (Bosma et al., 2019; Chen et al., 2012; Comesaña et al., 2012, 2019; Hancin-Bhatt & Nagy, 1994; Kelley & Kohnert, 2012; Malabonga et al., 2008; Méndez Pérez et al., 2010; Proctor & Mo, 2009; Puimège & Peters, 2019; Robinson Anthony et al., 2020; Tonzar et al., 2009; Valente et al., 2018; Von Holzen et al., 2019) and this effect has been shown to be gradual: the more overlap between the L1 and the L2 word, the easier it is to acquire the new L2 word (Bosma et al., 2019; Valente et al., 2018; Von Holzen et al., 2019). A study with L1 English speakers in an L2 Spanish immersion program, however, showed that cognates can also enhance L1 vocabulary acquisition (Cunningham & Graham, 2000). Furthermore, a longitudinal study

that followed the vocabulary acquisition of a bilingual toddler showed that cognates are more easily acquired in both languages when bilingual language acquisition is simultaneous (Schelletter, 2002).

This pattern of results, with larger cognate facilitation effects in the dominant than in the non-dominant language, has also been found in lexical processing studies (picture naming: Poarch & Van Hell, 2012; reading: Bosma & Nota, 2020; Brenders et al., 2011; Jared et al., 2012; Schröter & Schroeder, 2016). In children with unbalanced bilingual proficiency, this effect has mainly been found in the weaker (reading) language (Bosma & Nota, 2020; Brenders et al., 2011; Jared et al., 2012; Poarch & Van Hell, 2012), whereas in children with balanced bilingual proficiency, it has been found in both languages (Poarch & Van Hell, 2012; Schröter & Schroeder, 2016). This suggests that the processing benefit of cognates depends on a child's bilingual proficiency. This interpretation is in line with vocabulary acquisition studies that show that children with a higher level of proficiency in their L1 are more sensitive to cognates in their L2 (Malabonga et al., 2008; Méndez Pérez et al., 2010), while children with a higher level of proficiency in their L2 are less sensitive to cognates in their L2 (Kelley & Kohnert, 2012).

The effect of proficiency can be explained in terms of the relative strength of the connections between semantic and phonological representations, which are usually weaker for lexical items in the L2 than for lexical items in the L1. As a result, processing is slower in the L2 than in the L1, which gives more time for co-activation from the L2 to the L1 than vice versa. A higher level of proficiency in the L1 reinforces this discrepancy, while a higher level in the L2 reduces it. The graduality of the cognate facilitation effect furthermore shows that the connections between cognates with more overlap are stronger than those between cognates with less overlap (Dijkstra & Van Heuven, 2002).

Not only proficiency but also age seems to play a role in cognate facilitation. Several studies have shown that older children are more sensitive to cognates than younger children, suggesting that, without explicit instruction, children's sensitivity to cross-linguistic overlap develops as they grow older (Arteagoitia & Howard, 2015; Bosma et al., 2019; Hancin-Bhatt & Nagy, 1994; Hipfner-Boucher et al., 2016; Kelley & Kohnert, 2012; Malabonga et al., 2008; Muñoz et al., 2018; Puimège & Peters, 2019). This may in part be due to the fact that older children are more proficient in their L1, but there is some evidence that an older age results in an increase in cognate sensitivity above and beyond the increase that is due to a higher level of L1 proficiency (Hancin-Bhatt & Nagy, 1994).

One potential explanation for the modulating effect of age is that older children have better developed metalinguistic skills, which means that they are better able to consciously reflect on the nature of language (Corthals, 2010; Edwards & Kirkpatrick, 1999). Cognate awareness can be seen as such a metalinguistic ability, as it requires reflection on the relationship between different linguistic forms (Chen et al., 2012). This is an important skill, as it facilitates L2 vocabulary development (D'Angelo et al., 2017) and reading comprehension (Hipfner-Boucher et al., 2016; Nagy et al., 1993). Nagy et al. (1993), for example, measured cognate awareness through a cognate-circling task, in which children received written instructions about the definition of a cognate and then had to encircle all the cognates in a text. They found that cognate awareness predicted English reading comprehension above and beyond proficiency in L2 English and L1 Spanish. Furthermore, there was a strong positive relationship between Spanish vocabulary and English reading comprehension for children with high cognate awareness skills, while this relationship was negative for children with low cognate awareness skills. Thus, only children who were able to see the relationship between Spanish and English words benefited from a larger L1 vocabulary when reading in their L2.

In sum, the results of the research described above show that bilingual children acquire and process cognates more easily than non-cognates. This cognate facilitation effect is influenced by language proficiency, age, and metalinguistic awareness. The more proficient children are in their L1, the more easily they acquire cognates in their L2. Cognate facilitation is furthermore more pronounced in older children and children with better cognate awareness skills. For educational practices, this means, in the first place, that cognate facilitation can be enhanced through stimulation of the home language. Knowing more words in the L1 will implicitly facilitate cognate transfer from the L1 to the L2. Once children have attained a higher level of proficiency in their L2, however, the role of this type of transfer will probably decrease. In the second place, the positive effect of cognate awareness suggests that teaching strategies that focus on improving children's skill to identify cognate relationships may further facilitate lexical transfer from the L1 to the L2. In the next section, we discuss the empirical evidence for this hypothesis.

Cognate facilitation: educational interventions

In all of the research described above, children were not explicitly instructed about cognate relationships between words in their two languages, with the exception of the studies that investigated the effect of cognate awareness. In these studies, however, the cognate awareness task in which the children were informed about cognate relationships was always administered last, so that the instruction could not influence the results of the vocabulary and reading tasks. Still, when discussing the practical implications of their findings, many researchers suggest that explicit instruction may enhance children's vocabulary acquisition (Arteagoitia & Howard, 2015; Chen et al., 2012; Kelley & Kohnert, 2012; Malabonga et al., 2008; Méndez Pérez et al., 2010; Proctor & Mo, 2009; Ramírez et al., 2013; Robinson Anthony et al., 2020; Tonzar et al., 2009).

There are good reasons to believe that cognate instruction may indeed be useful, because although children are sensitive to cognates, they still do not notice a large part of the cognates they encounter (Harley et al., 1986; Nagy et al., 1993). In Nagy et al.'s (1993) study, for example, children identified only less than half of the cognates that they knew in both languages. This suggests that there is indeed room for improvement, but, as we show below, research on the effect of cognate instruction has yielded mixed results.

There is some evidence that explicit instruction can enhance children's cognate awareness (Dressler et al., 2011; Otwinowska, 2016; Otwinowska et al., 2020). In a qualitative study on word inferencing in reading, for example, Dressler et al. (2011) showed that fifth-graders who had received explicit instruction about the use of cognates were better able to guess the meaning of derived words with a cognate root (e.g., 'amorous', which contains the Spanish root *amor* 'love') than their peers who had not received such instruction. Similarly, in a quantitative study, Otwinowska (2016) showed that 14-year-old Polish learners of English identified more cognates in a text when they were explicitly taught about cognate relationships.

The finding that explicit instruction can enhance children's cognate awareness (Dressler et al., 2011; Otwinowska, 2016; Otwinowska et al., 2020) has strengthened the view that teaching children about cognates can boost vocabulary learning. To our knowledge, however, there is so far no single study that unequivocally shows that cognate awareness training also improves children's acquisition of cognates, although a number of studies claim they did (Arteagoitia & Howard, 2015; Carlo et al., 2004; Dam et al., 2020). Carlo et al. (2004), for example, reported that a vocabulary enrichment intervention that also included cognate

awareness training enhanced vocabulary acquisition and reading comprehension. However, as the cognate awareness training was only one of the many activities included in the intervention, no conclusions can be drawn about the specific effect of the cognate awareness training. Dam et al. (2020) also reported that a vocabulary intervention with explicit cognate instruction improved vocabulary acquisition, but in this study, there was no comparison to a control group that had not received the intervention. Hence, it is not clear whether children's increase in vocabulary was indeed the result of the cognate intervention. In another study, Arteagoitia and Howard (2015) reported that preliminary findings from a cognate-based intervention study suggest that this intervention had a positive effect on L2 vocabulary skills, but as far as we could ascertain, the full study has never been published.

To our knowledge, there is only one published study that directly investigated whether a cognate intervention enhances vocabulary learning, and this study found a null effect. Otwinowska et al. (2020) divided a group of 12- to 15-year-old Polish learners of English in an experimental and a control group. The control group received a 45-minute training on general vocabulary learning strategies, while the experimental group received a very similar training that also included cognate awareness-raising exercises. These training sessions were conducted by one of the researchers, after which both groups received the same regular vocabulary teaching from their own teachers for a period of 6 weeks. Pre- and post-tests consisted of an L2 to L1 translation task and a questionnaire on vocabulary learning strategies, and were conducted prior to the training and immediately after the vocabulary teaching phase. During the post-test session, participants also completed a reading task and a cognate recognition task. These tests showed that in both the pre- and post-test session, participants in both groups performed better on cognates than on non-cognates and false friends. Furthermore, all participants improved their vocabulary during the 6-week vocabulary training, but in contrast to what was expected, cognates, non-cognates, and false friends were acquired to a similar degree and there were no differences between the experimental and control group on any of the tasks.

In a follow-up experiment, the authors intensified the experimental manipulation by organizing four workshops on vocabulary learning strategies instead of one, and reversed the direction of the translation task (L1 to L2 instead of L2 to L1) to exclude the possibility of cognate guessing. The results, however, showed the same pattern: no effect of cognate awareness training. In fact, the experimental group translated non-cognates slightly worse than the control group. The only positive effect of the cognate awareness training was that the experimental group identified more cognates in the cognate recognition task than the control group, but the effect size was relatively small and the results on this post-test could not be compared to a pre-test, which means that the effect could also reflect initial differences between the two groups. Overall, the authors thus concluded that their cognate awareness intervention had little to no effect.

Taken together, there is some evidence that explicit instruction about cognate relationships can enhance children's cognate awareness (Dressler et al., 2011; Otwinowska, 2016; Otwinowska et al., 2020), but it has so far not been proven that this kind of instruction also boosts vocabulary learning. This means that although we do not exclude the possibility that there may be positive effects, it would be premature to jump to conclusions at this point.

Conclusion

In the current realist review, we evaluated the often recurring claim that translanguaging in the classroom supports the development of the bilingual lexicon by enhancing cross-linguistic transfer (García & Li, 2015; García & Lin, 2017; Günther-van der Meij et al., 2020). To address this issue, we integrated findings from psycholinguistics and educational sciences in order to identify how effective pedagogical practices for monolingual children can be extended to pedagogical practices for bilingual children. By combining insights from different fields, we found strong indications that translanguaging can indeed be beneficial for the development of the bilingual lexicon, although a few caveats must be noted that deserve special attention in future research.

An important insight from psycholinguistics is that the architecture of the monolingual and bilingual lexicon is very similar in the sense that they both get organized according to semantic and phonological relatedness. This happens at more or less the same rate of development for monolingual and bilingual children (Arias-Trejo & Plunkett, 2009; DeAnda & Friend, 2020; Styles & Plunkett, 2009), but the mental lexicon of bilingual children develops in such a way that it not only connects related words within, but also across languages (Floccia et al., 2020; Jardak & Byers-Heinlein, 2019; Singh, 2014; Von Holzen & Mani, 2012; Von Holzen et al., 2019). Within bilingual development, there is an important role for translation equivalents (different lexical representations in each language for the same concept). Bilingual children are more likely to acquire a new word in one language if they already know it in the other (Bilson et al., 2015; DeAnda & Friend, 2020; Goodrich et al., 2016), showing that there is cross-linguistic transfer of conceptual information. Furthermore, knowledge of translation equivalents strengthens bilingual children's semantic network: these words are processed more efficiently than words without a known translation equivalent (Poulin-Dubois et al., 2018) and in their L1, bilingual children with a larger proportion of translation equivalents show faster lexical access overall (Poulin-Dubois et al., 2013).

The development of a dense semantic network with a lot of connections between related words is important, because it has been shown to facilitate vocabulary learning (Borovsky et al., 2016a, 2016b; Dickinson et al., 2019) and reading comprehension (e.g., Cremer & Schoonen, 2013; Nation & Snowling, 1999; Ouellette, 2006; Proctor et al., 2009; Roth et al., 2002; Silverman et al., 2015; Tannenbaum et al., 2006; but see Spätgens & Schoonen, 2018, 2019). With respect to education, this stresses the importance for teaching strategies that do not only focus on vocabulary breadth (the number of words known) but also on vocabulary depth (the richness of word knowledge) and semantic organization (Ouellette, 2006). Effective monolingual strategies in this regard include the teaching of word definitions (Biemiller & Boote, 2006; Coyne et al., 2007, 2009; Dickinson et al., 2019; Hadley et al., 2019; Penno et al., 2002) and word relations (Booth, 2009; Dickinson et al., 2019; Hadley et al., 2019; Nelson et al., 2008; Neuman & Dwyer, 2011; Neuman et al., 2011), the use of vocabulary items in different contexts (Hills et al., 2010; McKeown & Beck, 2014), and the vocal repetition of target words (Hadley et al., 2019). These strategies strengthen within-language connections.

For bilingual children, there is also a need for teaching strategies that strengthen cross-language connections because of the integrated nature of the bilingual lexicon. Research shows that this can be facilitated through the use of the L1 in education: there is evidence that bilingual book reading and narrative interventions that stimulate the L1 can also have a positive effect on the L2. This concerns both interventions where the languages

are kept separate (Armon-Lotem et al., 2021; Perozzi & Chavez Sanchez, 1992; Roberts, 2008) and interventions where the languages get mixed (Leacox & Jackson, 2014; Lugo-Neris et al., 2010; Méndez et al., 2015, 2018; Read et al., 2020). This clearly shows that translanguaging strategies such as multilingual label quests, in which the teacher elicits vocabulary items from students in multiple languages (e.g., Arthur & Martin, 2006; Creese & Blackledge, 2010; Duarte & Van der Meij, 2018; Ticheloven et al., 2020), and the use of multiple languages in book reading (Moody et al., 2021; Rowe, 2018) and in writing (Cummins, 2005; Rowe, 2018) can facilitate conceptual transfer from the L1 to the L2. To our knowledge, no comparison has yet been made between bilingual interventions where the languages get mixed and bilingual interventions where the languages are strictly separated. Given the architecture of the bilingual lexicon, one hypothesis is that language mixing leads to stronger cross-language connections and, as a consequence, stronger effects of cross-linguistic transfer, but whether this is indeed the case is a question for future research.

When the two languages of a bilingual child are closely related, there is an additional advantage for vocabulary learning through cognates, that is, translation equivalents that overlap in (phonological and/or orthographic) form. These are acquired and processed more easily than non-cognates, especially in the non-dominant language (e.g., Bosma & Nota, 2020). This cognate facilitation effect is influenced by language proficiency, age, and metalinguistic awareness. The more proficient children are in their L1, the more easily they acquire cognates in their L2 (Malabonga et al., 2008; Méndez Pérez et al., 2010). Cognate facilitation is furthermore stronger in older children (e.g., Kelley & Kohnert, 2012; Malabonga et al., 2008) and children with better cognate awareness skills (Hancin-Bhatt & Nagy, 1994).

For educational practices, this means that cognate facilitation can be enhanced through stimulation of the home language. Knowing more words in the L1 will implicitly facilitate cognate transfer from the L1 to the L2. Furthermore, the positive effect of cognate awareness suggests that teaching strategies that focus on improving children's skill to identify cognate relationships may further facilitate lexical transfer from the L1 to the L2. This hypothesis is, however, only partially supported: there is indeed evidence that explicit instruction about cognate relationships can enhance children's cognate awareness skills (Dressler et al., 2011; Otwinowska, 2016; Otwinowska et al., 2020), but it has so far not been proven that this also results in a boost in vocabulary learning (Otwinowska et al., 2020). As research on this topic is still relatively scarce, we do not exclude the possibility that there may be positive effects, but more research is needed before we can draw definitive conclusions here.

Despite this reservation, we see, overall, great potential for the use of translanguaging in the classroom, as it could fulfill the need for a pedagogical approach that supports the organization of the bilingual lexicon. As we have shown in this realist review, both monolingual and bilingual children may benefit from teaching strategies that strengthen the mental connections between semantically and phonologically related words. For bilingual children, these strategies should exploit the interconnectedness of the bilingual lexicon by taking into account both within- and cross-language connections. In this respect, translanguaging strategies such as multilingual label quests and the use of multiple languages in reading and writing could be seen as the bilingual equivalent of monolingual strategies like the teaching of word definitions and the use of vocabulary items in different contexts. All of these strategies have in common that they are intended to strengthen the connections between words in the mental lexicon.

Given the central role that vocabulary plays in language learning and its highly predictive value for later educational outcomes (Bleses et al., 2016), the integrated insights of this

review provide an important basis for the language learning objective of translanguaging. Importantly, the insight that the bilingual lexicon comprises words from two languages in one integrated system supports the idea that translanguaging is not simply ‘going between’ two separate autonomous languages, but also ‘going beyond’ them (García, 2009; García & Li, 2015; Li, 2011, 2018), as the whole is greater than the sum of its parts. For educational practices, this means that translanguaging strategies can foster the use and integration of both languages of a bilingual student. We believe these strategies can be used in all sorts of educational settings, not just in classrooms with only two languages, but also in classrooms with many different languages where the teacher does not speak all of them. The teacher’s role, then, is to create opportunities for language use, rather than to act as the linguistic authority. This can be done, for example, by giving children space to work together in a language they share or by providing them with linguistic resources such as (online) dictionaries (García & Li, 2015).

As language comprises more than just vocabulary, it remains to be determined to what extent translanguaging also supports other aspects of language learning. Furthermore, this review did not take into account subject learning and home-school cooperation, the other two main objectives of translanguaging (Baker, 2001: 281–2). We do, however, think that the realist approach that we adopted in this review may also be useful to evaluate the effectiveness of translanguaging for these two other goals.

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Declarations

Conflict of interest The authors declare no competing interests.

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Current themes of research and most relevant publications

Evelyn Bosma is a postdoctoral researcher. She investigates the relationship between bilingualism and cognition, mainly among Frisian-Dutch bilingual children.

Blom, E., Bosma, E., & Heeringa, W. (2021). Regular and irregular inflection in different groups of bilingual children and the role of verbal short-term and verbal working memory. *Languages*, 6(1), 56. <https://doi.org/10.3390/languages6010056>

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Bosma, E., & Nota, N. (2020). Cognate facilitation in Frisian–Dutch bilingual children's sentence reading: An eye-tracking study. *Journal of experimental child psychology*, 189, 104699. <https://doi.org/10.1016/j.jecp.2019.104699>

Arthur Bakker is an associate professor with an interest in multilingualism, boundary crossing, and embodied cognition in Mathematics and Science Education.

Abdu, R., van Helden, G., Alberto, R., & Bakker, A. (2021). Multimodal dialogue in small-group mathematics learning. *Learning, Culture and Social Interaction*, 29, 100491. <https://doi.org/10.1016/j.lcsi.2021.100491>

Bakker, A., Cai, J., & Zenger, L. (2021). Future themes of mathematics education research: an international survey before and during the pandemic. *Educational Studies in Mathematics*, 107(1), 1–24. <https://doi.org/10.1007/s10649-021-10049-w>

Draijer, J., Bakker, A., Slot, E., & Akkerman, S. (2020). The Multidimensional Structure of Interest. *Frontline Learning Research*, 8(4), 18-36. <https://doi.org/10.14786/flr.v8i4.577>

Linda Zenger is a researcher with interest in multilingualism, STEM education, and issues concerning sustainability and equality.

Bakker, A., Cai, J., & Zenger, L. (2021). Future themes of mathematics education research: an international survey before and during the pandemic. *Educational Studies in Mathematics*, 107(1), 1-24. <https://doi.org/10.1007/s10649-021-10049-w>

Elma Blom is Professor of language development and multilingualism in family and educational context.

Blom, E., Soto-Corominas, A., Attar, Z. Daskalaki, E., & Paradis, J. (in press). Interdependence between L1 and L2: the case of Syrian children with refugee backgrounds in Canada and the Netherlands. *Applied Psycholinguistics*.

Francot, R., Blom, E., Broekhuizen, M., & Leseman, P. (2021). Profiles of bilingualism in early childhood: A person-centred Latent Profile Transition Approach. *Bilingualism: Language and Cognition*, 24(3), 569-582. <https://doi.org/doi:10.1017/S1366728920000383>

Ticheloven, A., Blom, E., Leseman, P., & McMonagle, S. (2019). Translanguaging challenges in multilingual classrooms: scholar, teacher and student perspectives. *International Journal of Multilingualism*, 1-24. <https://doi.org/10.1080/14790718.2019.1686002>

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