

Assessments of working memory: a tool for differentiating between language disorder and language difference in multilingual contexts?

C. WEALER, P. M. J. ENGEL DE ABREU

Institute for Research on Multilingualism,
University of Luxembourg.

Conflits d'intérêts : les auteurs déclarent
n'avoir aucun conflit d'intérêt.

RÉSUMÉ : Évaluation de la mémoire de travail : un outil de différenciation entre trouble du langage et différence du langage dans des contextes multilingues ?

Diagnostiquer les troubles du langage chez les enfants bilingues représente un défi clinique en raison des similitudes dans le profil de compétence linguistique entre les enfants bilingues au développement typique et les enfants monolingues avec un trouble du langage. Les mesures de la mémoire de travail dépendent moins des connaissances accumulées que les tests de langage traditionnels et pourraient contribuer à différencier un trouble du langage d'une différence de langage liée aux expériences avec une langue.

Mots clés : Bilinguisme – Mémoire de travail – Évaluation – Diagnostic – Trouble du langage.

SUMMARY: Assessments of working memory: a tool for differentiating between language disorder and language difference in multilingual contexts?

Diagnosing language disorders in bilingual children represents a clinical challenge because of similarities in the language proficiency profile between typically developing bilingual children and monolingual children with a language disorder. Measures of working memory are less dependent on accumulated knowledge than traditional language tests and might help to differentiate a language disorder from a language difference related to experiences with a language.

Key words: Bilingualism – Working memory – Assessment – Diagnosis – Language disorder.

RESUMEN: Evaluación de la memoria de trabajo: una herramienta para diferenciar entre trastorno del lenguaje y diferencia lingüística en contextos multilingües?

El diagnóstico de trastornos del lenguaje en niños bilingües representa un desafío clínico debido a las similitudes en el perfil de competencia lingüística entre los niños y niñas bilingües con un desarrollo típico y los niños y niñas monolingües con un trastorno del lenguaje. Las medidas de la memoria de trabajo dependen menos del conocimiento acumulado que las pruebas de lenguaje tradicionales y podrían ayudar a diferenciar un trastorno del lenguaje de una diferencia de lenguaje relacionada con experiencias con un lenguaje.

Palabras clave: Bilingüismo – Memoria de trabajo – Evaluación – Diagnóstico – Trastorno del lenguaje.

In this article we use “bilingualism” as a generic term, including multilingualism.



Pour citer cet article : Wealer, C. & Engel de Abreu, P. M. J. (2021). Assessments of working memory: a tool for differentiating between language disorder and language difference in multilingual contexts? A.N.A.E., 171,194-204.

School populations have become increasingly linguistically and culturally diverse over recent decades (OECD, 2018). Linguistically diverse children do not only raise challenges for teachers in schools, but also for clinicians in the assessment of their language skills. It is clearly established that growing up with several languages is not a risk factor for a developmental disorder (for review see Armon-Lotem *et al.*, 2015). However, the overrepresentation of bilingual children in special-education programmes in contrast to their monolingual peers is an alarming global trend. Bilingual children's performance on standardised language tests can look like it is impaired because their total language proficiency is distributed over several languages. It is therefore crucial to assess bilingual children in all their languages. Yet, in reality, direct assessments of all languages are often not undertaken in bilingual speakers for various reasons. This review paper provides a narrative overview of the literature and discusses how processing-dependant working memory assessments could represent a way forward and help clinicians to better distinguish between a language disorder and a language difference in bilingual children.

Working memory

A limited-capacity system for storage and processing

Working memory is a concept developed by cognitive psychologists that refers to a system responsible for the temporary maintenance and the processing of information during thinking and reasoning tasks (Baddeley, 2000). In other words, the working memory system helps us to maintain access to goal-relevant information in the face of concurrent processing and/or distraction. Theories of how working memory might be structured and how it functions can help to understand how we use memory processes during day-to-day activities or during activities that require cognitive effort. For example, suppose you are doing grocery shopping during times of a global pandemic. While shopping, you must mentally maintain the different items needed (possibly planning far ahead), while you scan the multiple product options. Some products may no longer be available and you must quickly adjust your "mental shopping list" without getting distracted. You also need to mentally keep track of the products that are already in your shopping cart to avoid buying items twice. Working memory helps you to remember the products that you need, while at the same time, searching the store, updating your mental "mental

shopping list" and ignoring various distractors such as advertisements or other customers strolling around the store. It is not surprising that some people (including the authors) find grocery shopping mentally exhausting because it requires optimal working memory functioning. Working memory is involved in many cognitive activities including planning, reasoning, attention control or problem-solving and it is also a key predictor of academic learning (Cowan, 2014). Furthermore, children with various types of learning difficulties often score below expected levels on working memory tests (Archibald, & Gathercole, 2006; Sabol, & Pianta, 2012). It has been proposed that the conception of working memory is crucial to understanding cognitive development, both typical and atypical (Camos, & Barrouillet, 2018; Cowan, 2014).

The specific structure and functioning of working memory have been researched extensively in adults and in children (Alloway *et al.*, 2004; Baddeley, 2000; Camos, & Barrouillet, 2011; Cowan *et al.*, 2003; Engel de Abreu *et al.*, 2010; Engle *et al.*, 1999) and it is still an extremely active field of research today (see Logie *et al.*, 2021). Most views converge in considering working memory as a complex cognitive system of limited capacity (Baddeley, 2000; Barrouillet, & Camos, 2010; Cowan, 2010; Engle, & Kane, 2004). An influential theory proposed in the 1970s by British psychologists, Alan Baddeley and Graham Hitch (1974) originally conceptualised working memory as a system that is composed of different components including an attentional control system (the "central executive") and two passive storage buffers that are responsible for the short-term storage of verbal (the "phonological loop") and visuo-spatial information (the "visuospatial sketchpad") (see the article of Fitamen and Camos in this special issue). The basic tripartite modular structure of working memory has been suggested to be in place in children as young as six years (possibly earlier) and it has been shown that the different components undergo substantial expansions in functional capacity throughout the childhood years (Gathercole *et al.*, 2004). The simple structural approach of the multicomponent model has been extremely useful in describing and understanding a range of neurodevelopmental disorders in children. Although the multicomponent model continues to be one of the leading models in the field, alternative working memory theories have also been developed that generally emphasise functions and processes over structure (e.g. Barrouillet *et al.*, 2004; Engle, & Kane, 2004; Jonides *et al.*, 2008).

Traditionally, working memory is assessed with different types of measures that broadly fall into two categories – complex and simple span tasks (Colom *et al.*, 2006; Conway *et al.*, 2002). From

the perspective of the multicomponent model, discussed above, simple span tasks are thought to tap into the passive storage buffers “phonological loop” and “visuo-spatial sketchpad”. They are also commonly referred to as tests for measuring short-term memory. If the task involves verbal material, it assesses verbal short-term memory (aka the phonological loop) and if it involves visuo-spatial material it is considered to measure visuo-spatial short-term memory (aka visuospatial sketchpad). Arguably, the most well-known measure of verbal short-term memory is the digit span task that dates back to 1903 (Binet, 1903). Participants have to repeat sequences of numbers that are presented to them. Complex span tasks, in contrast, engage multiple components of the working memory system. They are often considered as more typical executive-loaded working memory tests because they involve information processing beyond that needed for passive item memorisation (Conway *et al.*, 2005). Essentially, they are dual tasks in which individuals have to remember items while engaging in a relatively simple secondary task. In the “counting recall task” for example, participants are asked to count target items in a series of successively presented images and recall the total for each image at the end of the sequence (Case *et al.*, 1982).

Working memory and language learning

Many learning activities require us to maintain small amounts of information in a readily accessible form while new information is processed and potentially distracting information is ignored. It is therefore not surprising that there are strong links between children’s working memory skills and their scholastic achievement and academic success. Verbal short-term memory, in particular, has consistently been shown to play a key role in language learning, including first language acquisition (Avons *et al.*, 1998; Majerus *et al.*, 2006), second language acquisition (Engel de Abreu, & Gathercole, 2012; Engel de Abreu *et al.*, 2011; Gathercole, & Masoura, 2005), and artificial language learning (Mosse, & Jarrold, 2008). In their seminal article, Baddeley and colleagues (1998) argue that verbal short-term memory represents a “language learning device” that allows to temporarily store sound patterns while permanent representations of the phonological form of new words are being constructed in long-term memory. Put simply, it represents a system that facilitates the language learning process. For example, the Quechua word for “thank you” is “diuspagarapusunki”. To say it back correctly, the different sounds in that word need to be kept in the right sequence in the verbal short-term memory store. Most French speakers might struggle to repeat this

word after hearing it for the first time, because it might exceed their verbal short-term memory limits.

Measures of verbal short-term memory have shown high correlations with vocabulary knowledge in children (Gathercole *et al.*, 1997, Engel de Abreu, & Gathercole, 2012; Engel de Abreu *et al.*, 2011) and in adults (Linck *et al.*, 2014; Kaushanskaya *et al.*, 2011). Studies with clinical populations indicate that many children with developmental language disorder (DLD) present deficits in verbal working memory and can struggle specifically with verbal simple and complex span tasks (Archibald, & Gathercole, 2007; Henry *et al.*, 2012; Montgomery, 2003; Marton, & Schwartz, 2003). DLD is a neurodevelopmental disorder that manifests itself in difficulties talking and/or understanding language for no obvious reasons (Bishop, 2006). Notably, it is not caused by a child’s exposure or experience with one or multiple languages but is thought to arise from an underlying cognitive deficit. In bilinguals, signs of DLD appear in all languages spoken by the child (Thordardottir, & Topbas, 2019).

Nonword repetition, in particular, has been suggested to represent a clinical marker of DLD (Archibald, 2008). In their meta-analysis, which assesses effects across a large range of individual studies, Estes and colleagues (2007) showed that children with DLD performed on average 1.27 standard deviations ($\approx 40\%$) lower on nonword repetition tasks than their typically developing peers. In a classic nonword repetition test, children hear made-up nonsense words (aka nonwords), like *cupifla* or *gimuto*, and have to repeat them. Performance on such tasks is regarded by many as reflecting verbal short-term memory skills because it involves the ability to temporarily hold unfamiliar sound sequences in memory (Gathercole *et al.*, 1994). Initially, it was thought that nonword repetition is a relatively pure measure of verbal short-term memory. It was argued that the temporary storage of the unfamiliar nonwords was not supported by long-term lexical knowledge (Gathercole, & Baddeley, 1989). However, it has become increasingly clear that reproducing a nonword relies on many phonetic and linguistic skills, in addition to working memory. It may, indeed, be that nonword repetition is a sensitive marker for language disorder precisely because it taps into multiple cognitive processes that are related to language (Archibald, & Gathercole, 2007). Performance on nonword repetition tasks can also be influenced by prior vocabulary knowledge, especially when nonwords resemble real words in a given language (Engel de Abreu *et al.*, 2011; Gathercole, 1995).

The bilingual learner

A labelling challenge

Although bilingualism is the norm rather than the exception, the field of bilingualism research has struggled with a clear definition of what a bilingual learner actually is. A host of different labels and descriptions currently exist in the research literature and in practice (Surrain, & Luk, 2017). At the very basic level, one can consider “bilingualism” as the ability to know more than one language. However, things become more complex when having to label a child as “bilingual or not” in the context of research studies or clinical practice. A fundamental problem lies in uncertainty over the factors that one should consider for classification (Goldstein, 2019; Montrul, 2008).

Whereas for some, language proficiency is the key defining factor, other base classification on the child’s age of acquisition of the different languages or other factors. Part of the problem lies in the fact that a label (monolingual vs. bilingual) is imposed on something that is not inherently categorical (Gullifer, & Titone, 2020; Yow, & Li, 2015). In fact, bilingual learners are a very heterogeneous group. The level up to which they master their languages varies greatly, can change throughout development and may or may not depend on the age at which they started to learn a language. Even adults who acquire additional languages later in life can become highly proficient in several languages. Often it is life circumstances, such as immigration, intermarriage or education that require the use of several languages, which leads to people becoming bilingual. In this respect, it has been argued that it is the “need to use several languages” that greatly drives language acquisition (Grosjean, 2010).

Considering bilingualism as categorical is therefore almost certainly a fallacy on substantive as well as statistical grounds. Indeed, it has been argued that bilingualism should be treated as a continuous variable (Luk, & Bialystok, 2013). However, from a measurement point of view, it is currently not clear how such a hypothetical continuous measure should be constructed and how useful this might actually be. Research and clinical practice therefore, still mainly rely on the categorical approach.

One common way to distinguish groups of bilingual learners is based on language proficiency levels in each language. Terminology such as “balanced bilinguals” or “dominant bilinguals” have been (and are being) used to refer to bilingual speakers often defined on the basis of their performance in some sort of language tests. Early research in the field defined a person as bilingual if s/he was equally and fully fluent in

two or more languages (see Bloomfield, 1933). Others have introduced a more nuanced view, by attributing the label “bilingual” also to a person with a minimum level of second language competence in either speaking, listening, reading, or writing (MacNamara, 1967). More recent definitions of bilingualism are moving away from the idea that being bilingual means mastering more languages equally well and optimally. In fact, it has been argued that the notion of a “balanced bilingual” is rare (to non-existent) and might actually be an unhelpful concept in the study of bilingualism (Treffers-Daller, 2011). Upon close scrutiny, language dominance varies in most bilinguals according to the domain of life and function for which languages are used, which are not necessarily permanent traits. Furthermore, most assessment instruments have been developed from a monolingual perspective (Armon-Lotem *et al.*, 2015). They often do not capture the full language abilities of bilingual speakers and might underestimate their true competence in their different languages. In his influential work, Grosjean claims that a bilingual is not two monolinguals in one (Grosjean, 1989, 2006). In his complementary principle, he proposes that bilinguals use their languages for different purposes (e.g. at home, at school, in the workplace), which is why they rarely develop equal fluency across all domains in all their languages. In this sense, a bilingual person is anyone who can communicate in two or more languages regularly in daily life and not necessarily someone who is equally fluent in different languages (Grosjean, 1982, 2010).

Another common approach for categorising groups of bilingual learners relies on information on age of acquisition, i.e. the age at which a language has been learned. Different terms, such as “simultaneous” or “sequential” learners have been proposed. Simultaneous bilinguals are often defined as individuals who have acquired their different languages at birth or at a young age and are regularly exposed to different languages (De Houwer, 2009). Sequential bilinguals on the other hand, speak one language during the first years of life and are only later introduced to a second language (Genesee, 2010). However, this form of categorisation is also problematic for a host of reasons. It is unclear what the age cut-off point should be to be considered a simultaneous or a sequential bilingual. Furthermore, information on the age of acquisition does not tell us anything about the actual level of language proficiency. It is not necessarily the case that a “simultaneous” bilingual becomes highly proficient in all his or her languages across all domains (Thordardottir, 2017; Hoff, & Ribot, 2017). In fact, as discussed above, this is very often not the case.

Taken together, categories are problematic when attempting to classify a bilingual child's strengths and weaknesses because they neglect to take into account the heterogeneous experiences children have in their different language environments. Bilingualism is a dynamic and idiosyncratic process that exists on a continuum. In other words, bilingual speakers may demonstrate superior language skills in one language for some domains but superior skills for other domains in another language (Goldstein, 2019; Thordardottir, 2019; Paradis et al., 2011). Bilingual language development is influenced by a range of individual and environmental factors including socio-economic status, quantity and quality of language input, number of languages to be learned, age of acquisition, acquisition context, prestige of the languages in a country, child-internal factors, etc. (Bialystok, 2001; Grosjean, 2010). This poses special challenges and considerations in the study of bilingualism in research but also in clinical practice.

An assessment challenge

Although the exact definition of bilingualism remains a topic of debate, it is clearly established that bilingualism does not cause a language delay (Lowry, 2018). Bilingual children reach the major developmental milestones at a similar pace as monolinguals (Genesee, 2006; Hoff et al., 2012) and the rate of language acquisition is not slower than the language development of monolingual children (Paradis, 2010).

That said, it is important to acknowledge that bilingual language development differs in many ways from monolingual development because bilinguals are exposed to several languages instead of just one. The time they spend in their different language environments is divided and their total language proficiency spreads over several languages. Language development is highly dependent on the amount and type of input received (Thordardottir, 2011; Pearson, 2007). Bilingual children are arguably provided with fewer learning opportunities in each language as if they were only learning one language and they tend to perform at lower levels than monolinguals on tests of vocabulary if measured separately in each language (Hoff et al., 2012). Findings from a meta-analysis including 82 studies indicate that, as a group, bilingual learners exhibit lower language levels compared to monolingual learners (Melby-Lervag, & Lervag, 2014). In a study with Portuguese-Luxembourgish bilingual children in the early school years in Luxembourg, Engel de Abreu and colleagues (2012) found that the bilingual group lagged behind their monolingual peers in tests of vocabulary in Luxembourgish and in Portuguese as well as in a conceptual vocabulary score that combined both languages. Similar findings emerged from a study with French-English bilingual preschool-age children that showed that bilingual children may score significantly lower than monolingual peers in various aspects of language (Thordardottir et al., 2006). Notably, that study showed that the extent of the difference depended on several factors such as the specific language combinations being learned, the amount of bilingual exposure or language-specific factors. This causes obvious assessment challenges, mostly because there is a lack of suitable instruments for assessing language abilities in children learning more than one language and clinicians are often, for practical reasons, only able to assess a child in one of his or her languages. Generally, this is the language spoken by the majority culture that is often the child's second language but the first language of the clinician. Furthermore, bilingual language proficiency is overwhelmingly determined based on performance on vocabulary tests, which often reflect background knowledge and culture rather than a comprehensive assessment of oral language skills per se. It has been suggested that in addition to direct measures of word knowledge, other language measures should be considered that provide a more comprehensive evaluation of language proficiency (Peña et al., 2018; Golinkoff et al., 2017).

The use of standardised language tests that have been devised for monolinguals, to assess the language abilities of bilinguals is highly questionable (Rethfeldt, 2019). Indeed, bilingual children are particularly vulnerable to being misdiagnosed. In the absence of reliable assessment instruments and norms against which bilinguals could be compared, low performance on separate language tests might be attributed to a language disorder when in reality language development might be typical for a bilingual learner (overidentification). It might also be the case that an assessor considers low task performance as "normal for a bilingual", whereas a genuine language disorder is present and the child needs tailored support (underidentification, Bedore, & Peña, 2008).

Evidence of overidentification can be found when looking at the numbers of children who receive special education services. In theory, bilingual children with a language disorder should proportionally not be more numerous than monolingual children with a language disorder. However, in the Netherlands, for example, 14% of the mainstream school population are bilingual, but bilinguals constituted 24% of the population in special schools for children with development language disorders (de Jong et al., 2010). A similar picture emerges for Lux-

Evidence of overidentification can be found when looking at the numbers of children who receive special education services. In theory, bilingual children with a language disorder should proportionally not be more numerous than monolingual children with a language disorder. However, in the Netherlands, for example, 14% of the mainstream school population are bilingual, but bilinguals constituted 24% of the population in special schools for children with development language disorders (de Jong et al., 2010). A similar picture emerges for Lux-

Evidence of overidentification can be found when looking at the numbers of children who receive special education services. In theory, bilingual children with a language disorder should proportionally not be more numerous than monolingual children with a language disorder. However, in the Netherlands, for example, 14% of the mainstream school population are bilingual, but bilinguals constituted 24% of the population in special schools for children with development language disorders (de Jong et al., 2010). A similar picture emerges for Lux-

embourg where children classified as “foreigners” represent 53% of the school population in special education (*éducation différenciées*) but only approximately 46% in regular education (MENJE, 2018; see Lehti *et al.*, 2018 for similar findings in Finland).

In clinical practice, the diagnosis of a language learning disorder in a bilingual learner is often inconclusive. In Luxembourg for instance, many bilingual children who present considerable oral language weaknesses receive the label “suspicion for DLD” because a thorough assessment of the child’s first language skills is often not possible for practical reasons, including the clinician’s unfamiliarity with the child’s first language and (or) absence of diagnostic instruments in that language. There is currently no way around this diagnostic dilemma. Development of separate norms for monolingual and bilingual children might be a way forward. Indeed, most existing standardised measures of language do not consider bilingual or linguistically diverse children in their norming process (Luk, & Christodoulou, 2016). Yet, as has been discussed before, this approach also presents a number of pitfalls, mainly because bilingualism is not a uniform category and is highly variable at an individual level. This in turn makes it almost impossible to determine reliable clinical norms for all bilingual children.

It is clear from the foregoing literature review that disentangling bilingualism from language disorder is currently difficult. The overlap of features of bilingual language development and impaired language development leads to many methodological and clinical confounds which are problematic for differential diagnosis (Armon-Lotem, & de Jong, 2015; Bonifacci *et al.*, 2018; Verhoeven *et al.*, 2011). Also, there is currently not much research on how DLD manifests itself in bilingual speakers (Armon-Lotem, & de Jong, 2015; Engel de Abreu *et al.*, 2014). By implication, a major challenge for practitioners lies in differentiating between bilingual children who present symptoms of DLD and bilingual children who show signs of a language difference possibly due to insufficient exposure to the language of test administration.

Despite these challenges, progress has also been made. Increased research in recent years has contributed towards reshaping people’s perception on bilingualism (Cenoz, 2013). The field has started to move away from the view of a bilingual as the sum of two “incomplete” monolinguals. Instead, a bilingual learner should be considered a fully competent language user with a language proficiency that is different, yet not less in nature to that of a monolingual learner. This observation in turn calls for a re-evaluation of the procedures that are current-

ly in place to assess the language proficiency in bilinguals and also the diagnostic procedures used to identify a language disorder in children who speak more than one language. Although this is a relatively new and complex field of study, guidelines for diagnostic procedures for use in bilingual and cross-linguistic contexts have been proposed (Thordardottir, 2015; Goldstein, 2019; Rethfeldt, 2013).

Identification of language disorders in bilingual learners

A framework for the evaluation of language skills in bilingual learners.

At present, clinical and educational professionals frequently rely on a combination of formal measurements (often in one language only) and indirect assessment procedures to determine whether a language disorder might exist in a bilingual child. It is important to bear in mind that many factors can influence bilingual language development and these factors need to be carefully considered when assessing a child who speaks several languages (Rethfeldt, 2013). Ideally, assessments should determine areas of strengths and weaknesses across different domains in all the languages that are spoken.

There is currently no established overarching framework for the evaluation of language skills in bilingual learners. In clinical practice, different frameworks that often overlap are generally combined, which is recommended practice as each of these frameworks presents its own strengths and weaknesses (de Lamo White, & Jin, 2011; Grech, & McLeod, 2012). Approaches include the use of norm-referenced standardised tests or criterion-referenced measures, dynamic assessments or socio-cultural approaches. One approach advocates complementing “traditional” language assessments (e.g. vocabulary, grammar) with language-processing tasks, such as those of verbal working memory measures.

Working memory assessments in bilinguals

Verbal working memory measures - such as nonword repetition or digit span - are considered by many to tap into language-processing skills rather than language knowledge per se. In contrast to traditional language tests that often assess crystallised abilities, they are thought to rely less on prior knowledge and experience and instead tap into fluid cognition (Engel de Abreu *et al.*, 2010). In a study involving children from impoverished and wealthy backgrounds in Brazil, Engel de Abreu *et al.* (2008) found significant differences between the groups on measures of expressive and receptive vocabulary, but no

group differences on measures of verbal working memory. Similar results were obtained in a study of Portuguese-Luxembourgish bilinguals growing up in Luxembourg. Despite large differences in their language abilities in comparison to monolinguals from Portugal, bilinguals from Luxembourg and monolinguals from Portugal exhibited comparable performance on verbal simple and complex span tasks (Engel de Abreu *et al.*, 2014b). These studies suggest that certain working memory measures may provide useful methods for detecting language learning difficulties that are relatively independent of environmental opportunity and background knowledge.

There is strong evidence that DLD might be secondary to general cognitive processing limitations, including in the domain of verbal working memory (Archibald, & Gathercole, 2007; Henry *et al.*, 2012). Indeed, verbal working memory measures have been shown to accurately distinguish children with and without DLD, for both bilingual and monolingual speakers (e.g. Archibald, & Gathercole, 2006; Thordardottir, & Brandeker, 2013). In a cross-cultural study, Engel de Abreu and colleagues explored working memory and language in monolingual and bilingual children with and without DLD (Engel de Abreu *et al.*, 2014a). More specifically, they compared bilingual children with DLD from Luxembourg whose first language was Portuguese, with monolingual Portuguese-speaking children with DLD from Brazil. The study also included different control groups of typically developing children from Luxembourg, Brazil and Portugal. Findings corroborate previous studies, indicating significant group differences on the language measures between the typically developing bilinguals and monolinguals (e.g. Engel de Abreu *et al.*, 2012, 2013). The study also showed that monolingual as well as bilingual children with DLD performed significantly less well on measures of verbal simple and complex span tasks of working memory compared to their typically developing peers. Another comparative study explored the pattern of working memory performance in Portuguese-Luxembourgish bilinguals with and without DLD from Luxembourg and typically developing monolingual speakers from Portugal (Engel de Abreu *et al.*, 2014a). While the bilingual children with DLD performed equally well compared with their typically developing peers on measures of visuospatial working memory, they had significantly lower scores than both control groups on tasks of verbal working memory.

Although verbal working memory tasks almost certainly have reduced linguistic biases in comparison to classical tests of word knowledge, it is important to bear in mind that they are not completely language free and indepen-

dent of background factors either (Conlin, & Gathercole, 2006; Hulme *et al.*, 1991). In fact, Engel de Abreu and colleagues (2013) showed that typically developing children who were deprived in terms of education had equal performance to matched groups of children with better educational opportunities on visuo-spatial working memory tasks as well as on the verbal digit recall test. However, they scored significantly lower than their educationally advantaged peers on the verbal complex span tasks counting recall. As no group differences were found on any other working memory tasks, the decreased performance on counting recall is unlikely to indicate a working memory deficit but might instead reflect a difference in background knowledge (counting). Another study explored cross-linguistic and cross-cultural effects on verbal working memory tasks and vocabulary in bilingual children (Engel de Abreu *et al.*, 2013). The bilingual children completed all the measures in their first language, Portuguese, and in their second language, Luxembourgish. Their performance was compared to Portuguese-speaking monolingual children. As expected, large cross-linguistic and cross-cultural effects were found on the vocabulary measures. For the working memory tasks, the study showed no effect of test language or cultural status on tasks involving numerical memoranda. However, there were significant group differences on nonword repetition with the monolingual children outperforming the bilinguals. Notably, follow-up analyses showed that group differences only emerged in the repetition of nonwords that were similar to real words whereas no differences between groups were observed in the repetition of words that were substantially different to existing words.

Another potential bias to take into consideration when using working memory tests with bilingual speakers resides in the so-called "bilingual advantage in executive function effect" (Bialystok, 2017; Engel de Abreu *et al.*, 2012). According to the bilingual advantage theory, cognitive processing in bilinguals differs from that in monolinguals because of the additional cognitive demand of having to function and switch between different languages (Green, 1998; Bialystok, & Poarch, 2014). In practice, this means that bilingual learners can outperform monolinguals on certain tasks of executive functions (Adesope *et al.*, 2010). Working memory is regarded by many as an executive function among others (Diamond, 2013; Miyake *et al.*, 2000). It is therefore possible that the cognitive advantage effect might manifest itself in working memory test performance. However, existing evidence indicates that, if at all, the bilingual effect on working memory is small. Engel de Abreu (2011) explored whether early

childhood bilingualism affects working memory task performance in 6- to 8-year-olds. The study concludes that the need to manage several language systems in the bilingual mind has little impact on the development of working memory. These results are in line with a recent meta-analysis indicating that bilingual learners do not have an advantage over monolingual learners in tests of working memory (Gunnerud et al., 2020). From a practical point of view, these findings are relevant because they indicate that working memory test norms established on monolingual learners might also be suitable for bilinguals. Taken together the available evidence suggests that certain working memory tasks are relatively unaffected by experience and prior knowledge and might therefore provide reliable tools to explore working memory capacity in bilingual learners.

Conclusion

This narrative review article showed that typically developing bilingual learners can present limited performance in language tests and that they can show language profiles similar to those of monolingual learners with a language disorder. The vast heterogeneity of learners that are labelled “bilingual” poses challenges to clinical assessments, especially when relying on standardised instruments that have been developed for monolinguals. Due to a lack of instruments that are suitable for assessing children who are learning more than one language, bilingual children often end up with a suboptimal evaluation of their language skills via diagnostic tests that are problematic on a number of levels. Verbal working memory measures are sensitive to language ability and are less affected by variations in life experience and prior knowledge than classical language tests. The assessment of bilingual learners’ working memory skills could therefore be an important supplement to traditional language tests, in order to differentiate a language disorder, associated with a cognitive impairment, from a language difference related to a child’s experiences with a language. Although disentangling language difference from disorder will, without doubt, remain a challenge, it could be argued that working memory measures may have clinical utility in the diagnosis of a language disorder in multilingual contexts.

ACKNOWLEDGMENT

We would like to acknowledge the funding received from the Luxembourg National Research Fund (FNR), PRIDE/15/10921377.

REFERENCES

- Adesope, O. O., Lavin, T., Thompson, T., & Ungerleider, C. (2010). A systematic review and meta-analysis of the cognitive correlates of bilingualism. *Review of Educational Research, 80*(2), 207-245.
- Alloway, T. P., Gathercole, S. E., Willis, C., & Adams, A. M. (2004). A structural analysis of working memory and related cognitive skills in young children. *Journal of Experimental Child Psychology, 87*(2), 85-106.
- Archibald, L. M. (2008). The promise of nonword repetition as a clinical tool. *Canadian Journal of Speech-Language Pathology and Audiology, 32*, 21-28.
- Archibald, L. M., & Gathercole, S. E. (2006). Short-term and working memory in specific language impairment. *International Journal of Language, & Communication Disorders, 41*(6), 675-693.
- Archibald, L. M., & Gathercole, S. E. (2007). Nonword repetition in specific language impairment: More than a phonological short-term memory deficit. *Psychonomic Bulletin, & Review, 14*, 919-924.
- Armon-Lotem, S., & de Jong, J. (2015). Introduction. In S. Armon-Lotem, J. de Jong, & N. Meir. (Eds.), *Assessing bilingual children. Disentangling bilingualism from language impairment* (pp. 1-24). Bristol: Bilingual Matters.
- Armon-Lotem, S., de Jong, J., & Meir, N. (2015). *Assessing multilingual children: Disentangling bilingualism from language impairment*. Multilingual matters.
- Atkinson, R. C., & Shiffrin, R. M. (1968). Human memory: A proposed system and its control processes. In K. W. Spence, & J. T. Spence (Eds.), *The psychology of learning and motivation* (Vol. 2, pp. 89-195). New York: Academic Press.
- Avons, S. E., Wragg, C. A., Cupples, W. L., & Lovegrove, W. J. (1998). Measures of phonological short-term memory and their relationship to vocabulary development. *Applied Psycholinguistics, 19*(4), 583-601.
- Baddeley, A. D. (2000). The episodic buffer: a new component of working memory? *Trends in Cognitive Sciences, 4*(11), 417-423.
- Baddeley, A. D., Gathercole, S. E., & Papagno, C. (1998). The phonological loop as a language learning device. *Psychological Review, 105*(1), 158-173.
- Baddeley, A. D., & Hitch, G. (1974). Working memory. In G. H. Bower (Ed.), *The psychology of learning and motivation* (pp. 47-89). San Diego: Academic Press.
- Baddeley, A. D., Allen, R. J., & Hitch, G. J. (2011). Binding in visual working memory: The role of the episodic buffer. *Neuropsychologia, 49*(6), 1393-1400.
- Barrouillet, P. N., & Camos, V. (2010). Working memory and executive control: A time-based resource-sharing account. *Psychologica Belgica, 50*(3/4), 353-382.
- Barrouillet, P., Bernardin, S., & Camos, V. (2004). Time constraints and resource sharing in adults’ working memory spans. *Journal of Experimental Psychology: General, 133*, 83-100.
- Bedore, L. M., & Peña, E. D. (2008). Assessment of bilingual children for identification of language impairment: Current findings and implications for practice. *International Journal of Bilingual Education and Bilingualism, 11*(1), 1-29.
- Bialystok, E. (2001). *Bilingualism in development: Language, literacy, and cognition*. Cambridge: University Press.
- Bialystok, E. (2017). The bilingual adaptation: how minds accommodate experience. *Psychological bulletin, 143*(3), 233-262.
- Bialystok, E., & Poarch, G. J. (2014). Language experience changes language and cognitive ability. *Zeitschrift für Erziehungswissenschaft, 17*(3), 433-446.
- Binet, A. (1903). *L'étude Experimentale de l'intelligence*. Paris: Schleicher Frères.
- Bishop, D. V. M. (2006). What causes specific language impairment in children? *Current Directions in Psychological Science, 15*, 217-221.

- Bloomfield, L. (1933). *Language*. New York: Holt, Rinehart, & Winston.
- Bonifacci, P., Barbieri, M., Tomassini, M., & Roch, M. (2018). In few words: Linguistic gap but adequate narrative structure in preschool bilingual children. *Journal of Child Language*, 45(1), 120-147.
- Camos, V., & Barrouillet, P. (2011). Developmental change in working memory strategies: from passive maintenance to active refreshing. *Developmental Psychology*, 47, 898-904.
- Camos, V., & Barrouillet, P. (2018). *Working memory in development*. New York: Routledge.
- Case, R., Kurland, D. M., & Goldberg, J. (1982). Operational efficiency and the growth of short-term memory span. *Journal of experimental child psychology*, 33(3), 386-404.
- Cenoz, J. (2013). Defining multilingualism. *Annual Review of Applied Linguistics*, 33, 3-18.
- Colom, R., Rebollo, I., Abad, F. J., & Shih, P. C. (2006). Complex span tasks, simple span tasks, and cognitive abilities: A reanalysis of key studies. *Memory, & Cognition*, 34(1), 158-171.
- Conlin, J. A., & Gathercole, S. E. (2006). Lexicality and interference in working memory in children and in adults. *Journal of Memory and Language*, 55(3), 363-380.
- Conway, A. R., Cowan, N., Bunting, M. F., Theriault, D. J., & Minkoff, S. R. B. (2002). A latent variable analysis of working memory capacity, short-term memory capacity, processing speed, and general fluid intelligence. *Intelligence*, 30, 163-183.
- Conway, A. R., Kane, M. J., Bunting, M. F., Hambrick, D. Z., Wilhelm, O., & Engle, R. W. (2005). Working memory span tasks: A methodological review and user's guide. *Psychonomic bulletin, & review*, 12(5), 769-786.
- Cowan, N. (2010). The magical mystery four: How is working memory capacity limited, and why? *Current directions in psychological science*, 19(1), 51-57.
- Cowan, N. (2014). Working memory underpins cognitive development, learning, and education. *Educational psychology review*, 26(2), 197-223.
- Cowan, N., Towse, J. N., Hamilton, Z., Sauls, J. S., Elliott, E. M., Lacey, J. F., Moreno, M. V., & Hitch, G. J. (2003). Children's working-memory processes: A response-timing analysis. *Journal of Experimental Psychology: General*, 132(1), 113-132.
- De Houwer, A. (2009). *Bilingual first language acquisition*. Clevedon, UK: Multilingual Matters.
- De Jong, J., Çavuş, N., & Baker, A. (2010). Language impairment in Turkish-Dutch bilingual children. In S. Topbaş, & M. Yavaş (Eds.), *Communication Disorders in Turkish* (pp. 288-300). Bristol: Bilingual Matters.
- De Lamo White, C., & Jin, L. (2011). Evaluation of speech and language assessment approaches with bilingual children. *International Journal of Language, & Communication Disorders*, 46(6), 613-627.
- Diamond, A. (2013). Executive functions. *Annual review of psychology*, 64, 135-168.
- Engel de Abreu, P. M. J. (2011). Working memory in multilingual children: Is there a bilingual effect? *Memory*, 19(5), 529-537.
- Engel de Abreu, P. M. J., Baldassi, M., Puglisi, M. L., & Befi-Lopes, D. M. (2013). Crosslinguistic and cross-cultural effects on verbal working memory and vocabulary: Testing language minority children with an immigrant background. *Journal of Speech, Language and Hearing Research*, 56(2), 630-642.
- Engel de Abreu, P. M. J., Conway, A. R., & Gathercole, S. E. (2010). Working memory and fluid intelligence in young children. *Intelligence*, 38(6), 552-561.
- Engel de Abreu, P. M. J., Cruz-Santos, A., Tourinho, C. J., Martin, R., & Bialystok, E. (2012). Bilingualism enriches the poor: Enhanced cognitive control in low-income minority children. *Psychological science*, 23(11), 1364-1371.
- Engel de Abreu, P. M. J., & Gathercole, S. E. (2012). Executive and phonological processes in second-language acquisition. *Journal of Educational Psychology*, 104(4), 974-986.
- Engel de Abreu, P. M. J., Gathercole, S. E., & Martin, R. (2011). Disentangling the relationship between working memory and language: The roles of short-term storage and cognitive control. *Learning and Individual Differences*, 21(5), 569-574.
- Engel de Abreu, P. M. J., Dos Santos, F., & Gathercole, S. E. (2008). Are working memory measures free of socio-economic influence? *Journal of Speech, Language and Hearing Research*, 51, 1580-1587.
- Engel de Abreu, P. M. J., Puglisi, M. L., Cruz-Santos, A., & Befi-Lopes, D. M. (2014a). *Executive functions and Specific Language Impairment (SLI) A cross-cultural study with bi- and monolingual children from low income families in Luxembourg, Portugal, and Brazil*. Paper presented at the meeting of the 13th International Congress for the Study of Child Language. Amsterdam, Netherlands.
- Engel de Abreu, P. M. J., Puglisi, M. L., Cruz-Santos, A., Befi-Lopes, D. M., & Martin, R. (2014b). Effects of impoverished environmental conditions on working memory performance. *Memory*, 22(4), 323-331.
- Engle, R. W., & Kane, M. J. (2004). Executive attention, working memory capacity, and a two-factor theory of cognitive control. In B. Ross (Ed.), *The psychology of learning and motivation* (pp. 145-199). New York: Academic Press.
- Engle, R. W., Tuholski, S. W., Laughlin, J. E., & Conway, A. R. (1999). Working memory, short-term memory, and general fluid intelligence: a latent-variable approach. *Journal of experimental psychology: General*, 128(3), 309.
- Estes, K. G., Evans, J. L., & Else-Quest, N. M. (2007). Differences in the nonword repetition performance of children with and without specific language impairment: A meta-analysis. *Journal of Speech, Language, and Hearing Research*, 50, 177-195.
- Gathercole, S. E. (1995). Is nonword repetition a test of phonological memory or long-term knowledge? It all depends on the nonwords. *Memory, & cognition*, 23(1), 83-94.
- Gathercole, S. E., & Baddeley, A. D. (1989). Evaluation of the role of phonological STM in the development of vocabulary in children: A longitudinal study. *Journal of memory and language*, 28(2), 200-213.
- Gathercole, S. E., Hitch, G. J., & Martin, A. J. (1997). Phonological short-term memory and new word learning in children. *Developmental psychology*, 33(6), 966-979.
- Gathercole, S. E., & Masoura, E. V. (2005). Contrasting contributions of phonological short-term memory and long-term knowledge to vocabulary learning in a foreign language. *Memory*, 13(3-4), 422-429.
- Gathercole, S. E., Pickering, S. J., Ambridge, B., & Wearing, H. (2004). The Structure of Working Memory from 4 to 15 Years of Age. *Developmental Psychology*, 40(2), 177-190.
- Gathercole, S. E., Willis, C. S., Baddeley, A. D., & Emslie, H. (1994). The Children's Test of Nonword Repetition: A test of phonological working memory. *Memory*, 2(2), 103-127.
- Genesee, F. (2006). Bilingual first language acquisition in perspective. In P. McCardle, & E. Hoff (Eds.), *Childhood bilingualism: Research on infancy through school age* (pp. 45-67). Bilingual Matters: Clevedon.
- Genesee, F. (2010). Dual language development in preschool children. In E. Garcia, & E. Frede (Eds.), *Young English language learners: Current research and emerging directions for practice and policy* (pp. 59-79). New York: Teachers College Press.
- Goldstein, B. (2019). Bilingual children's language development: assessment and intervention. In S. Levey (Ed.), *Introduction to language development* (pp. 207-226). San Diego, CA: Plural Publishing.
- Golinkoff, R. M., de Villiers, J., Hirsh-Pasek, K., Iglesias, A., & Wilson, M. S. (2017). *User's manual for the Quick Interactive Language Screener™ (QUILSTM): A measure of vocabulary, syntax, and language acquisition skills in young children*. Baltimore, MD: Paul H. Brookes.
- Grech, H., & McLeod, S. (2012). Multilingual speech and language development and disorders. In D. Battle (Ed.), *Communication Disorders and Development in Multicultural Populations* (pp. 120-147). St Louis, MO: Elsevier.
- Green, D. W. (1998). Mental control of the bilingual lexico-semantic system. *Bilingualism: Language and cognition*, 1(2), 67-81.
- Grosjean, F. (1982). *Life with two languages: An introduction to bilingualism*. Cambridge, MA: Harvard University Press.
- Grosjean, F. (1989). Neurilinguistics, beware! The bilingual is not two monolinguals in one person. *Brain and Language*, 36(1), 3-15.
- Grosjean, F. (2006). The bilingual is not two monolinguals in one person. In K. Bolton, & B. B. Krachru (Eds.), *World Englishes: Critical concepts in linguistics* (Vol. 4, pp. 202-213). Abingdon-on-Thames, UK: Taylor, & Francis.
- Grosjean, F. (2010). *Bilingual. Life and Reality*. Cambridge, MA: Harvard University Press.
- Gullifer, J. W., & Titone, D. (2020). Engaging proactive control: Influences of diverse language experiences using insights from machine learning. *Journal of Experimental Psychology: General*. Advance online publication.
- Gunnerud, H. L., Ten Braak, D., Reikerås, E. K. L., Donolato, E., & Melby-Lervåg, M. (2020). Is bilingualism related to a cognitive advantage in

- children? A systematic review and meta-analysis. *Psychological Bulletin*, 146(12), 1059-1083.
- Henry, L. A., Messer, D. J., & Nash, G. (2012). Executive functioning in children with specific language impairment. *Journal of Child Psychology and Psychiatry*, 53(1), 37-45.
- Hoff, E., Core, C., Place, S., Rumiche, R., Señor, M., & Parra, M. (2012). Dual language exposure and early bilingual development. *Journal of Child Language*, 39(1), 1-27.
- Hoff, E., & Ribot, K. (2017). Language growth in English monolingual and Spanish-English bilingual children from 2.5 to 5 years. *The Journal of Pediatrics*, 190, 241-245.
- Hulme, C., Maughan, S., & Brown, G. D. (1991). Memory for familiar and unfamiliar words: Evidence for a long-term memory contribution to short-term memory span. *Journal of memory and language*, 30(6), 685-701.
- Jonides, J., Lewis, R. L., Nee, D. E., Lustig, C. A., Berman, M. G., & Moore, K. S. (2008). The mind and brain of short-term memory. *Annu. Rev. Psychol.*, 59, 193-224.
- Kaushanskaya, M., Blumenfeld, H. K., & Marian, V. (2011). The relationship between vocabulary and short-term memory measures in monolingual and bilingual speakers. *International Journal of Bilingualism*, 15(4), 408-425.
- Lehti, V., Gyllenberg, D., Suominen, A., & Sourander, A. (2018). Finnish-born children of immigrants are more likely to be diagnosed with developmental disorders related to speech and language, academic skills and coordination. *Acta Paediatrica*, 107(8), 1409-1417.
- Linck, J. A., Osthus, P., Koeth, J. T., & Bunting, M. F. (2014). Working memory and second language comprehension and production: A meta-analysis. *Psychonomic bulletin, & review*, 21(4), 861-883.
- Logie, R.H., Camos, V., Cowan, N. (2021). *Working Memory: State of the Science*. Oxford, UK: Oxford University Press.
- Lowry, L. (2018). *Bilingualism in young children: separating fact from fiction*. Hanen Center. Retiré Décembre 15, 2020, de <http://www.hanen.org/Helpful-Info/Articles/Bilingualism-in-Young-Children--Separating-Fact-fr.aspx>
- Luk, G., & Bialystok, E. (2013). Bilingualism is not a categorical variable: Interaction between language proficiency and usage. *Journal of Cognitive Psychology*, 25(5), 605-621.
- Luk, G., & Christodoulou, J. A. (2016). Assessing and understanding the needs of dual-language learners. In N. K. Lesaux, & S. M. Jones (Eds.), *Leading edge of early childhood education: linking science to policy for a new generation* (pp. 67-90). Cambridge, Massachusetts: Harvard Education Press.
- Macnamara, J. (1967). The bilingual's linguistic performance-a psychological overview. *Journal of Social Issues*, 23(2), 58-77.
- Majerus, S., Poncelet, M., Greffe, C., & Van der Linden, M. (2006). Relations between vocabulary development and verbal short-term memory: The relative importance of short-term memory for serial order and item information. *Journal of experimental child psychology*, 93(2), 95-119.
- Marton, K., & Schwartz, R.G. (2003). Working memory capacity and language processes in children with specific language impairment. *Journal of Speech, Language, & Hearing Research*, 46(5), 1138-1153.
- Melby-Lervåg, M., & Lervåg, A. (2014). Reading comprehension and its underlying components in second-language learners: A meta-analysis of studies comparing first- and second-language learners. *Psychological Bulletin*, 140(2), 409-433.
- MENJE : Ministère de l'Éducation nationale de l'Enfance et de la Jeunesse. (2018). *Les Chiffres Clés de l'Éducation nationale. Statistiques et indicateurs 2016/2017*. Luxembourg : MENJE.
- Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive psychology*, 41(1), 49-100.
- Montgomery, J. W. (2003). Working memory and comprehension in children with specific language impairment: What we know so far. *Journal of communication disorders*, 36(3), 221-231.
- Montrul, S. (2008). *Incomplete Acquisition in Bilingualism. Re-examining the Age Factor*. Amsterdam: John Benjamins.
- Mosse, E. K., & Jarrold, C. (2008). Short Article: Hebb Learning, Verbal Short-Term Memory, and the Acquisition of Phonological forms in Children. *Quarterly journal of experimental psychology*, 61(4), 505-514.
- OECD. (2018). *The Resilience of Students with an Immigrant Background*. OECD Reviews of Migrant Education. Paris: OECD.
- Paradis, J. (2010). Bilingual children's acquisition of English verb morphology: Effects of language exposure, structure complexity, and task type. *Language Learning*, 60(3), 651-680.
- Paradis, J., Genesee, F., & Crago, M. (2011). *Dual language development and disorders: a handbook on bilingualism and second language acquisition* (2nd ed.). Baltimore, MD: Brookes Publishing.
- Pearson, B. Z. (2007). Social factors in childhood bilingualism in the United States. *Applied psycholinguistics*, 28(3), 399-410.
- Peña, E. D., Gutiérrez-Clellen, V. F., Iglesias, A., Goldstein, B. A., & Bedore, L. M. (2018). *Bilingual English Spanish Assessment (BESA)*. Baltimore, MD: Brookes.
- Rethfeldt, W. S. (2013). *Kindliche Mehrsprachigkeit. Grundlagen und Praxis der sprachtherapeutischen Intervention*. Stuttgart: Georg Thieme.
- Rethfeldt, W. S. (2019). Speech and Language Therapy Services for Multilingual Children with Migration Background: A Cross-Sectional Survey in Germany. *Folia Phoniatrica et Logopaedica*, 71(2-3), 116-126.
- Sabol, T. J., & Pianta, R. C. (2012). Patterns of school readiness forecast achievement and socioemotional development at the end of elementary school. *Child Development*, 83, 282-299.
- Skutnabb-Kangas, T. (1984). *Bilingualism or Not: The Education of Minorities*. Clevedon: Multilingual Matters.
- Surrain, S. H., & Luk, G. (2017). Describing bilinguals: A systematic review of labels and descriptions used in the literature between 2005-2015. *Bilingualism: Language and Cognition*. 22(2), 1-15.
- Thordardottir, E. (2011). The relationship between bilingual exposure and vocabulary development. *International Journal of Bilingualism*, 15(4), 426-445.
- Thordardottir, E. (2015). Proposed diagnostic procedures and criteria for Cost Action Studies on Bilingual SLI. In S. Armon-Lotem, J. de Jong, & N. Meir (Eds.), *Methods for assessing multilingual children: Disentangling bilingualism from language impairment* (pp. 176-208). Bristol, UK: Multilingual Matters.
- Thordardottir, E. (2017). Are background variables good predictors of need for L2 assistance in school? Effects of age, L1 amount, and timing of exposure on Icelandic language and nonword repetition scores. *International Journal of Bilingual Education and Bilingualism*, 23(4), 400-422.
- Thordardottir, E. (2019). Amount trumps timing in bilingual vocabulary acquisition: Effects of input in simultaneous and sequential school-age bilinguals. *International Journal of Bilingualism*, 23(1), 236-255.
- Thordardottir, E., & Brandeker, M. (2013). The effect of bilingual exposure versus language impairment on nonword repetition and sentence imitation scores. *Journal of Communication Disorders*, 46(1), 1-16.
- Thordardottir, E., Rothenberg, A., Rivard, M.-E., & Naves, R. (2006). Bilingual assessment: Can overall proficiency be estimated from separate measurement of two languages? *Journal of Bilingual Communication Disorders*, 4(1), 1-21.
- Thordardottir, E., & Topbas, S. (2019). The social and cultural context of intervention for children with developmental language disorder. In J. Law, C. McKean, C.A. Murphy, & E. Thordardottir, (Eds.), *Managing children with developmental language disorder: Theory and practice across Europe and beyond* (pp. 110-130). New York: Routledge.
- Treffers-Daller, J. (2011). Operationalizing and measuring language dominance. *International Journal of Bilingualism*, 15(2), 147-163.
- Verhoeven, L., Steenge, J., van Weerdenburg, M., & van Balkom, H. (2011). Assessment of second language proficiency in bilingual children with specific language impairment: A clinical perspective. *Research in Developmental Disabilities*, 32(5), 1798-1807.
- Yow, W. Q., & Li, X. (2015). Balanced bilingualism and early age of second language acquisition as the underlying mechanisms of a bilingual executive control advantage: why variations in bilingual experiences matter. *Frontiers in psychology*, 6, 164.