

Welsh-English bilingual adolescents' performance on verbal analogy and verbal classification tasks: the role of language exposure and use on vocabulary knowledge

Binks, Hanna; Thomas, Enlli

International Journal of Bilingual Education and Bilingualism

DOI:

[10.1080/13670050.2023.2236278](https://doi.org/10.1080/13670050.2023.2236278)

E-pub ahead of print: 24/07/2023

Publisher's PDF, also known as Version of record

[Cyswllt i'r cyhoeddiad / Link to publication](#)

Dyfyniad o'r fersiwn a gyhoeddwyd / Citation for published version (APA):

Binks, H., & Thomas, E. (2023). Welsh-English bilingual adolescents' performance on verbal analogy and verbal classification tasks: the role of language exposure and use on vocabulary knowledge. *International Journal of Bilingual Education and Bilingualism*. Advance online publication. <https://doi.org/10.1080/13670050.2023.2236278>

Hawliau Cyffredinol / General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal ?

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.



Welsh–English bilingual adolescents’ performance on verbal analogy and verbal classification tasks: the role of language exposure and use on vocabulary knowledge

Hanna L. Binks & Enlli Môn Thomas

To cite this article: Hanna L. Binks & Enlli Môn Thomas (2023): Welsh–English bilingual adolescents’ performance on verbal analogy and verbal classification tasks: the role of language exposure and use on vocabulary knowledge, International Journal of Bilingual Education and Bilingualism, DOI: [10.1080/13670050.2023.2236278](https://doi.org/10.1080/13670050.2023.2236278)

To link to this article: <https://doi.org/10.1080/13670050.2023.2236278>



© 2023 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group



Published online: 24 Jul 2023.



Submit your article to this journal [↗](#)



Article views: 55



View related articles [↗](#)



View Crossmark data [↗](#)

Welsh–English bilingual adolescents’ performance on verbal analogy and verbal classification tasks: the role of language exposure and use on vocabulary knowledge

Hanna L. Binks ^a and Enlli Môn Thomas^b

^aDepartment of Psychology, Aberystwyth University, Aberystwyth, UK; ^bSchool of Educational Sciences, Bangor University, Bangor, UK

ABSTRACT

Numerous studies suggest that bilinguals demonstrate smaller vocabularies than monolinguals, and that bilinguals’ breadth of vocabulary knowledge – both expressive and receptive – is linked to input frequencies in each language [e.g. Hoff, E., S. Welsh, S. Place, and K. Ribot. 2014. “Properties of Dual Language Input That Shape Bilingual Development and Properties of Environments That Shape Dual Language Input.” In *Input and Experience in Bilingual Development*, edited by T. Grüter, and J. Paradis, Vol. 13, 119–140. Amsterdam: John Benjamins]. However, relatively little is known about the quality of bilinguals’ knowledge of the words they do know (e.g. their understanding of how words relate to each other semantically) and how input frequencies influence that knowledge. Using the Cognitive Abilities Tasks – 4 (CAT-4), this study explored the potential links between three types of input sources – home language exposure, self-reported rates of language use in general, and language use with friends – and bilinguals’ performance on two types of vocabulary tests in both Welsh and English: verbal analogy and verbal categorisation. Results revealed similar performance across-the-board in relation to their knowledge of English vocabulary, regardless of their exposure to and use of Welsh and/or English in general and with friends, but their knowledge of the links between words in Welsh was related to home language exposure and rates of language use. The implications and application of these results in practice are discussed.

ARTICLE HISTORY

Received 4 March 2021
Accepted 10 May 2023

KEYWORDS

Welsh; minority language;
bilingual education;
vocabulary knowledge; input
quantity

Introduction

Numerous studies have demonstrated clear links between the frequency of linguistic input a child receives in any one language, and their vocabulary development in that language (Ribot, Hoff, and Burridge 2018; Siow et al. 2022). Bilinguals typically perform below (monolingual) age-based norms on measures of receptive vocabulary, in one (Bialystok, Craik, and Luk 2008), or both of their languages (Uchikoshi 2006), and have smaller vocabularies than monolinguals (Hoff et al. 2014). Across various language pairs, children schooled in their L2 typically score one Standard Deviation below the mean on measures of receptive vocabulary in that language in comparison to their monolingual counterparts (Thordardottir 2019). Similarly, bilinguals with higher frequencies of exposure to one of their languages tend to outperform bilinguals with lower frequencies of exposure

CONTACT Enlli Môn Thomas  enlli.thomas@bangor.ac.uk

© 2023 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent.

to that same language on measures of vocabulary breadth (Gathercole and Thomas 2007; Gathercole, Thomas, and Hughes 2008). For example, L1 Welsh (L1W) children raised in Welsh-speaking homes outperform those raised in a 2L1 (one-parent-one-language) homes, bilingual in a dominant societal language and the school language. 2L1 Welsh-English bilinguals, in turn, out-perform L2 Welsh (L2W) speaking children raised in non-Welsh speaking homes but who attend Welsh-medium schools (Gathercole and Thomas 2009). These patterns are often more salient in bilinguals' less dominant language and largely absent in their dominant one (Hoff et al. 2012; Pearson, Fernández, and Oller 1993), although this is not always the case (Rhys and Thomas 2013). Even when both languages are used regularly, bilinguals typically score below monolinguals on measures of vocabulary knowledge (Gollan, Montoya, and Werner 2002). This pattern has been documented at all ages – at age 3–5 years (Allman 2005), 6–10 years (Bialystok et al. 2010), 10–11 years (Oller, Pearson, and Cobo-Lewis 2007), 11–15 years (Thomas, Gathercole, and Hughes 2013), and continues through adulthood (Bialystok and Luk 2012). Whatever the reason for the differential performance across types of bilinguals or across bilingual and monolingual speakers, these differences are not indicative of a lack of linguistic competence in each language. In relation to vocabulary in particular, these differences reflect different rates of learning as the speakers are exposed to different vocabularies in various domains of use (Oller 2005; Oller and Eilers 2002). However, exposure to a wide range of vocabulary of various word frequencies is more challenging in some contexts than others. Whilst monolinguals spend all their time learning vocabulary in one language, it is argued that bilingual children require between 40% and 60% exposure time in each language to score within the normal [monolingual] range for vocabulary and morphology (Hoff, Quinn, and Giguere 2018; Thordardottir 2015), which is often unattainable for many bilinguals, particularly those learning a minority or minoritised language where ample exposure is a challenge (although see De Houwer 2014). In Wales, Welsh is spoken by 17.5% (538,300) of the population of Wales (Office for National Statistics 2022), resulting in Welsh being considered a minority language. As a result, Welsh Medium education [WME] is relied upon to produce speakers of Welsh. The introduction of the Government (2017) strategy to achieve 1 million Welsh speakers by 2050 places significant emphasis on WME as a route to achieve this through increasing the proportion of children in WME to 40% in 2050. Although, WME has been considered an effective way of enabling successful acquisition of Welsh in particular (Baker and Jones 1998), students' linguistic outcomes can vary depending on provision, particularly when linguistic skills in a minority language such as Welsh are not reinforced outside of the school (Welsh Government, 2016).

Testing paradigms

Words are complex units of language, and standardised tests tend to test children's awareness of words rather than their conceptual representations (Carroll 2017). Vocabulary breadth is often characterised as the number of words for which an individual knows some of the aspects of their meanings (Anderson and Freebody 1981). A lesser measured aspect of vocabulary is the 'quality' of an individual's understanding of a word's meaning – knowledge that can contribute significantly to learners' reading comprehension (Anderson and Freebody 1981; Qian 1999). This includes understanding that words may have multiple meanings; how they can be used in different contexts (Beck, McKeown, and Kucan 2013); the knowledge of word classes and syntactic structures; and knowledge of a word's morphological structure, and the richness of their semantic representations (Ordóñez et al. 2002; Snow and Locke 2001). As words can be known to a greater or lesser degree, some have argued that breadth of vocabulary may not be as informative to understanding vocabulary knowledge in comparison to other measures of vocabulary knowledge (Schmitt and Meara 1997; Wesche and Paribakht 1996), leading to the need to assess both separately (Qian 1999). Exploring what speakers know about words, their associations, and extended meanings – information that may well stem from regular interpersonal interactions using the target language – could provide a more holistic measure of their vocabulary knowledge (although see Vermeer 2001 for a discussion

regarding the false distinction between breadth and other measures of vocabulary). Of the studies that have looked specifically at bilinguals' vocabulary knowledge, some have reported a similar 'lag' in performance relative to monolingual peers that is often reported for vocabulary breadth. For example, Turkish-Dutch bilingual children acquiring the dominant language, Dutch, lagged behind Dutch monolingual children when using curriculum-dependent and curriculum-independent lexical tests (Appel and Vermeer 1998). Using an extended word definition task, bilingual Turkish-Dutch children were also found to demonstrate less rich semantic representations (Verhallen and Schoonen 1998). L2 speakers also appear to be less clear on the syntactic categories of words in comparison to L1 speakers on word association tasks (Söderman 1993), and have been found to be less secure in their use of these words (Verhallen and Schoonen 1993).

However, very little is known about the acquisition of vocabulary knowledge within a minority language context, and to date, little research has been conducted on adolescents' knowledge of Welsh vocabulary. As a large population of Welsh learners learn the language through a formal route at school, it may result in a situation where educators focus on teaching vocabulary breadth, instead of instilling knowledge about the words required for production (O'Dell, Read, and McCarthy 2000). Moreover, if knowledge about vocabulary is related to the continuous use of vocabulary, both for educational purposes and in interpersonal conversations, one could question to what extent language use in a minority language context can develop greater levels of vocabulary knowledge. Studies from Wales have already demonstrated that breadth of vocabulary knowledge, among older teenagers, is influenced by the predominance of the language in the wider community (Thomas, Gathercole, and Hughes 2013), with L2W bilinguals' vocabulary knowledge plateau around age 15, with no gains seen beyond this age. While this finding may be linked to domain specificity of the lexicon, it is possible that acquiring Welsh through an education context would lead to vocabularies tied to the curriculum and may not expand much further beyond that domain. The likelihood that bilinguals use a minority language in interpersonal communication is greater in contexts where over 65% of pupils at the school come from Welsh-speaking backgrounds (Thomas and Roberts 2011). An alternative explanation for these findings is the tendency for L2W children in secondary schools to use English in peer-peer interactions (Morris, 2014; Price and Tamburelli 2020), regardless of the medium of instruction at the school. This suggests that Welsh-medium education alone cannot provide the optimal exposure to Welsh vocabulary that is needed to support L2W children's acquisition of Welsh vocabulary. Similar observations have also been found for L1 Catalan-Spanish bilingual children (Huguet 2007). Overall, these studies lend support to the notion that measures of input frequency need to be inclusive of the socio-linguistic context of language use and not reliant on information about home language transmission alone (Carroll 2017). Extending the research on lexical development in bilinguals to include measures of vocabulary knowledge and to explore the role of language use in addition to language exposure would therefore help enhance our understanding of bilinguals' vocabulary knowledge and the conditions under which their knowledge may be enhanced.

Given the paucity of studies looking at Welsh-English bilinguals' vocabulary knowledge, particularly at older ages, this study is the first to explore Welsh-English bilingual adolescents' knowledge of semantic links between words, looking at the role exposure and language use may have in facilitating that knowledge. The aims of the study were therefore threefold: first, we explored bilinguals' vocabulary knowledge through measuring their verbal analogy and verbal categorisation skills; second, we compared performance on these tasks across different types of bilinguals, as measured by their language environment; and third, we assessed the role of interpersonal language use on vocabulary knowledge.

Predictions

In line with previous findings in the literature, the predicted outcomes of the current study were as follows:

- For English, there would be no significant difference in participants' scores across the different language background groups, although performance among L1W bilinguals may be lower in comparison to the 2L1 and L2W bilinguals.
- For Welsh, it was predicted that there would be a difference in performance across the three language groups (L1W, 2L1, L2W) at ages 12–13, but that this difference would be smaller by age 16–17 years, particularly between L1W and 2L1 children.
- It is predicted that performance will be stronger in participants' who report a higher use of Welsh (i) in their daily lives and (ii) with friends.

Method

Participants

One-hundred-and-forty-two adolescent participants took part in this study. Participants were divided into two distinct age categories: 12–13 years ($n = 54$, age range: 12;4–13;6) and 16–17 years ($n = 88$, age range: 16;5–17;8). Within each age category, participants were subdivided into one of three bilingual groups (L1W; 2L1; L2W). Those categorised as L1W bilinguals were born into and raised by Welsh-speaking families where both parents spoke Welsh, and had acquired Welsh from birth (English later, around the age of 3). Those categorised as 2L1 bilinguals were raised in mixed-language households, where one parent spoke Welsh, the other English, and had therefore acquired both languages simultaneously from birth. Those categorised as L2W bilinguals were raised in English-speaking households, where both parents were English speakers, and had acquired English from birth, with the acquisition of Welsh starting age 4 upon school entry. None were reported as speaking or hearing any other languages other than Welsh or English in the home (Table 1).

Participants were recruited from Welsh-medium secondary schools where all subjects bar English are taught through the medium of Welsh. These schools were located either in north-west Wales, in a region where 75.5% of the population speaks Welsh, or in south-west Wales, in a region where 53.1% of the population speaks Welsh (Welsh Government 2022). Schools were also compared in terms of their socio-economic metrics to rule out any confounding effects of SES on linguistic access. Using parental occupation as a proxy measure of SES, a chi-square analysis revealed no significant association between the groups [Maternal: $X^2(2) = 2.757$, $p = .252$, $V = .131$; Paternal: $X^2(2) = 1.953$, $p = .377$, $V = .114$]. While it is impossible to quantify the exact amount of exposure each child had to either language at school (see, e.g. Unsworth 2014 for a discussion on exposure data), for the purpose of this present study, the major differences between each group lie in the age at which they were initially exposed to the second language, and if that language was Welsh or English.

Measures

Participants were given a Verbal Analogy and Verbal Categorisation test, a subset of tasks adapted from the *Cognitive Abilities Test: Fourth Edition* (CAT-4) in English and the *Prawf Gallu Gwybyddol 4: Argraffiad Cymraeg* in Welsh (PGG-4) that assessed general verbal reasoning. Each test included 24 questions. For each question, five possible answers were presented, and all five choices shared some commonalities (Examples 1 & 2 below). The participants' role was to identify the conceptual link between three words that were presented and decide which of the five-word choices best fit

Table 1. Number of participants according to age and home language background.

Age	L1W	2L1	L2W	Total
12–13	27	10	17	54
16–17	40	26	22	88
Total	67	36	39	142

with the three words provided. The reason for using this sub-set of tasks for this study was to assess participants' ability to demonstrate knowledge of the semantic links between words as a measure of vocabulary knowledge. Another reason for using the CAT-4 and the PGG-4 was that they were the only vocabulary tests available in both English and Welsh for the age group tested. As a task that caters for children between the ages of 7 and 18, it was also possible to provide age-appropriate versions for the participants. Participants aged between 12 and 13 years received an adaptation of version E of the task; participants aged between 16 and 17 years received an adaptation of version G. Each correct answer produced was given a score of 1; answers that were not correct were given a score of 0. The total correct response scores were converted into percentages to provide the proportion of correct responses from the number of attempts (see Binks 2017 for more detail).

Example 1: Verbal Analogy				
Cow – Milk : Chicken				
Feather	Dinner	Egg	Hen	Bird
Buwch – Llaeth : lâr –				
Pluen	Cinio	Ŵy	Cyw	Aderyn
Example 2: Verbal Categorisation				
	Rain	Fog	Sunshine	
Winter	Snow	Weather	Dark	Night
	Glaw	Niwl	Haul	
Gaeaf	Eira	Tywydd	Tywyll	Nos

Questionnaire

Participants were also given a questionnaire (adapted from Thomas and Roberts 2011). This was made up of two key components: (i) open-ended questions regarding demographic information, such as living history, parental education, and date of birth; and (ii) forced-choice questions regarding their use of each language and which language was used when speaking to different family members, friends, and acquaintances and in which situation(s). Responses to these questions were on set on a scale that best expressed the view, e.g. always in Welsh, mostly in Welsh, Welsh and English, mostly in English, or always in English. Each response was given a ranked value, with Welsh ranked higher than English so that higher use of Welsh would be reflected in a higher score. Overall use of Welsh was calculated by adding responses to all questions relating to language use and converting that score into a percentage. Use of Welsh with friends was calculated from responses to a subsection of questions from the questionnaire that related to their language practices with friends. In order that meaningful comparisons could be made across adolescents involved in the study according to their self-reported exposure patterns to Welsh, they were further divided into one of three language use pattern groups: high use [80%+], moderate use [50–70%], and low use [<40%]. These categories reflected the predominant use patterns found within the data.

Procedure

Ethical approval was granted by Bangor University College of Business, Law, Education and Social Sciences Ethics Board. Consent was obtained and participants were tested in two sessions as a part of a larger study. The order of the testing alternated, with some participants given the English test in the first session, and the Welsh in the second session and vice versa. Participants were provided with an explanation of the task and asked to circle the word they believed that fit into the sequence best. They were asked to complete the Verbal Analogies test first. There were two practise questions to complete, and then they were given eight minutes to go through the remaining 24 items before being asked to stop. These instructions were the same for both the English and Welsh tests. The same procedure was replicated for the Verbal Categorisation test. Each word sequence was presented in a line, with the five possible answers underneath, as shown in Examples 1 and 2 above.

Results

Study 1: vocabulary knowledge \times bilingual group

A 2X2X3 Repeated Measures ANOVA was conducted on the data with Test Language (English, Welsh) and Test Type (Verbal Categorisation, Verbal Analogy) as the Within-Subject factors and Bilingual Group (L1W, 2L1, L2W) as the Between-Subjects factor. The results of both age groups were analysed independently as each age group completed an age-appropriate test.

Age 12–13 years

In contrast to predictions, results of the analysis found no main effect of Bilingual Group, with each group performing at the same level [$F(2, 51) = .515, p = .600, \eta^2 = .020$]. This result presents a strong and comparable performance on both Welsh and English vocabulary for this age group, indicating a general convergence in knowledge across bilingual groups.

While no main effect was found for Bilingual Group, a main effect was found for Test Language [$F(1, 51) = 19.360, p < .001, \eta^2 = .275$], with performance generally higher on Welsh vocabulary [$M = 57.17, SE = 2.83$] in comparison to English vocabulary [$M = 50.21, SE = 2.98$]. Data also revealed a significant interaction between Bilingual Group and Test Language [$F(2, 51) = 3.764, p = .030, \eta^2 = .129$]. Post hoc analysis revealed that both the 2L1 bilinguals [$p = .002$] and L1W bilinguals [$p < .001$] demonstrated stronger Welsh vocabulary knowledge [L1W: $M = 55.02, SE = 3.69$; 2L1: $M = 59.38, SE = 6.07$] in comparison to English vocabulary knowledge [L1W: $M = 46.37, SE = 3.89$; 2L1: $M = 48.16, SE = 6.39$], as measured by these tasks. L2W bilinguals demonstrated no significant differences in either language [Welsh: $M = 57.11, SE = 4.65$; English: $M = 56.13, SE = 4.90, p = .708$] (see Figure 1).

There was also a main effect of Test Type [$F(1, 51) = 9.567, p = .003, \eta^2 = .158$], with participants significantly performing stronger on Verbal Categorisation [$M = 56.42, SE = 2.91$] in comparison to

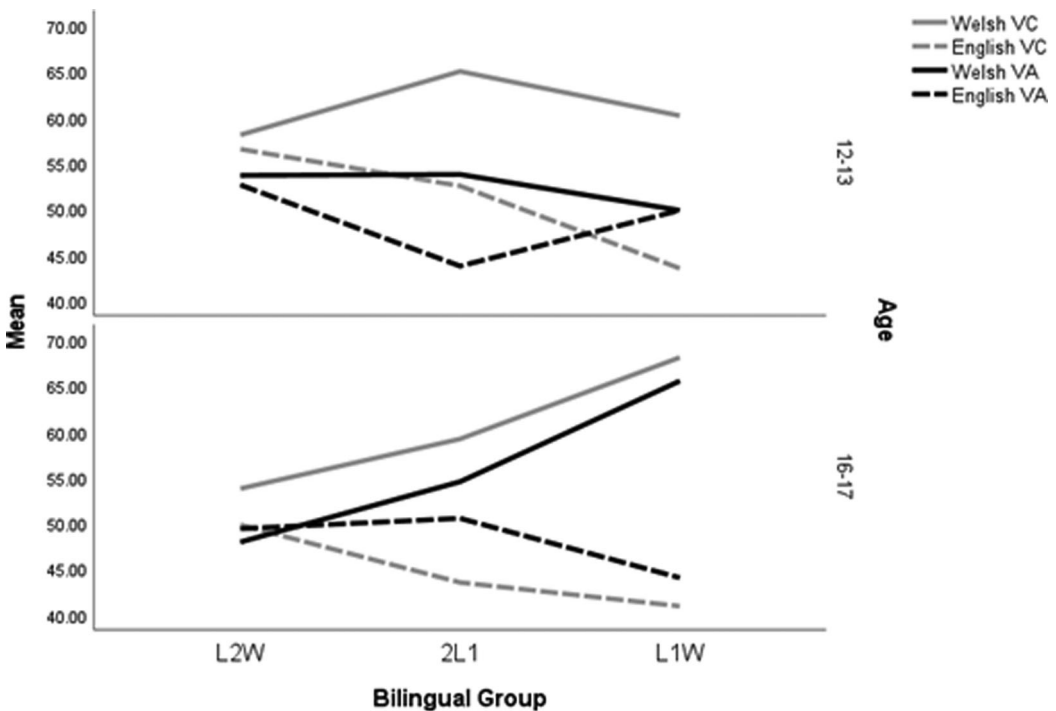


Figure 1. Performance (%) of Welsh-English adolescents on measures of vocabulary knowledge across bilingual group.

Verbal Analogy [$M = 50.95$, $SE = 2.96$]. However, an interaction of Test Language X Test Type [$F(2, 51) = 6.373$, $p = .015$, $\eta^2 = .111$], revealed that this was only the case in Welsh with performance on the Welsh Verbal Categorisation task [$M = 61.61$, $SE = 2.84$] being significantly stronger in comparison to performance on the Welsh Verbal Analogy task [$M = 52.72$, $SE = 3.24$, $p < .001$]. However, there were no significant differences between the English Verbal Categorisation and Verbal Analogy tasks [$p = .355$].

Data revealed a further 3-way interaction between Test Language, Test Type and Bilingual Group. No significant differences were revealed between the three bilingual groups; however, pairwise comparison revealed that the interaction effect was due to the 2L1 bilinguals significantly performing stronger on Welsh Verbal Categorisation in comparison to Verbal Analogy [$p = .024$], but also demonstrating stronger Welsh vocabulary in comparison to English on both the Verbal Categorisation [$p = .004$] and Verbal Analogy [$p = .042$].

L1W also significantly performed stronger on Welsh Verbal Categorisation in comparison to Verbal Analogy [$p = .001$], but conversely performed significantly stronger on English Verbal Analogy in comparison to Verbal Categorisation [$p = .041$]. As with the 2L1 bilinguals, L1W participants demonstrated stronger Welsh vocabulary on Verbal Categorisation in comparison to English [$p < .001$]. This was not the case for Verbal Analogy, with no significant differences seen between the performance on Welsh and English [$p = .833$]. No significant differences were found in the L2W bilinguals across Test Type or Test Language.

Age 16–17 years

Results of the older participants also revealed no main effect of Bilingual Group [$F(2, 81) = .486$, $p = .617$, $\eta^2 = .012$], suggestive of a general convergence in knowledge across bilingual groups. Results also revealed a main effect of Test Language [$F(1, 81) = 53.746$, $p < .001$, $\eta^2 = .399$], that was due performance on average being higher for Welsh vocabulary [$M = 58.15$, $SE = 2.06$] compared with English vocabulary [$M = 46.35$, $SE = 2.13$] consistent with the pattern seen within the younger participants.

These results were modified further by a significant interaction between Bilingual Group and Test Language [$F(2, 81) = 19.368$, $p < .001$, $\eta^2 = .324$]. Post hoc tests revealed the interaction was due to a significant difference between L1W [$M = 66.77$, $SE = 2.91$] and L2W bilinguals [$M = 50.83$, $SE = 4.07$] on the Welsh versions of the tasks [$p = .006$], indicative of a lack of convergence in performance at this age. Therefore, whereas younger pupils tended to perform similarly in Welsh, regardless of home language practices, at the older ages, the L1W outperform the 2L1.

Regarding language, performance of the L1W bilinguals and 2L1 bilinguals [$M = 59.38$, $SE = 6.07$] was significantly stronger on Welsh vocabulary [L1W: $p < .001$; 2L1: $p = .002$] in comparison to English vocabulary [L1W: $M = 42.47$, $SE = 3.01$; 2L1: $M = 47.00$, $SE = 3.75$]. No significant differences were found for the L2W bilinguals [Welsh: $M = 50.83$, $SE = 4.07$; English: $M = 49.58$, $SE = 4.20$, $p = .695$], similar to the performance patterns seen within the younger participants.

Unlike the younger bilinguals, there was no main effect of Test Type [$F(1, 81) = .145$, $p = .704$, $\eta^2 = .002$] nor was there a significant interaction between Test Type and Bilingual Group [$F(2, 81) = .662$, $p = .519$, $\eta^2 = .016$] suggesting that all three bilingual groups performed similarly on the Verbal Analogy and Verbal Categorisation tasks.

However, a significant interaction was revealed between Test Type and Test Language [$F(1, 81) = 13.252$, $p < .001$, $\eta^2 = .141$]. Performance on both Welsh Verbal Analogy [$M = 55.97$, $SE = 2.49$] and Welsh Verbal Categorisation [$M = 60.32$, $SE = 1.95$] was significantly higher [both $p < .001$] than on the English Verbal Analogy [$M = 47.96$, $SE = 2.58$] and English Verbal Categorisation [$M = 44.74$, $SE = 2.05$]. In relation to test language, performance on Welsh Verbal Categorisation was significantly higher than Welsh Verbal Analogy [$p = .013$], whereas no significant differences were found between the Verbal Analogy and Verbal Categorisation in English [$p = .093$]. There was no significant three way interaction [$F(2, 81) = .995$, $p = .385$, $\eta^2 = .023$].

Study 2: vocabulary knowledge and language use

To explore the influence of the language of interpersonal interactions on knowledge of vocabulary, the data were also analysed using participants' Overall Use of Welsh and their Use of Welsh with Friends as Between-Subjects factors. Three new groups of participants were created: low use of Welsh (those reporting using Welsh under 40% of the time), moderate use of Welsh (those reporting using Welsh 50–70% of the time), and high use of Welsh (those reporting using Welsh over 80% of the time). Those whose use of Welsh was in-between each category were excluded from analysis to establish a clear difference between groups. Consequently, the total numbers of participants for these analyses were lower than for the previous analyses, and therefore data were collapsed across the two age groups in order that any statistical analyses would be meaningful. The final number of participants per group is noted in [Table 2](#).

Vocabulary X use of Welsh

A 2X3X3 Repeated Measures ANOVA was conducted on the data with Test Language (English, Welsh) and Test Type (Verbal Categorisation, Verbal Analogies) as the Within-Subject factors and Use of Welsh (<40%, 50–70%, 80%+) as the Between-Subjects factor. Results revealed no main effect of Use of Welsh [$F(2, 98) = .821, p = .443, \eta^2 = .016$] suggesting that all participants were performing comparably irrespective of their overall Use of Welsh ([Figure 2](#)).

A main effect of Test Language was found [$F(1, 98) = 27.399, p < .001, \eta^2 = .218$], where performance on the Welsh tasks was significantly higher than performance on the English tasks [$p < .001$]. This effect was further modified by Use of Welsh [$F(2, 98) = 12.667, p < .001$], where those who reported a high use of Welsh significantly outperformed those with low use of Welsh on the Welsh tasks [$p = .011$], and second, bilinguals with moderate and high use of Welsh performing significantly higher on the Welsh than on the English tasks [$p < .001$].

However, no main effect of Test Type [$F(1, 98) = 1.275, p = .262, \eta^2 = .013$] or an interaction between Test Type and Use of Welsh [$F(1, 98) = .90, p = .914, \eta^2 = .002$] was found, suggesting that, on the whole, performance did not differ across groups with all three group performing similarly on Verbal Analogy and Verbal Categorisation tasks. However, there was an interaction between Test Language and Test Type [$F(1, 98) = 27.399, p < .001, \eta^2 = .218$], where due performance was significantly stronger on Verbal Categorisation than on Verbal Analogy in Welsh [$p = .003$] but with no such differences for English [$p = .306$].

Vocabulary X use of Welsh with friends

A 2X2X3 Repeated measures ANOVA was conducted on the data with Test Type (Verbal Analogies, Verbal Categorisation) and Test Language (English, Welsh) as the Within-Subjects factors and Welsh with Friends (<40%, 50–70%, 80%+) as the Between-Subjects factor. No main effect of Welsh with Friends was revealed [$F(2, 105) = 1.149, p = .321, \eta^2 = .021$] following a similar pattern to participants' overall use of Welsh ([Figure 3](#)).

As observed with Overall use of Welsh, a main effect of Test Language was found, [$F(1, 105) = 30.454, p < .001, \eta^2 = .225$], with participants receiving higher scores on the Welsh vocabulary in comparison to the English vocabulary tests. This effect was further modified by Use of Welsh with Friends

Table 2. Number of participants per type of language use measure and per percent use.

	Percentage of Use			Total
	Under 40%	50–70%	Over 80%	
Overall Use of Welsh	13	46	42	101
Welsh with Friends	14	48	46	108

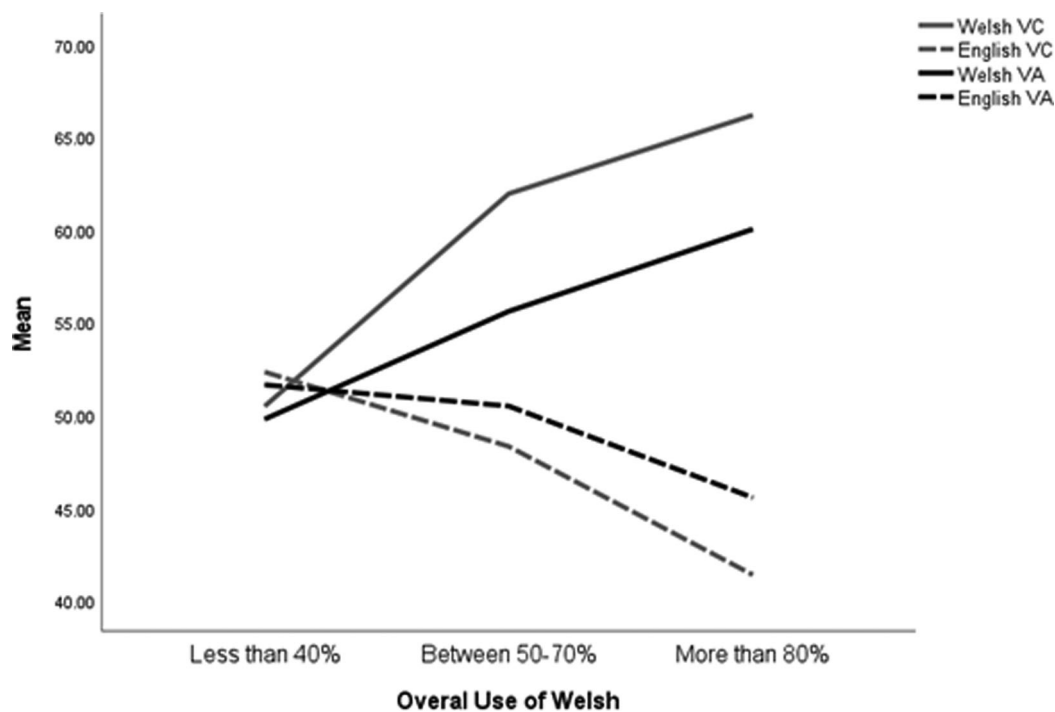


Figure 2. Performance (%) of Welsh-English adolescents vocabulary knowledge based on overall use of Welsh.

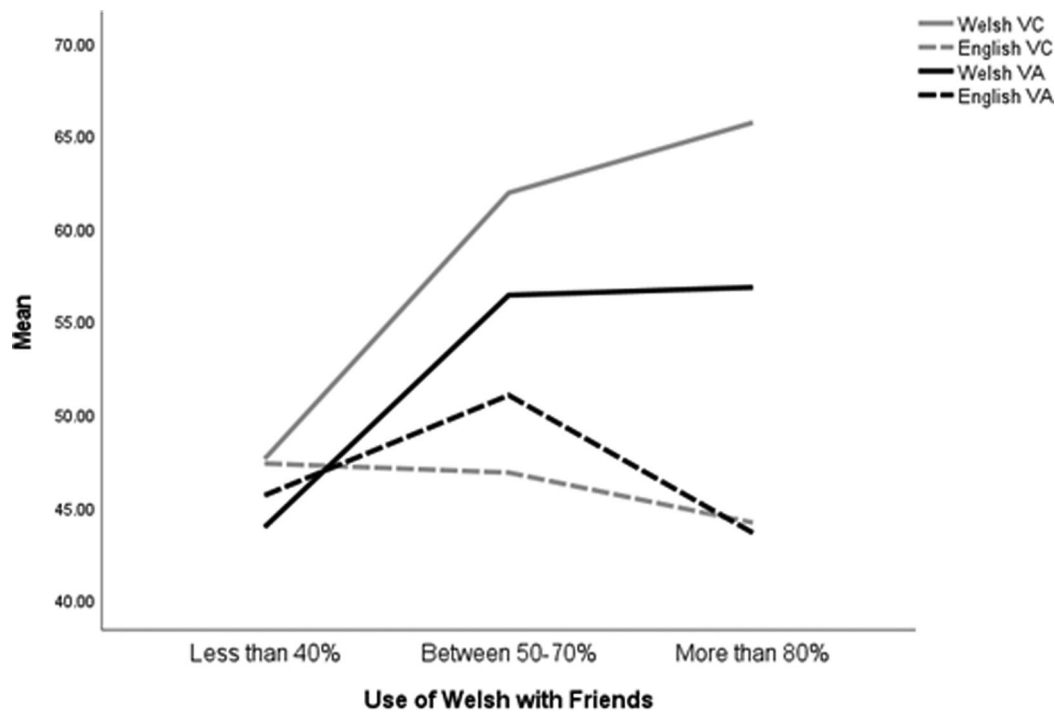


Figure 3. Performance (%) of Welsh-English adolescents vocabulary knowledge based on use of Welsh with friends.

$[F(2, 105) = 7.345, p = .001, \eta^2 = .123]$. Post hoc analysis revealed that this interaction was due to participants who reported high use of Welsh with friends (80%+) and those who reported moderate use of Welsh with friends (50–70%) received higher scores on the Welsh vocabulary tasks than on the English vocabulary tasks [both $p < .001$]. In addition, those who reported high use of Welsh with Friends outperformed those with low use with Friends on Welsh vocabulary [$p = .032$], suggesting that use on Welsh can impact of vocabulary knowledge.

Contrary to previous analysis, a fairly weak main effect of Test Type was found, $[F(1, 105) = 4.363, p = .039, \eta^2 = .040]$, where performance seemed stronger on Verbal Categorisation in comparison to Verbal Analogy. This was not modified further by Welsh with Friends, suggesting, as with the previous analysis, that performance across the three groups did not differ significantly based on the type of test $[F(2, 105) = 2.117, p = .125, \eta^2 = .039]$. There was, however, an interaction between Test Language X Test Type $[F(1, 105) = 17.792, p < .001, \eta^2 = .145]$. This effect was due to the performance on Verbal Categorisation in Welsh being significantly stronger in comparison to Verbal Analogy [$p < .001$]. However, as with previous analysis, there were no significant differences between test type seen within the English [$p = .438$].

Discussion

The purpose of the present study was to measure adolescent Welsh-English bilinguals' vocabulary knowledge in both Welsh and English at two different age points, early adolescence (12–13 years) and late adolescence (16–17 years). The study aimed to explore the extent to which different types of Welsh-English adolescents converge on their knowledge of vocabulary, and the potential role of interpersonal language use on adolescents' vocabulary knowledge. Observed differences in Welsh-English bilinguals' vocabulary knowledge, as compared to different types of bilingual speakers of the same language(s), have been linked to the varying levels of linguistic input bilinguals have in each language (Gathercole and Thomas 2009). Given that vocabulary is largely learned item-by-item, it is logical to predict that frequency of exposure may impact on the words speakers know, i.e. on their vocabulary knowledge, and how increased exposure to language over time might lead to a convergence in speakers' vocabulary knowledge across various types of bilinguals (Oller and Eilers 2002). Our study wanted to explore whether differences are found in Welsh-English adolescents' vocabulary knowledge and to what extent frequency of language use, both in general and with peers, modifies those outcomes. Our predictions were that those who reported higher use of Welsh in general and with peers would perform highest on measures of vocabulary, although 2L1 bilinguals' performance would converge with those from L1W backgrounds by age 16–17 years. Whilst some notion of convergence across language groups was observed among the data, the occurrence of this convergence was not as predicted and appeared among the 12–13-year-olds but was not observed at the older age group.

Minority vs. Majority vocabulary knowledge

English

In line with previous findings in the field (Gathercole and Thomas 2009; Gathercole et al. 2013) no main effects of bilingual group were found for English. The three different 'types' of adolescent bilinguals, both at 12–13 and 16–17 years of age, performed similarly to one another on Verbal Analogy and Verbal Classification tasks in English. These findings suggest that the prevalence of English in bilinguals' environment is sufficient to achieve the optimum 40–60% exposure required to sustain language development (Thordardottir 2015), regardless of the medium of instruction at school. In contrast to the findings of Rhys and Thomas (2013) that primary school-aged children from Welsh-speaking backgrounds continue to perform below monolingual English norms for English

vocabulary at age 11, the children in the current study were older, and had likely benefitted from a wider, more sustained exposure to English over time (Unsworth 2013) and in various domains.

L1W and 2L1 bilinguals demonstrated greater vocabulary knowledge in Welsh than in English, suggesting that some home language effects remain, or that Welsh continues to be the dominant language for some of these speakers (Thordardottir 2021, for similar findings for Icelandic adolescents). Whilst these patterns are in keeping with previous results in the field, there may have been some methodological issues that contributed to this pattern. First, in comparison to Welsh, English has a wide range of synonyms that lend themselves well to verbal analogy and verbal categorisation tasks, as presented to bilinguals in this study. Welsh in comparison, does not have the same range of synonyms for certain items. L1W bilinguals may therefore have found it easier to deduce the answers within the Welsh tests in comparison to the English. Second, the English vocabulary tests were created for a monolingual population, in comparison to the Welsh tests. While Welsh-English bilinguals are generally regarded as 'fluent' in English, bilinguals are not two monolinguals in one (Grosjean 2013), and monolingual English-normed tests may not always be suitable. This issue echoed by minority/heritage language context whereby English normed tests have not always been found to be suitable (Marinis, Armon-Lotem, and Pontikas 2017; Papastergiou and Sanoudaki 2021). However, this issue was somewhat mitigated in this study by not using the standard normed scores.

Welsh

Whilst performance on tasks of vocabulary in English was consistent across the different bilingual groups, both at 12–13 and at 16–17 years of age, performance on tasks of vocabulary in Welsh was more variable. While we see a convergence to an extent, the differences seen within the older bilinguals suggest that this may not be universal. At both ages, performance was best on the Welsh tasks as compared to the English tasks for L1W and 2L1 bilinguals with little or no difference between the two languages among the L2W bilinguals. However, contrary to previous findings for vocabulary (Gathercole and Thomas 2009; Rhys and Thomas 2013), performance on measures of vocabulary across the three bilingual groups remained similar among the 12–13 age group, indicative of convergence in performance and knowledge. At the older age group, whilst no main effect of Bilingual Group were found, an interaction effect demonstrated that the L1W bilinguals outperformed the 2L1 bilinguals on Welsh tasks. This suggests that L1W bilinguals may progress with Welsh at a faster pace, in comparison to 2L1 bilinguals, who may in turn, progress at a faster pace than L2W bilinguals.

Language use and vocabulary

In line with Thomas, Gathercole, and Hughes (2013), the greater division between L1W bilinguals and their 2L1 and L2W peers at the older ages in Welsh may be related to the language choices pupils make at school. Whilst there were no main effects of language use in general or of language use with friends, interaction effects with Language of Test revealed significant differences between those who reported high use of Welsh (in general and with friends) and those who reported low use of Welsh when tested in Welsh. In both cases, those reporting using the greatest amount of Welsh demonstrated greater vocabulary knowledge in Welsh than those reporting using the least amount of Welsh, highlighting the role of continuous use of Welsh in maintaining pupils' vocabulary knowledge. Similar findings from a previous study comparing L1W, 2L1 and L2W-speaking parents' vocabulary knowledge showed how parents who coupled with another Welsh-speaking parent retained higher levels of vocabulary knowledge than those who coupled with a 2L1 or an L2W or non-Welsh-speaking parent (Gathercole et al. 2007), demonstrating the importance of continued opportunities to use the target language in interpersonal communication.

Whilst L1W bilinguals have the benefit of naturalistic exposure to Welsh in the home, as well as continued exposure to Welsh – both formally and informally – at school, 2L1 and L2W pupils' exposure to Welsh at school, particularly during later adolescence, may be reduced through the types of choices teenagers make (Thomas, Gathercole, and Hughes 2013). These choices include (a) whether they study a given subject through the medium of Welsh, bilingually or through the medium of English, where options are provided, and (b) which peer groups they belong to and choose to spend time in their company. We know that children, even as early as primary school age, tend to migrate towards those from similar home language backgrounds at school (Thomas and Roberts 2011). Coupled with the option to study certain subjects through the medium of English or bilingually at A-level (post-16 statutory qualification), pupils, even in Welsh-medium settings, can place themselves either intentionally or unintentionally in an English-dominant environment, thus reducing their exposure to both natural conversational Welsh and formal, subject-based terms and expressions in the language (cf. Cummins' notion of Basic Interpersonal Communicative Skills & Cognitive Academic Language Proficiency, Cummins 1979). This reduction in exposure, particularly within the school domain, has been shown in other studies to influence L2 speakers' outcomes. In a study of Icelandic adolescent students, Thordardottir (2021) showed that even with over 5 years of exposure to Icelandic, L2 Icelandic students were still lagging behind L1 speakers. One hypothesised reason for this effect was the shorter than average Icelandic school days reducing their exposure to the language. In the present study, it may well be that with the increasing opportunities to study through the medium of English at the older ages and/or the dominance of L2W speakers within friendship groups, adolescents' exposure to Welsh within Welsh-medium settings does not necessarily support its continued development at the same rate as for 2L1 and L1W bilinguals. Moreover, given that vocabulary size is also linked to literacy (Milton 2009), it may be that L1W and 2L1 bilinguals read, or have more exposure to, written materials in Welsh via the language choices they make at school. Consequently, L1W and 2L1 bilinguals may read more challenging materials in Welsh, exposing speakers to more sophisticated vocabulary, and may develop greater levels of confidence in using the language (see authors, in preparation).

Interestingly, however, those who reported higher use of Welsh with their friends (80%+) did not significantly outperform those who reported moderate use of Welsh (50–0%). This suggests that speaking 20–50% English within a friendship group does not impair L1W speakers' vocabulary knowledge in Welsh and may possibly result in gains for 2L1 and L2W bilinguals, particularly if they identify with Welsh social groups (Morris, 2014). Participants who reported less than 40% use of Welsh continued to lag behind the other two groups, which supports the findings of Thordardottir (2021). However, while this study is the first to examine catch-up effects among Welsh-English bilingual adolescents, it does provide a good starting point to establish the role of social group and vocabulary ability, but further studies are needed to expand on these initial findings.

Limitations

Whilst the results of the current study suggest more convergence in Welsh-English bilinguals' vocabulary knowledge, mediated by language use in Welsh, these results are exploratory and should be interpreted with caution, for the following reasons:

First, it is worth noting that any results could be influenced (and any success exaggerated) by the small sample size within the younger age group, and the limited number of participants within some bilingual groups, therefore any wide generalisations of these data must be taken with this in mind. This applies also to the location of the sample. Given that the data were collected from two of the Welsh 'heartlands' the performance on the Welsh vocabulary test may be stronger here in comparison to how it could appear in more Anglicised areas of Wales.

Second, vocabulary is largely acquired 'item-by-item' (Gathercole and Hoff 2008); therefore, it is likely that success on these tests will be highly contingent on their overall exposure to Welsh across different domains. L2W bilinguals typically acquire Welsh within the school context, and as such are

likely to have domain specific vocabularies. If this is the case, the nature of the test items (non-school-based vocabulary) may have had an influence on their performance. Research conducted by Bialystok et al. (2010) suggests that domain effects are largely contained to words related to the home context rather than school context, thus future research could assess the differences across the two domains. In addition, the range of items in each test was limited. While these items are from standardised testing materials, the sample of words in each test was relatively small. Given that adolescents are likely to have a vocabulary size of 10,000 + items (Nation 2022), ensuring that the items contained within tasks are reflective of the lexical experiences of bilingual adolescents and their language practices is important.

Implications for education

Bilinguals experience their two languages in very different ways, and these experiences differ from one bilingual to the next. The experiences bilinguals bring to the learning environment impacts on their learning and on their ultimate linguistic outcomes, achievement, and behaviours. Maximising exposure, particularly to a minority language, is key to pupils' successful acquisition of that language, and successful acquisition, in turn, impacts on pupils' willingness to use the language in their daily lives. The results of the current study provide evidence to suggest that bilingual Welsh-English adolescents attending Welsh-medium secondary schools achieve similar outcomes in English vocabulary, regardless of their wider language experiences, leading to 'additive' bilingualism for these pupils. At the same time, whilst all bilinguals performed similarly on the Welsh tasks among the 12–13-year-olds, those from L1W backgrounds seemed to progress faster in their knowledge of Welsh words during late adolescence than those from 2L1 and L2W backgrounds. Whilst most pupils attending Welsh-medium schools study Welsh as an L1, it is important for educators and curriculum designers to acknowledge that potential differences in linguistic behaviours do exist across different types of bilinguals, and that these differences are not always 'neutralised' through education. To ensure pupils are gaining the most from their bilingual journeys, some pupils may require enhancement in their vocabulary knowledge in Language A whereas other pupils may require enhancement in their vocabulary knowledge in Language B. This may be achieved in some cases through bilingual teaching techniques that encourage pupils to fully comprehend the content of any given input language in order to produce an output in another language, such as translanguaging (Cenoz and Gorter 2021). Whereas in other cases, focused work around bilingual terminology may be required. In helping pupils recognise that increasing use can support their knowledge of Welsh, schools have a role to play in developing pupils' oral skills to achieve at least 50% use of Welsh during school hours. Since vocabulary size, along with grammar and literacy, is frequently used to measure L2 growth and success within pupils (Thordardottir 2019), schools need to actively support pupils in making suitable linguistic choices where options are provided, so that those who require additional exposure to Welsh are confident to do so and encouraged to monitor the impact of any interventions on pupils' vocabulary development.

Ultimately, the results of this present study demonstrate that attending Welsh-Medium education is not enough to ensure L2W bilinguals achieve their full potential in Welsh, and that continuous exposure to and use of Welsh is necessary in order that speakers benefit from cumulative exposure over time. In aiming towards achieving 1 million speakers of Welsh by 2050 and increasing the number of speakers who use the language on a daily basis from 10% to 20% (Government 2017), schools have a clear role to play in encouraging such behaviour among pupils and in developing effective language planning initiatives to help achieve this goal.

Acknowledgements

We wish to express our sincere gratitude to the reviewers for their helpful comments and to all participating schools for their kindness and time, and to the children who took part in the research.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by Coleg Cymraeg Cenedlaethol and Economic and Social Research Council.

Notes on contributors

Dr Hanna L. Binks is a lecturer in Psychology in Aberystwyth University.

Professor Enlli Môn Thomas is a Professor in Education at the School of Educational Sciences in Bangor University.

ORCID

Hanna L. Binks  <http://orcid.org/0000-0003-1563-1182>

References

- Allman, B. 2005. *Vocabulary Size and Accuracy of Monolingual and Bilingual Preschool Children*. Paper Presented at the Proceedings of the 4th International Symposium on Bilingualism.
- Anderson, R. C., and P. Freebody. (1981). "Vocabulary Knowledge." In *Comprehension and Leaching: Research reviews*, edited by J. T. Guthrie, 77–117. Newark, DE: International Reading Association.
- Appel, R., and A. Vermeer. 1998. "Speeding up Second Language Vocabulary Acquisition of Minority Children." *Language and Education* 12 (3): 159–173. <https://doi.org/10.1080/09500789808666746>.
- Baker, C., and S. P. Jones. 1998. *Encyclopaedia of bilingualism and bilingual education*. Multilingual Matters.
- Beck, I. L., M. G. McKeown, and L. Kucan. 2013. *Bringing Words to Life: Robust Vocabulary Instruction*. New York: Guilford Press.
- Bialystok, E., F. I. M. Craik, and G. Luk. 2008. "Lexical Access in Bilinguals: Effects of Vocabulary Size and Executive Control." *Journal of Neurolinguistics* 21 (6): 522–538. <https://doi.org/10.1016/j.jneuroling.2007.07.001>.
- Bialystok, E., and G. Luk. 2012. "Receptive Vocabulary Differences in Monolingual and Bilingual Adults." *Bilingualism: Language and Cognition* 15 (2): 397–401. <https://doi.org/10.1017/S136672891100040X>.
- Bialystok, E., G. Luk, K. F. Peets, and S. Yang. 2010. "Receptive Vocabulary Differences in Monolingual and Bilingual Children." *Bilingualism: Language and Cognition* 13 (4): 525–531. <https://doi.org/10.1017/S1366728909990423>.
- Binks, H. 2017. Investigating the Bilingual 'Catch-up' in Welsh-English Bilingual Teenagers." Unpublished PhD thesis, Bangor University.
- Carroll, S. E. 2017. "Exposure and Input in Bilingual Development." *Bilingualism: Language and Cognition* 20 (1): 3–16. <https://doi.org/10.1017/S1366728915000863>.
- Cenoz, J., and D. Gorter. 2021. *Pedagogical Translanguaging*. Cambridge: Cambridge University Press.
- Cummins, J. 1979. "Cognitive/Academic Language Proficiency, Linguistic Interdependence, the Optimum Age Question and Some Other Matters." Working Papers on Bilingualism 19.
- De Houwer, A. 2014. "The Absolute Frequency of Maternal Input to Bilingual and Monolingual Children." In *Input and Experience in Bilingual Development*, edited by T. Grüter, and J. Paradis, 37–58. Amsterdam: John Benjamins.
- Gathercole, V. C. M., and E. Hoff. 2008. "Input and the Acquisition of Language: Three Questions." In *Blackwell Handbook of Language Development*, edited by E. Hoff and M. Shatz, 107–127. Oxford: Blackwell Publishing Ltd.
- Gathercole, V., and E. Thomas. 2007. *Prawf Geirfa Cymraeg [Welsh Vocabulary Test]*. Bangor University.
- Gathercole, V. C. M., and E. M. Thomas. 2009. "Bilingual First-Language Development: Dominant Language Takeover, Threatened Minority Language Take-up." *Bilingualism: Language and Cognition* 12 (2): 213–237. <https://doi.org/10.1017/S1366728909004015>.
- Gathercole, V. C., E. Thomas, and E. Hughes. 2008. "Designing a Normed Receptive Vocabulary Test for Bilingual Populations: A Model from Welsh." *International Journal of Bilingual Education and Bilingualism* 11 (6): 678–720.
- Gathercole, V. C. M., E. M. Thomas, E. Roberts, C. Hughes, and E. K. Hughes. 2013. "Issues in the Assessment of Bilinguals." *Issues in the Assessment of Bilinguals*, 20–55. <https://doi.org/10.21832/9781783090105-004>.
- Gathercole, V. C. M., E. M. Thomas, E. Williams, and M. Deuchar. 2007. *Language Transmission in Bilingual Families in Wales*. Cardiff: Welsh Language Board.
- Gollan, T. H., R. I. Montoya, and G. A. Werner. 2002. "Semantic and Letter Fluency in Spanish-English Bilinguals." *Neuropsychology* 16 (4): 562–576. <https://doi.org/10.1037/0894-4105.16.4.562>.

- Government, W. 2016. "Welsh-medium Education Strategy: Next Steps." <http://gov.wales/docs/dcells/publications/160309-next-steps-en-v2.pdf>.
- Government, W. 2017. "Cymraeg 2050: A million Welsh speakers." <http://gov.wales/topics/welshlanguage/welsh-language-strategy-and-policies/cymraeg-2050-welsh-language-strategy/?lang=en>.
- Grosjean, F. 2013. "Bilingualism: A Short Introduction." In *The Psycholinguistics of Bilingualism*. First Edition, edited by F. Grosjean and Pang Li, 5–25. New Jersey: Wiley-Blackwell.
- Hoff, E., C. Core, S. Place, R. Rumiche, M. Señor, and M. Parra. 2012. "Dual Language Exposure and Early Bilingual Development." *Journal of Child Language* 39 (01): 1–27. <https://doi.org/10.1017/S0305000910000759>.
- Hoff, E., J. M. Quinn, and D. Giguere. 2018. "What Explains the Correlation Between Growth in Vocabulary and Grammar? New Evidence from Latent Change Score Analyses of Simultaneous Bilingual Development." *Developmental Science* 21 (2): e12536. <https://doi.org/10.1111/desc.12536>.
- Hoff, E., S. Welsh, S. Place, and K. Ribot. 2014. "Properties of Dual Language Input That Shape Bilingual Development and Properties of Environments That Shape Dual Language Input." In *Input and Experience in Bilingual Development*, edited by T. Grüter, and J. Paradis, Vol. 13, 119–140. Amsterdam: John Benjamins.
- Huguet, A. 2007. "Language use and Language Attitudes in Catalonia." In *Multilingualism in European Bilingual Contexts: Language Use and Attitudes*, edited by D. Lasagabaster and Á. Huguet, 17–35. Bristol: Multilingual Matters.
- Marinis, T., S. Armon-Lotem, and G. Pontikas. 2017. "Language Impairment in Bilingual Children." *Linguistic Approaches to Bilingualism* 7 (3-4): 265–276. <https://doi.org/10.1075/lab.00001.mar>.
- Milton, J. 2009. *Measuring Second Language Vocabulary Acquisition*. Bristol: Multilingual Matters.
- Morris, J. (2014). The Influence of Social Factors on Minority Language Engagement Amongst Young People: An Investigation of Welsh-English Bilinguals in North Wales. *International Journal of the Sociology of Language*, 230, 65–89.
- Nation, I. 2022. *Learning Vocabulary in Another Language*. 3rd ed. Cambridge: Cambridge University Press.
- O'Dell, F., J. Read, and M. McCarthy. 2000. *Assessing vocabulary*: Cambridge university press.
- Office for National Statistics., (2022). *Welsh language: Census 2021 in Wales*. <https://www.ons.gov.uk/releases/welshlanguagecensus2021inwales>
- Oller, D. K. 2005. "The Distributed Characteristic in Bilingual Learning." Paper Presented at the Proceedings of the 4th International Symposium on Bilingualism.
- Oller, D. K., and R. E. Eilers. 2002. *Language and Literacy in Bilingual Children*. Bristol: Multilingual Matters.
- Oller, D. K., B. Z. Pearson, and A. B. Cobo-Lewis. 2007. "Profile Effects in Early Bilingual Language and Literacy." *Applied Psycholinguistics* 28 (2): 191–230. <https://doi.org/10.1017/S014716407070117>.
- Ordóñez, C. L., M. S. Carlo, C. E. Snow, and B. McLaughlin. 2002. "Depth and Breadth of Vocabulary in two Languages: Which Vocabulary Skills Transfer?" *Journal of Educational Psychology* 94 (4): 719. <https://doi.org/10.1037/0022-0663.94.4.719>.
- Papastergiou, A., and E. Sanoudaki. 2021. "Language Skills in Greek-English Bilingual Children Attending Greek Supplementary Schools in England." *International Journal of Bilingual Education and Bilingualism* 25 (8): 2834–2852. <https://doi.org/10.1080/13670050.2021.1980496>.
- Pearson, B. Z., S. C. Fernández, and D. K. Oller. 1993. "Lexical Development in Bilingual Infants and Toddlers: Comparison to Monolingual Norms." *Language Learning* 43 (1): 93–120.
- Price, A. R., and M. Tamburelli. 2020. "Welsh-Language Prestige in Adolescents: Attitudes in the Heartlands." *International Journal of Applied Linguistics* 30 (2): 195–213. <https://doi.org/10.1111/ijal.12274>.
- Qian, D. 1999. "Assessing the Roles of Depth and Breadth of Vocabulary Knowledge in Reading Comprehension." *The Canadian Modern Language Review* 56 (2): 282–308. <https://doi.org/10.3138/cmlr.56.2.282>.
- Rhys, M., and E. M. Thomas. 2013. "Bilingual Welsh–English Children's Acquisition of Vocabulary and Reading: Implications for Bilingual Education." *International Journal of Bilingual Education and Bilingualism* 16 (6): 633–656. <https://doi.org/10.1080/13670050.2012.706248>.
- Ribot, K. M., E. Hoff, and A. Burridge. 2018. "Language use Contributes to Expressive Language Growth: Evidence from Bilingual Children." *Child Development* 89 (3): 929–940. <https://doi.org/10.1111/cdev.12770>.
- Schmitt, N., and P. Meara. 1997. "Researching Vocabulary Through a Word Knowledgeframework." *Studies in Second Language Acquisition*, 17–36. <https://doi.org/10.1017/S0272263197001022>.
- Siow, S., I. Lepadatu, N. Gillen, and K. Plunkett. 2022. "UK Bilingual Toddlers Show a lag in Vocabulary Size Relative to Monolinguals in Both Comprehension and Production." *Proceedings of the Annual Meeting of the Cognitive Science Society*, 44 (44).
- Snow, C., and J. Locke. 2001. "Quality of Phonological Representations of Lexical Items." *Applied Linguistics* 22: 283–477.
- Söderman, T. 1993. "Word associations of foreign language learners and native speakers: The phenomenon of a shift in response type and its relevance for lexical development." Near-native proficiency in English, 91–182.
- Thomas, E. M., V. Gathercole, and E. Hughes. 2013. "Sociolinguistic Influences on the Linguistic Achievement of Bilinguals: Issues for the Assessment of Minority Language Competence." In *Solutions for the Assessment of Bilinguals*, edited by V. C. M. Gathercole, 175–193. Bristol: Multilingual Matters.
- Thomas, E. M., and D. B. Roberts. 2011. "Exploring Bilinguals' Social use of Language Inside and out of the Minority Language Classroom." *Language and Education* 25 (2): 89–108. <https://doi.org/10.1080/09500782.2010.544743>.

- Thordardottir, E. 2015. "The Relationship Between Bilingual Exposure and Morphosyntactic Development." *International Journal of Speech-Language Pathology* 17 (2): 97–114. <https://doi.org/10.3109/17549507.2014.923509>.
- 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. <https://doi.org/10.1177/1367006917722418>.
- Thordardottir, E. 2021. "Adolescent Language Outcomes in a Complex Trilingual Context: When Typical Does not Mean Unproblematic." *Journal of Communication Disorders* 89. <https://doi.org/10.1016/j.jcomdis.2020.106060>.
- Uchikoshi, Y. 2006. "English Vocabulary Development in Bilingual Kindergarteners: What are the Best Predictors?" *Bilingualism: Language and Cognition* 9 (1): 33–49. <https://doi.org/10.1017/S1366728905002361>.
- Unsworth, S. 2013. "Assessing the Role of Current and Cumulative Exposure in Simultaneous Bilingual Acquisition: The Case of Dutch Gender." *Bilingualism: Language and Cognition* 16 (01): 86–110. <https://doi.org/10.1017/S1366728912000284>.
- Unsworth, S. 2014. "Comparing the Role of Input in Bilingual Acquisition Across Domains." In *Input and Experience in Language Development*, edited by T. Grüter, and J. Paradis, Vol. 13, 181–201. Amsterdam: John Benjamins.
- Verhallen, M., and R. Schoonen. 1993. "Lexical Knowledge of Monolingual and Bilingual Children." *Applied Linguistics* 14 (4): 344–363. <https://doi.org/10.1093/applin/14.4.344>.
- Verhallen, M., and R. Schoonen. 1998. "Lexical Knowledge in L1 and L2 of Third and Fifth Graders." *Applied Linguistics* 19 (4): 452–470. <https://doi.org/10.1093/applin/19.4.452>.
- Vermeer, A. 2001. "Breadth and Depth of Vocabulary in Relation to L1/L2 Acquisition and Frequency of Input." *Applied Psycholinguistics* 22 (2): 217. <https://doi.org/10.1017/S0142716401002041>.
- Welsh Government, (2022). *Welsh language data from the Annual Population Survey: 2021*. <https://www.gov.wales/welsh-language-data-annual-population-survey-2021>
- Wesche, M., and T. S. Paribakht. 1996. "Assessing Second Language Vocabulary Knowledge: Depth Versus Breadth." *The Canadian Modern Language Review* 53 (1): 13–40. doi:10.3138/cmlr.53.1.13.