Critical Review:
Comparison of Phonological Awareness Abilities of Bilingual and Monolingual Children

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This critical review investigates differences in phonological awareness abilities of monolingual and bilingual children. Study designs included 6 cohort studies describing and comparing two distinct linguistic groups. Overall the evidence is inconclusive, with some studies supporting, and others refuting, a bilingual advantage to phonological awareness. Although no generalized understanding of bilingualism and phonological awareness is yet available, current evidence suggests that speech language pathologists should be aware of the potential for bilingual differences.

Introduction

Understanding bilingual language development, including phonological awareness (PA), is an increasingly researched topic (Kuo, & Anderson, 2010). PA refers to the understanding that spoken language is made up of smaller constituent parts, such as syllables and sounds, as well as the ability to manipulate those sounds. PA has been established as an important contributor to the development of literacy (Hamilton & Gillon, 2006).

However, the effect of bilingualism on the development of PA is not thoroughly understood (Verhoven, 2007). Bilingual children are believed to have greater metalinguistic skills, as a result of simultaneously learning and comparing two language codes (Chen et al., 2004), which may allow them to also develop stronger PA skills (Chen et al., 2004). Bilingual children may have stronger PA skills due to increased exposure to oral language (Bialystok & Harmon, 1999), cross-transfer between languages (Kuo & Anderson, 2010) or due to increased metalinguistic skills (Laurent & Martinot, 2010). Understanding PA in bilingual children may allow speech-language pathologists to better assist in literacy development for bilingual populations (Bialystok & Herman, 1999).

Objectives

The objective of this review was to critically evaluate the evidence comparing differences in PA abilities of monolingual and bilingual children.

Methods

Search Strategy

Electronic databases (CINAHL, SCOPUS, PubMed) were queried using the following search terms:
[bilingualism OR bilingual OR multilingualism OR multilingual AND phonological awareness].

Selection Criteria: Studies selected for inclusion directly compared the PA skills of bilingual and monolingual age-matched groups. No languages were excluded. Studies that mixed typically developing and language-disordered children, and those published prior to 1995, were excluded.

Data Collection: Papers included in this review are primarily cohort studies, describing and comparing two separate groups of age-matched monolingual and bilingual children.

Results

Laurent and Martin (2010) compared PA skills of 55 monolingual (French) and 44 bilingual (French-Occitan) students in grades 3,4, and 5, to assess whether bilingualism would advantageously affect development of PA skills, and if length of exposure to bilingualism would affect PA. Well-formulated research questions were investigated using an appropriate cohort design. Well-matched language groups did not significantly differ in age, nonverbal intelligence, socio-economic status, or family attitudes towards literacy. Due to the nature of the comparison, participants could not be randomized to language group or grade. However, order of presentation of assessment tasks was randomized to prevent an effect of task order. Experimenters were not blinded to the purpose of the study, nor to the participants' language status (bilingual vs. monolingual), which may have influenced results. Participant criteria, methodology, and analyses were described in sufficient detail to allow replication. Three commonly used PA tasks were selected: syllable deletion (initial, medial, final), phoneme deletion, and permutation (syllable and phoneme). To control for the influence of word meaning, performance was compared on real words and pseudo-words.

Grade 3 results: Appropriate ANOVA analyses indicated that language groups did not significantly differ on any PA tasks, though there was a trend

towards significance for medial phoneme deletion, in favour of the monolingual group (p =.07). A ceiling effect was observed for the syllable deletion and initial and final phoneme deletion tasks. Thus, these tasks were not readministered during Gr. 4 assessments, due to their inability to capture differences. This modification was based on a sound rationale, but nonetheless constitutes a post-hoc modification of methodology, possibly affecting validity of results.

Grade 4 results: ANOVA analyses revealed that the bilingual group was significantly stronger for phoneme permutation (p=.05) and syllable permutation (p=.05), but did not differ on medial phoneme deletion. A grade by language group ANOVA revealed a significant interaction for medial phoneme deletion, where the bilingual group appeared to catch up to monolinguals. Grade 5 results: ANOVA analyses revealed that the bilingual group had significantly higher PA scores than monolinguals on medial phoneme deletion (p=.05), phoneme permutation (p<.05) and syllable permutation (p<.01). No Tukey's post-hoc test was used to control for unequal sample size. No post-hoc test, such as the Bonferroni correction, was used to correct for multiple comparisons. No effect size was reported. Overall, these results are considered suggestive.

Jackson, Holm, and Dodd (1998) compared the PA skills of 36 monolingual (English) and 36 bilingual (English-Cantonese) children of preschool and school age. Languages with maximally different structures (tonal vs. alphabetic) were chosen to eliminate the influence of cross-language transfer and assess whether bilingual status alone, and not shared language features, can account for a possible bilingual advantage.
Participants could not be randomized to language group or grade. However, presentation of task order was randomized. Experimenters were not blinded to the study's purpose, or to the participants' language status. Participant criteria, methodology, and analyses were all sufficiently described to allow replication.

An appropriate cohort design allowed comparison of four distinct groups: bilingual and monolingual preschool (ages 3;0 to 6;0) and school-age (ages 6;0-10;9). One noteworthy design flaw occurred: the authors compared the British school-age bilinguals to a data set of school-age Australian monolinguals from a previous study. The authors do provide a rational, along with evidence that British and Australian children have previously been identified as having similar PA skills. However, use of a culturally different comparison group affects the validity of any conclusions.

The authors did not report on participant's home language. No attempt was made to control for, or group by, the amount of exposure to Chinese, preventing assessment of group homogeneity at baseline. Children were deemed to have no speech and language issues not by assessment, but by consultation of student records. Thus, kids with unidentified disorders may have inadvertently been included into the study.

Preschool groups were assessed using the following subtests from the *Pre-Reading Assessment of Phonological Inventory (PIPA):* Syllable segmentation, Aliteration Awareness, Rhyme Awareness, Phoneme Isolation and Phoneme Segmentation. Subsequent ANOVAS showed that language groups differed only on the rhyme awareness task, with monolinguals significantly outperforming bilinguals (p<.001). School-aged groups were assessed using the following subtests from the *Queensland University Inventory of Literacy (QUIL):* Nonword spelling, nonword reading, syllable identification, syllable segmentation, spoken rhyme recognition, spoonerism, and phoneme detection. Appropriate multivariate ANOVAS revealed that the monolinguals performed significantly better than bilinguals on the following measures: Nonword reading (p<.026), Nonword Spelling (p<.006), Spoonerisms (p<.04), and Phoneme Manipulation (p<.008).

The authors concluded that exposure to two languages does not result in stronger PA skills. Although the authors posited a precise and well-formulated question, poorly defined groups and exclusion criteria may have affected the validity of the data and conclusion. The evidence is considered minimally suggestive.

Kuo and Anderson (2010) compared the PA skills of 41 monolingual (Mandarin) and 95 bilingual (Mandarin-Southern Min) preschool and school age Taiwanese children, to determine if a bilingual advantage is best attributed to cross-language transfer or to structural sensitivity theory (SST). SST states that bilingualism helps children better recognize the similarities and differences that exist between language structures. To this end, novel and existing words were used, as well as onsets shared between languages and onsets belonging to only one. A sound rationale postulated that, comparing shared and nonshared stimuli would eliminate the impact of cross-language transfer, allowing them to attribute a bilingual advantage to other theories. Comparing novel and existing stimuli would then examine the effect of structural sensitivity, whereby better performance on novel words would indicate a more abstract understanding of phonology that supports SST.

Well-defined language groups were compared. Amount of Southern-min language exposure was quantified to ensure the homogeneity of groups at baseline. However,

many, but not all, of the 1st and 2nd graders also received after-school English instruction. Although language groups did not significantly differ in amount of English instruction, failure to control for this extra language factor may have affected results. Furthermore, the authors did not report recruitment procedures.

Groups were compared on three features of PA: onset awareness, rime awareness, and tone awareness. Onsets were analyzed using 4-way repeated measures ANOVA. A bilingual advantage was noted in kindergarten ($p<.01$), with this difference disappearing by grade 1. There was also a significant 3-way interaction between syllable novelty, onset overlap (shared vs. Mandarin-only) and language group ($p<.001$). Follow-up univariate tests indicated that Bilinguals performed significantly better than Monolinguals on existing syllables shared between languages ($p<.001$) and novel syllables shared between languages ($p<.005$).

Furthermore, bilinguals were significantly stronger at recognizing rimes for novel syllables ($p<.01$), and tones in nonsense syllables ($p<.03$), with no group differences noted for real syllables. The authors attributed this advantage for nonsense syllables as evidence that bilingual children were better able to abstractly process phonological features, thus supporting SST. The bilingual advantage for syllables shared between languages was attributed to bilingual children having greater exposure to syllables, and in more varied phonological contexts.

Kuo and Anderson (2010) formulated a specific and answerable questioned, and provided sufficient detail for replication. Appropriate analyses were conducted. However, a Tukey's post-hoc test was not used to control for very unequal sample size. Bonferroni correction was not used to control for Type 1 error from multiple comparisons Participant criteria may not have been stringent enough to prevent the effect of a nuisance variable. Furthermore, it is unclear whether experimenters were blinded to the purpose of the study to the language status of the groups. Overall, this provided suggestive evidence that a bilingual advantage may exist.

Bialystok, Majumder and Martin (2003) compared PA skills of three school-age groups: 33 English monolinguals, 25 Spanish-English bilinguals, and 31 Chinese-English bilinguals. Although the authors failed to postulate a precise question or hypothesis, it can be inferred from the analyses that this study aimed to investigate whether bilingualism itself would create better PA skills, or if differing language combinations and tasks would have differing results. All participants lived in a similar neighborhoods, attended English schools where all instruction was provided in English. Bilingual children were regularly exposed to either Spanish or Cantonese/Mandarin at home and in their community. The monolingual group had little to no exposure to any language other than English, though this was not measured or quantified. The authors did not compare groups to eliminate potential nuisance variables, such as socio-economic status, intelligence, or family attitudes towards literacy. The authors did not report whether children with speech/language disorders were excluded.

The Peabody Picture Vocabulary Test-Revised (PPVT-R) was administered as a basic measure of English proficiency, to ensure bilingual status. A 2-way ANOVA revealed that the monolingual group had significantly higher *PPVT-R* scores than the Chinese-English bilinguals ($p<.006$). The Spanish-English bilinguals did not significantly differ from either group. The following phonological awareness and literacy tasks were administered: sound meaning, phoneme segmentation phoneme substitution, word identification, and word attack. The phoneme segmentation and sound meaning tasks were developed by the experimenters and may not have been valid and reliable measures of PA.

Appropriate ANOVA analyses were conducted. A 2-way anova and subsequent Duncan' Multiple Range Test of Means revealed that all three groups significantly differed from each other on the phoneme segmentation task ($p<.05$). Importantly, the experimenters examined the correlation between these segmentation scores and the PPVT-R scores, to ensure that the task did not inadvertently measure vocabulary knowledge. Segmentation and vocabulary scores were poorly correlated ($r=.11$), indicating that poorer segmentation scores were not likely an artifact of poor vocabulary knowledge, but rather did indeed indicate lower PA skills. No significant differences between language groups were found on the other measures of PA. On the segmentation task, the Spanish-English group was strongest, while the Chinese-English bilinguals were weakest. The authors therefore concluded that bilingual status alone does not appear to produce a significant advantage to the development of PA.

Although this study was very well designed, it lacked a precise hypothesis and failed to eliminate possible nuisance variables. Inclusion of Duncan's and correlation tests increased the validity of the conclusions. However, the authors did not use a Tukey's post-hoc test to control for unequal sample sizes, nor did they control for Type 1 error due to multiple comparisons. Tasks created by examiners lacked validity or reliability data. Overall, results from this

cohort study do present suggestive evidence that bilingualism alone does not lead to better PA skills.

Marinova-Todd, Zhao, and Bernhardt (2010) investigated whether bilingualism would affect PA skills in one or both languages of 5 and 6-year-old children. They compared three groups of children: 61 Mandarin monolinguals, 21 English monolinguals, and 62 Mandarin-English bilinguals. Bilinguals were tested in both Mandarin and English. Although the authors did describe the language background of each group, and attempted to control for SES by using schools in middle class neighborhood, they did not ensure that groups did not differ statistically from each other on a variety of possible extraneous variables, such as family education and literacy, SES, or nonverbal intelligence. They did attempt to exclude children with hearing loss and physical, cognitive or emotional difficulties but did so using teacher report only. Furthermore, some, but not all, mandarin-speaking children also had regular exposure to Pin Yin, a Chinese orthographic language. No attempt was made to control for the possible effect of this additional orthographic instruction.

Mandarin testing consisted of the Chinese version of the *PPVT-III* and five PA tasks: syllable deletion, onset-rime, initial sound identification, rhyme detection and tone discrimination. Syllable deletion, onset-rime and initial sound identification were created by the authors and made to match similar subtests from the *Comprehensive Test Of Phonological Processing (CTOPP)*. As a result, the validity and reliability of these assessments as adequate measures of Mandarin PA could not be confirmed. English testing consisted of the *PPVT-III*, and the elision, blending and sound matching subtests of the *CTOPP*.

A 3-way ANOVA revealed that the bilingual group had significantly higher scores than English monolinguals for deletion ($p=.02$) and blending ($p=.04$). A 3-way ANOVA also indicated that the 5-year old bilingual children had significantly better onset-rime ($p<.0001$), initial sound identification ($p<.0001$) and rhyme detection ($p<.005$), compared to the monolingual mandarin group. Also, 6-year-old bilinguals had significantly better onset-rime ($p<.0003$), initial sound identification ($p<.0001$), rhyme detection ($p<.0001$) and tone discrimination ($p<.0003$), compared to 6-year-old Mandarin monolinguals. Although appropriate ANOVA analyses were conduced, a Tukey's post-hoc analysis was not used to control for unequal group sizes.

Results from the PPVT-III indicated that the bilingual children were stronger in Mandarin than in English. Therefore, compared to monolingual children, bilinguals demonstrated some stronger PA skills in both their stronger and weaker languages. The authors concluded that, amongst 5 and 6-year-old children, exposure to two languages may be advantageous in the development of some PA skills.

Marinova-Todd and colleagues (2010) presented a well-formulated and testable research question. They used some appropriate statistical analyses to assess differences between groups, but failed to report on analyses to control for group size and multiple comparisons. However, failure to assess homogeneity of groups, and failure to control for confounding variables means that the validity of the results cannot be assured. Overall, this study provided suggestive evidence that bilingual children may develop stronger PA skills in both their languages.

Chen and colleagues (2004) designed two experiments to compare the PA skills of 105 monolinguals (Mandarin) and 170 bilinguals (Cantonese-Mandarin). Experiment 1 compared Gr. 2 and Gr. 4 students on tone, rime and onset awareness, using less-confusable words (no shared features between languages) and more-confusable words (containing shared features). A 3-way ANOVA revealed that groups did not differ in tone awareness skills. Onset and rime awareness were analyzed using 4-way repeated measures ANOVAs. In Gr. 2, bilinguals outperformed monolinguals for onset awareness of less-confusable words ($p<.01$), an advantage that had disappeared by Gr. 4 . In Gr. 2, groups did not differ for onset awareness of more-confusable words. However, in Gr. 4, monolinguals were significantly stronger ($p<.01$). For rime awareness, bilinguals were significantly stronger in Gr. 2 on less-confusable words, ($p=.03$) an advantage that was not present in Gr. 4. No group differences were found in Gr. 2 for more-confusable words. However, in Gr. 4, monolinguals were significantly stronger on more-confusable words.

A second experiment was designed to include Gr. 1 students, and to examine the effect of pseudo-words. In this second experiment, the authors compared family education and curriculum, with no significant between-groups differences found for either. Tone, onset and rime were compared using shared words, mandarin-only words, and pseudo-words. Appropriate ANOVA analyses were conducted. Bilinguals had greater tone awareness than monolinguals for shared words and pseudowords, in Gr. 1 ($p<.01$) and Gr. 2 ($p<.01$). However, this bilingual advantage had disappeared by Gr. 4. For onsets of shared words, groups were similar in Gr. 1. Bilinguals were stronger than monolinguals in Gr. 2 ($p<.01$), an advantage that had disappeared by Gr. 4. For Mandarin-only onsets, groups were similar in Gr. 1 and Gr.2, but monolinguals were significantly

stronger in Gr.4 ($p<.01$). For rimes of shared-words, bilinguals were stronger than monolinguals in Gr.2 ($p=.01$) and Gr.4 ($p=.02$).

The authors concluded that there does appear to be a bilingual advantage to PA in early grades. They argued that bilingualism was indeed a critical factor, as language groups had distinctly different patterns of PA development. They argued that, as bilinguals become fluent in a second language, their PA skills develop at an advanced rate, compared to monolinguals. However, by Gr. 4, groups were mostly equivalent, indicating that the bilingual advantage is not likely a permanent one.

Well-formulated research questions were examined with appropriate methodology and analyses. However, the authors did not report using Tukey's post-hoc analysis to control for unequal group sizes. Experiment 1 failed to control for family education levels, which may have inserted a nuisance variable. The authors did not ensure homogeneity of groups at baseline, nor did they report whether groups differed significantly in age, language ability, or non-verbal intelligence. The authors did not report whether children with speech and language difficulties were included in the groups. These factors may have introduced confounding variables that could have affected the validity of the results. The evidence is considered suggestive.

Discussion

Currently, the literature appears to lack compelling evidence that bilingual and monolingual children have differing PA abilities. This review presented suggestive and minimally suggestive evidence both for, and against, a bilingual advantage. Laurent and Martin (2010) found a bilingual advantage for some, but not all tasks, and in some, but not all grades. Kuo and Anderson (2010) found a kindergarten bilingual advantage for particular language features, but noted that this disappeared by Gr. 1. Similarly, Chen and colleagues (2004) found a bilingual advantage in early grades, disappearing by Gr. 4. Others, (Bialystok et al., 2003; Jackson et al., 1998) found no differences in PA between bilinguals and monolinguals, whereas Marinova-Todd and colleagues (2010) did find a bilingual advantage of PA in children's first and second languages. Thus, no consensus has yet been identified in the literature.

The study designs included here constitute level 2b evidence, which can only be considered suggestive at best. However, gold standard methodology, that is to say randomized-control trials, cannot be utilized for these purposes, as random assignment to age group, grade and language status is not possible. As such, the studies utilized the best available designs. However, several common flaws weakened the resulting evidence.

Failure to control for nuisance variables was a common flaw across all studies. All but one study (Laurent & Martin, 2010) failed to ensure that the groups did not differ on such important characteristics as nonverbal intelligence, socioeconomic status, and family attitudes to literacy. Lack of experimenter blinding to both the purpose of the study and to the children's language status was also common to all studies. Small sample sizes, and recruitment from limited test sites, were also common features across the studies, which may reduce the validity and reliability of any conclusions. All studies failed to report the results of a power analysis and effect size. Without this data, the reader is unable to assume whether the sample size was adequate to reject the null hypothesis.

Furthermore, none of the studies had stringent criteria, such as screening or assessment protocols, to prevent the inclusion of children with speech and language difficulties. Some studies failed to report any criterion, while others (Jackson et al., 1998; Marinova-Todd et al., 2010) used inadequate ones, such as teacher report or consultation of student records.

Conclusion

The studies in this review all focused on particular language groups. Consequently, results cannot be generalized beyond the particular language combinations studied, as of yet preventing a generalized understanding of bilingualism and PA.

Clinical Implications

In an increasingly multicultural society, the topic of bilingualism in early literacy and PA is of great importance. However there is no conclusive evidence to date indicating clear differences in PA between bilingual and monolingual children. However, available evidence suggests that clinicians need nonetheless be aware of the potential for such differences. Future research could attempt to:

- Control for extraneous variables such as socioeconomic status, length of exposure to bilingualism, family education, and family attitudes towards literacy
- Extend longitudinal focus to include early childhood and pre-literacy years
- Examine treatment outcomes of bilingual and monolingual children with identified PA difficulties.

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