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Normative Nasalance Values in a Population of French-Speaking Children

Normalisation des scores de nasalance recueillis au sein d'une population d'enfants francophones

Jelena Todic
Karen Sanguinetti
Igor Leuchter

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Jelena Todic, Karen Sanguinetti, and Igor Leuchter

Service d'oto-rhino-laryngologie et de chirurgie cervico-faciale, Hôpitaux universitaires de Genève, Genève, SUISSE

Faculté de Médecine, Université de Genève, Genève, SUISSE

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David H. McFarland

Abstract

Normative nasalance scores are essential for diagnosis and clinical follow-up. This research was conducted to establish a European French language protocol for nasometry and determine normative nasalance values for European French-speaking children. One hundred and seven French-speaking children aged 5–14 years (mean age, 9 years) with normal speech were included in this prospective study. Participants were asked to repeat different oral and nasal sounds (phonemes, words, sentences, and logatomes) and speech samples were recorded using a Nasometer II model. Normative nasalance values were measured with the Nasometer II model, including differences due to age, gender, context, and first language. Mean nasalance scores were 17% (95% CI, 6–39) for oral words, 13% (5–29) for oral sentences, 71% (50–84) for nasal words, and 63% (37–80) for nasal sentences. A significant effect of age on nasalance ($p < .05$) was observed with the highest scores in the youngest children, aged 5–6 years. There was no significant gender or mother tongue effect on nasalance scores. Nasalance values of oral speech samples were comparable with those reported for other languages. Findings indicated that our protocol is a simple and rapid-to-use tool that is applicable for French-speaking children in order to determine normative nasalance values. It can be recommended as an evaluation tool, as well as a quality control, following surgery and/or speech therapy.

Abrégé

La normalisation des scores de nasalance est essentielle pour le diagnostic et le suivi clinique. Les objectifs de la présente étude étaient de développer un protocole de nasométrie pour le français européen et d'établir des normes pour les scores de nasalance y étant recueillis auprès d'un échantillon d'enfants européens francophones. Cent sept enfants francophones âgés de 5 à 14 ans (âge moyen = 9 ans) et ayant une parole normale ont été inclus dans la présente étude prospective. Il leur a été demandé de répéter différents sons oraux et nasaux (phonèmes, mots, phrases, logatomes) et des échantillons de leur voix ont été enregistrés à l'aide d'un nasomètre (modèle II). Les normes pour les scores de nasalance ont été établies en tenant compte des différences dues à l'âge, au sexe, au type de son (oral ou nasal) et à la langue maternelle. Les scores moyens de nasalance étaient de 17 % (intervalle de confiance à 95 % = 6 %–39 %) pour les mots ne contenant que des phonèmes oraux, 13 % (intervalle de confiance à 95 % = 5 %–29 %) pour les phrases ne contenant que des phonèmes oraux, 71 % (intervalle de confiance à 95 % = 50 %–84 %) pour les mots contenant une proportion élevée de phonèmes nasaux et 63 % (intervalle de confiance à 95 % = 37 %–80 %) pour les phrases contenant une proportion élevée de phonèmes nasaux. Un effet significatif de l'âge a été observé sur les scores de nasalance ($p < 0,05$), les scores les plus élevés étant été observés chez les enfants plus jeunes (c.-à-d. chez les enfants âgés de 5 à 6 ans). Aucun effet significatif du sexe ou de la langue maternelle n'a été observé sur les scores de nasalance. Les scores de nasalance obtenus pour les mots ou phrases ne contenant que des phonèmes oraux étaient comparables à ceux obtenus dans d'autres langues. Les résultats indiquent que le protocole présenté dans la présente étude est simple et rapide et qu'il est applicable auprès d'enfants francophones pour déterminer les scores de nasalance. Il s'agit d'un outil pouvant être recommandé pour évaluer et faire un suivi de la qualité de la parole des enfants en contexte postopératoire et en orthophonie.

Hypernasality, also referred to as hypernasal speech, hyperrhinolalia, or *Rhinolalia aperta*, is an abnormal proportion of sound energy emerging from the nasal resonators as the consequence of congenital or acquired velopharyngeal dysfunction (VPD). Hypernasality accompanies oral vowels and consonants and gives rise to an abnormal nasalized voice quality and low volume in speech production. In contrast to hypernasality, hyponasality implies a diminished sound energy emerging through the nose during the production of nasal phonemes. Mixed resonance, hypernasal and hyponasal, is a combination of nasal obstruction and VPD (Kummer, 2011; Leuchter, 2015). Resonance disorders may be associated with articulation disorders and loss of intelligibility (Delvaux, 2009).

The assessment of hypernasality is the key task and most challenging aspect of the evaluation of VPD patients. As with the evaluation of voice disorders, acoustic-perceptual assessment is essential and remains the gold standard evaluation method. However, perceptual assessment has its limitations and may be a source of error, e.g., due to expertise of the judges, different internal standards of listeners (Kreiman et al., 1993), or confounding effects such as misarticulations or delayed language development (Keuning et al., 2002). There is consensus in the literature about the necessity of both objective tests and subjective assessment techniques for the evaluation of nasality (Bettens et al., 2018; Hirschberg, 1983). Nasality is a complex phenomenon, and its measure is not linearly related with velopharyngeal opening or even with perceived hypernasality (Hirschberg & Van Demark, 1997). It is influenced by various factors that can be speaker-related or due to technical specificities (Henningsson et al., 2008; Lewis et al., 2000).

There are simple clinical tests to observe nasal air loss during phonation, such as the Glatzel mirror test and the Gutzmann test (Gutzmann, 1913). The latter is simple to perform: The patient is asked to produce held vowels such as /a/ and /i/, with and without pinching the nose. A difference in sound perceived between the two conditions is an indicator of poor velopharyngeal closure. Instrumental evaluation of nasalance includes mainly nasofibroscopy, videofluoroscopy, aerophonometry, and nasometry (de Stadler & Hersh, 2015; Leuchter, 2015;). Nasofibroscopy allows, by means of a flexible optical fibre, the physician to observe the closure of the velopharynx directly from the nasopharynx (Glade & Deal, 2016). Videofluoroscopy is a radiologic exam that allows visualization of the velopharynx in different three-dimensional planes at rest or when closing (Lipira et al., 2011). Aerophonometry is an aerodynamic measurement of nasality allowing clinicians to calculate a ratio of nasal and oral airflows.

In 1970, Fletcher and Bishop introduced The Oral Nasal Radiometer (TONAR), an acoustic device measuring nasal resonance. Its successors, the Nasometer 6200, 6400, and 6450 (KayPentax), have been commercialized since 1986. The Nasometer consists of a metal plate placed perpendicular to the face at the level of the philtrum, between the base of the nose and the border of the upper lip. Two one-directional microphones separately pick up the nasal and oral acoustic energy within a specified frequency band. The acoustic signal is transmitted to a microprocessor, analyzed by a computer, and visualized on a monitor. The device computes a score, named "nasalance" (Fletcher & Daly, 1976), that reflects the relative amount of nasal acoustic energy in speech. Nasalance is expressed as a percentage and defined as

$$\text{Nasalance (\%)} = \frac{\text{nasal sound energy (dB)}}{\text{(nasal sound energy (dB) + oral sound energy (dB))}} \text{x100}$$

Thus, high nasalance scores can be expected in VPD patients, while low scores are measured in patients with obstruction of the nasopharynx or nasal tract. Nasalance scores depend naturally on the phonetic composition of speech samples. Fletcher et al.'s (1989) measurements of two different speech samples in typical American children illustrated this fact: Nasalance scores were 35.69% for the Rainbow Passage with an equilibrated distribution of nasal consonants and 15.53% for the Zoo Passage that is free of nasal consonants. Importantly, the protocol must be adapted to the patient's language to be correctly used in clinical practice.

Two similar instruments have been developed: NasalView (Tiger Electronics) and OroNasal System (Glottal Enterprises; Bressmann et al., 2006). The OroNasal System measures nasalance in a manner comparable to the Nasometer and NasalView but its microphones are sensitive to the airflow coming from the mouth and the nose, creating artefacts. The three systems measure nasalance in different ways and provide nasalance scores that are not interchangeable (Bressmann, 2005). In the literature, the Nasometer remains the gold standard in the evaluation of nasalance: Several advantages have been described: (a) it is an objective noninvasive measure that provides numerical values (Seaver et al., 1991); (b) users can obtain fast results in real time, even with small children (van der Heijden et al., 2011a; Sweeney et al., 2004); (c) it is a tool in speech therapy for visual feedback (van der Heijden et al., 2011a); (d) it allows for objectifying a patient's progress; and (e) it has significant correlation with perceptual evaluation (Hirschberg et al., 2006).

However, nasometry has its limitations. In a study where Dalston et al. (1991) assessed 514 patients aged 3 to 56 years perceptually (clinical evaluation of hypernasality by an experimenter) and instrumentally (nasometric evaluation), they suggested that nasometry reaches its optimal clinical utility when used in conjunction with clinical judgment; its utility decreases when used as a single method. Further, Vallino-Napoli and Montgomery (1997) pointed out that the scoring of nasalance has limitations when comparing different languages, concluding that the Nasometer should always be used as a complement to clinical evaluation. Finally, although the Nasometer is a useful tool for evaluation of hypernasality, there are still controversies over its usefulness for other nasal resonance problems such as hyponasality (Anderson, 1996).

The aims of this study were to establish a protocol for nasometry adapted in French and to determine normative nasalance values for European French-speaking children as measured with the Nasometer II model, including differences due to age, gender, context, and first language.

Method

The Institutional Review Board at the University Hospital Geneva approved our research on May 14, 2014 (ethical number: 80514).

Participants

We recruited 111 children from Geneva, the French part of Switzerland, aged 5 to 14 years, selected among three school levels and three age categories: 5–6 years (Grade 2), 8–10 years (Grade 6), and 12–14 years (Grade 10). Sample size was based on the recommendations of the International Federation of Clinical Chemistry to determine the range of normality for the values, defined between 0.025 and 0.975 percentiles (Poulsen et al., 1997). Parents of all children completed informed consent and an inclusion questionnaire with medical and demographic data. Inclusion criteria included European French-speaking children schooled in Switzerland with normal speech according to teachers' evaluation. Exclusion criteria were hypernasality or hyponasality, non-French speakers, speech and language disorders, previous surgery for cleft palate or facial malformation, syndromic diseases and craniofacial malformations, acute infection of the upper airway, or hearing impairment. Eleven patients had simple otolaryngologic surgeries: adenoidectomy (n = 5), tonsillectomy (n = 4), transtympanic drains (n = 2)—and were excluded. A first language different from French was not an exclusion criterion.

To exclude VPD participants, we performed the Gutzmann test (Gutzmann, 1913) as a first screening test; that is, each participant was asked to produce a series of /a/ and /i/ alternately with the nares opened and closed. A change in sound quality when the nares were closed indicated the existence of hypernasality. A recording of the voice counting from 1 to 10 was then conducted and later evaluated by a phoniatrician and speech-language therapist to exclude hypernasal or hyponasal speech.

Nasometry Assessment Protocol

Following acoustic-perceptual assessment, nasometry was performed using a Nasometer II model, version 3.3.3, which was installed on a laptop. A Nasometer consists of a metal plate slightly curved with two microphones, one on the upper side and another on the lower side. The plate is positioned against the participant's upper lip and is maintained by a helmet which must be adjusted on the head. Sidebars that connect the helmet to the plate were adjusted for each child so that the latter remained perpendicular to the vertical half of the face. We calibrated the Nasometer according to the manual's (Kay Pentax) recommendations. The upper microphone recorded a nasal sound wave and the lower microphone recorded an oral sound wave. Recordings were done in a quiet room in a seated position. Children were verbally instructed to repeat the sounds (phonemes, words, sentences, logatomes) the examiner pronounced. The audio recording and nasometric measures were done simultaneously, always with the same recorder distance (30–40 cm) and a natural speaking intensity. Recordings were completed successfully in 5 to 10 minutes. When an error occurred, the experimenter repeated the complete item. The same experimenter always evaluated the repeated session.

Data processing was done using the Nasometer software. Each item was associated with an acoustic signal represented by a curve as a function of time (on the x-axis) and of the percentage of nasalance (on the y-axis). Each item of our protocol was treated individually, with the same procedure. First, we selected the most stable part of the signal to analyze. We used the statistics function on the laptop to get numeric values and entered data in an SPSS file: mean nasalance (mean), minimal nasalance (min), maximal nasalance (max), duration of the selected signal (time range), precise moment of the start of the signal selected in seconds (start), and precise moment of the end of the signal (end).

Speech samples used in the protocol are known to influence nasalance results and their selection is particularly important in cross-language studies (Lewis et al., 2000; Watterson et al., 2005). Three types of stimuli are generally used to assess nasalance: oral sentences or texts which avoid nasal coarticulation (Lee & Browne, 2013; Mishima

et al., 2008; Seaver et al., 1991); nasal sentences or texts which allow closed rhinolalia evaluation (Lee & Browne, 2013; Seaver et al., 1991); and mixed sentences or mixed texts (containing both oral and nasal phonemes) which are representative of conversational speech, but provide no additional clinical information compared to other contexts (Dalston & Seaver, 1992). In English, three short texts usually serve as a standard protocol: the Zoo Passage which is devoid of nasal phonemes (oral text), the Rainbow Passage which contains 11.5% nasal phonemes (mixed text), and nasal phrases which contain 35% nasal phonemes (nasal text; Mayo & Mayo, 2011).

We designed our protocol based on those described in the literature (Abou-Elsaad et al., 2012; Anderson, 1996; Brunnegård & van Doorn, 2009; Falé & Hub Faria, 2008; Hirschberg et al., 2006; Lee & Browne, 2013; Lehes et al., 2018; Nichols, 1999; Okalidou et al., 2011; Putnam Rochet et al., 1998; Sweeney et al., 2004; van der Heijden et al., 2011b; Van Lierde et al., 2001; Whitehill, 2001). We followed specific principles for constructing speech samples to facilitate comparison across languages. To find the most appropriate speech materials, we based our protocol on Henningson et al.'s (2008) speech sampling guidelines. Specifically, single words containing only one vowel and both high and low vowels were sampled, all test words contained only one type of target pressure consonant per word and were sampled in different positions of occurrence in French, and words did not contain nasal consonants. Sentences included all vowel types relevant for European French, focusing on one pressure consonant target only, with at least one consonant from each of the pressure consonant categories. French has 38 phonemes: 16 vowels, 19 consonants, and three semi-vowels. A majority of phonemes are oral: 12 vowels (/a, ɑ, ə, ø, œ, e, ɛ, i, o, ɔ, y, u/) and 15 consonants (/b, s, k, d, f, g, ʒ, l, p, ʁ, t, v, z, ʃ, h/). Only eight are nasal phonemes: four vowels (/ɑ̃, ɔ̃, ɛ, œ̃/) and four consonants (/m, n, ɲ, ŋ/). Our protocol was designed to take into consideration the characteristics and peculiarities of French with phonetically well-balanced verbal stimuli, summarized in **Table 1**: five isolated oral vowels; three isolated nasal vowels, 14 oral words with a target consonant (/p, t, k, b, d, g, f, s, ʃ, v, z, ʒ, l, ʁ/), and two nasal words with a target consonant (/m, n/). We designed our sentences in three ways: oral (containing only oral phonemes), mixed (with oral and nasal phonemes in same proportion), and nasal (with high proportion of nasal phonemes). Our protocol involved seven oral sentences (0% of nasal phonemes); two nasal sentences (45.8% of nasal phonemes); one mixed sentence (11.76% of nasal phonemes); and three logatomes. Logatomes were designed including occlusives /p, t, k/ and fricatives /f, s, ʃ/ and /v, z, ʒ/. Finally, children were asked to repeat oral and nasal vowels in an alternating manner: /a/–/ã/, /e/–/ɛ̃/, and /o/–/õ/. The phonetic content of stimuli was carefully matched by the distribution of oral and nasal vowels. One passage was carried out with each participant.

Statistical Analyses

All data were analyzed with the Nasometer's software to obtain mean nasalance scores. Descriptive statistics were presented as the mean rate of nasalance, with the 95% confidence interval (CI) corresponding to the minimal and maximal values. Data were transcribed in an Excel table. We analyzed four variables which could influence nasalance scores: age, gender, context, and first language. Children were stratified into three age groups with a balanced number of participants. Statistical analyses were performed using SPSS software, v. 22.0. An analysis of variance test

Table 1

Design and Illustration of Verbal Stimuli Used in Our Protocol

Speech stimuli	Number	Illustration
Oral vowels	5	/a/, /e/, /i/, /o/, /u/
Nasal vowels	3	/ã/, /ɛ̃/, /õ/
Oral words	14	"papier," "tatou," "cacao," "baobab," "dodu," "gaga," "foufou," "saucisse," "chou-chou," "vive," "zazou," "joujou," "lilas," "arrière"
Nasal words	2	"mamie" et "nana"
Oral sentences	7	t'es pas cap, boule de glace, elle se fâcha, je vais au zoo, alors relis-le, le coq fait cocorico, apporte le petit pot
Nasal sentences	2	une nuit en montagne, un grand pain rond
Mixed sentences	1	Pierre a mangé tout le gâteau
Logatome	3	Pa-ta-ka, fa-sa-cha, vi-zi-ji

was performed to assess the impact of the age factor. An independent samples *t*–test was carried out to compare the mean nasalance scores for oral and nasal words according to gender. A two-factor analysis of variance test was then performed to compare nasalance scores as a function of the context (oral versus nasal) and gender (boys versus girls). An independent samples *t*–test was performed to compare nasalance scores of all items combined according to the child's first language (French versus other languages). The significance level was set at $p = .05$.

Results

We analyzed recordings from 111 children (48 boys and 63 girls). Four participants were excluded after perceptive analysis: two presented with slightly hypernasal speech, one had an acute nose obstruction, and one had data that was not interpretable. Thus, 107 children (mean age = 9 years) were included for the nasalance measures. Demographic data are summarized in **Table 2**. Thirty (28%) children were in Grade 2, 42 (39%) in Grade 6, and 35 (33%) in Grade 10. Among our group, 74% of the children had European French as their first language and 26% had another mother tongue: Portuguese ($n = 8$), Spanish ($n = 5$), Arabic ($n = 5$), Albanian ($n = 3$), Italian ($n = 2$), English ($n = 1$), Swedish ($n = 1$), Serbo-Croatian ($n = 1$), Thai ($n = 1$), Chinese ($n = 1$), and Japanese ($n = 1$). Regarding the language spoken at home, 94% spoke European French and 63% spoke a second language other than French: Spanish ($n = 14$), Italian ($n = 14$), Portuguese ($n = 13$), Arabic ($n = 8$), English ($n = 4$), Albanian ($n = 3$), German ($n = 2$), Serbo-Croatian ($n = 2$), Lingala ($n = 1$), Creole ($n = 1$), Swedish ($n = 1$), Thai ($n = 1$), Vietnamese ($n = 1$), Chinese ($n = 1$), and Japanese ($n = 1$).

Our results showed mean nasalance scores of 16% (3–46) for oral vowels, 69% (40–96) for nasal vowels, 17% (6–39) for oral words, 13% (5–9) for oral sentences, 71% (50–84) for nasal words, and 63% (37–80) for nasal sentences. Nasalance scores with their mean and CIs are summarized in **Table 3**. We observed a significant effect of age and school grade level on nasalance ($p < .05$), with the highest scores in children in Grade 2 (5–6 years; $M = 19\%$) compared to those in Grade 6 (8–10 years; $M = 15\%$). The effect of age was mostly present for isolated oral vowels. Gender nasalance scores were not significantly different ($p = .394$). The context of nasality and first language ($p = .764$) did not influence nasalance scores.

Discussion

Our findings showed a mean nasalance score of 13% for oral sentences and 14.5% for computed oral vowels, words, sentences, and logatomes. The nasalance values of oral speech samples were comparable with those reported for other languages, such as English, Finnish, Greek, and Swedish (Haapanen, 1991; Kavanagh et al., 1994; Van Doorn & Purcell, 1998), but scores for the nasal words and sentences were much higher due to the high proportion of nasal phonemes in the chosen samples. We found significantly higher nasalance scores for oral stimuli in the group of youngest children. The age effect could be due to acoustic factors. Young children have a high fundamental frequency that can sometimes be close to the lower end of the acoustic filters used by the Nasometer (Delvaux, 2012). Mayo and Mayo (2011) attributed this difference to a change in the neuromuscular control of the velum resulting in the enlargement of the vocal tract during growth. Indeed, growth and involution of adenoids over the years influence vocal resonance. However, other studies have observed no significant effect of age on nasalance scores (Brunnegård & van Doorn, 2009; Mayo & Mayo, 2011). We found no effect of gender for each of the age categories tested, which is consistent with the literature (Litzaw & Dalston, 1992). With regard to the first language , there was no significant effect on nasalance scores, which could suggest that our measures are applicable even in children with French as a second language.

One limitation of our study is that a variety of first languages other than French were combined into the same group. In clinical practice, we cannot affirm that a child with a first language different from French could be expected to perform within the norms established here. Nasalance scores have been reported to vary with speaker regional dialect when the same reading passage is used. Leeper et al. (1992) described the presence of regional dialectal variations for nasalance among speakers of Canadian English. Seaver et al. (1991) studied the influence of dialect on nasalance in English-speaking participants from four different geographic regions of the United States and Canada (Illinois, North Carolina, Alabama, and Ontario); he concluded that

Table 2

Demographic Data and Distribution of Participants

Variables	Values
Male:female ratio	46:61
Mean age (years)	9

Table 3

Summary of Mean Nasalance Scores With Confidence Interval

Verbal stimuli	Mean nasalance in % (95% CI)
Oral vowels	16 (3–46)
/a/	11 (3–33)
/e/	16 (5–44)
/i/	30 (14–55)
/o/	9 (2–28)
/u/	16 (5–36)
Nasal vowels	69 (40–96)
/ã/	55 (39–75)
/ɛ̃/	65 (49–91)
/õ/	82 (54–96)
Oral words	17 (6–39)
Nasal words	71 (50–84)
Oral sentences	13 (5–29)
Nasal sentences	63 (37–80)
Mixed sentences	26 (15–37)
Oral logatomes	15 (4–38)

participants from North Carolina had a higher nasalance score when compared to other regions. According to Kummer (2011), dialect differences mainly concern vowels. Mayo et al. (1996) hypothesized that differences between dialects are explained by difference in closing time of the soft palate during the transition between nasal consonants and vowels. Finally, several studies in the literature suggested that differences in nasalance scores according to dialect were not clinically significant (Mayo & Mayo, 2011; Mayo et al., 1996; Putnam Rochet et al., 1998; Seaver et al., 1991).

We performed measurements in only one passage. According to several studies, there was no significant difference between two successive passages for children without language disorders, which was the case with our cohort. For children with language disorders, a difference of up to 5% has been reported (Watterson et al., 2005).

Nasometry is a popular tool and easy to use, even with small children. The usefulness of this instrumental assessment depends on correlation with acoustic-perceptual evaluation of nasality. Several authors have reported good or moderate correlation between instrumental and perceptual assessment (Fletcher & Bishop, 1970; Hirschberg et al., 2006). Even though the Nasometer is considered the gold standard for the clinical diagnosis of VPD, there is variation in nasalance scores attributed to intraspeaker variability and variability in successive recording conditions (Sweeney et al., 2004, Watterson et al., 2005). With the introduction of new models of the Nasometer, there is also a between-machine variation (Kummer, 2011; Watterson et al., 2005).

Nasometry Normative Data

To the best of our knowledge, this is the first nasalance standard established in a large population of European French-speaking children. A previous study reported normative values of nasalance in a mixed-age Canadian French speaking population (Putnam Rochet et al., 1998). There is a significant difference in nasalance norms among languages including speaker-specific factors (idiosyncrasies), age-related and gender-related factors, and linguistics and dialectal factors. Nasalance scores are also a function of the linguistic material included in the protocol, which can vary across studies investigating the same linguistic community. A number of studies in different languages have been conducted to determine the normative values of nasalance in normal speakers (Abou-Elsaad et al., 2012; Anderson, 1996; Brunnegård & van Doorn, 2009; Falé & Hub Faria, 2008; Hirschberg et al., 2006; Lee & Browne, 2013; Lehes et al., 2018; Nichols, 1999; Okalidou et

al., 2011; Putnam Rochet et al., 1998; Sweeney et al., 2004; van der Heijden et al., 2011b; Van Lierde et al., 2001; Whitehill, 2001) and are summarized in **Table 4**.

The first conclusion to be drawn from these studies is that nasalance scores depend on the speaker's native language. This may be explained by the different proportion

Table 4

Means for Nasalance Scores in French and Other Languages

Language	Author	Year published	*N*	Age (years)	Gender	Mean nasalance (in %): Oral	Mean nasalance (in %): Mixed	Mean nasalance (in %): Nasal
English USA	Seaver et al.	1991	148	16–63	Both	16 (T)	36 (T)	62 (S)
English Canada	Kavanagh et al.	1994	52	18–33	Both	13.4 (T)	37.1 (T)	65.4 (S)
English Canada	Putnam Rochet et al.	1998	315	9–85	Both	11.3/11.5 (T)	32.9/34.5 (T)	61.6/62.7 (T)
French Canada	Putnam Rochet et al.	1998	153	9–85	Both	11.5/12.4 (T)	26/28.3 (T)	35.5/38.5 (T)
English Ireland	Sweeney et al.	2004	70	4–13	Both	14 (S)	16 (S)	51 (S)
English Ireland	Lee and Brown	2013	60	18–28	Both	11.5 (T)	29.6 (T)	47.6 (S)
Australian	Van Doorn and Purcell	1998	245	4–9	Both	13.1 (T)	–	59.6 (T)
Cantonese	Whitehill	2001	141	21	Both	16.79 (S)/13.68 (T)	35.46 (T)	55.67 (S)
Finnish	Haapanen	1991	58	21	Both	13.6 (T)	–	69.4 (S)
Japanese	Tachimura	2000	100	24	Both	9.1 (S)	–	–
Japanese	Mishima et al.	2008	68	23.5	Both	10.3/15.6 (T)	–	–
Spanish (Puerto Rican)	Anderson et al.	1996	40	21–43	Both	21.95 (T)	36.02 (T)	62.07 (S)
Spanish (Mexican)	Nichols	1999	152	8–40	Both	17.02 (S)	–	55.28 (S)
Swedish	Brunnegård and van Doorn	2009	220	9	Both	12.7 (S)	29.5 (S)	56.5 (S)
Thai	Prathanee	2003	188	9.5	Both	14.3 (T)	35.6 (T)	51,1 (T)
Flemish	Van Lierde	2001	58	19–27	Both	10.9 (T)	33.8 (T)	55.8 (T)
Dutch	Van der Heijden	2011b	55	4–6	Both	11(T)	27 (T)	–
Hungarian	Hirschberg	2006	30	5–25	Both	11(S)	31.7 (S)	–
Portuguese	Falé and Hub Faria	2008	25	19–27	Both	10 (T)	–	44(T)
Arabic	Abou-Elsaad et al.	2012	300	3–54	Both	29/33 (S)	–	77/75 (S)
Greek	Okalidou et al.	2011	80	18–34	Both	12.4 (T)	25.5 (T)	42 (T)
French (European)	**Our data**	**2022**	**107**	**5–14**	**Both**	**13 (S)**	**26 (S)**	**63 (S)**

Note. T = text; S = sentences; USA = United States of America

of phonemes in each language and by the presence of nasalized vowels in some languages, as in French /ã, ɛ̃, õ/. It follows therefore that standard passages should be developed for each language. In addition, studies show that not only different languages, but also regional dialects (Brunnegård & van Doorn, 2009; Kavanagh et al., 1994) may influence nasalance scores. Nasalance norms must then be determined for each language and each region.

Our study aimed to establish nasalance norms for European French and had some limitations. First, in our protocol for recordings, children were instructed to keep the recommended distance and the same experimenter did the evaluation. Nevertheless, no external control of intensity was performed. Also, children were evaluated on a single passage. Although other studies have found that a second passage does not result in different values, multiple repetitions would have been a better approach. The size of our sample (N = 107) is a respectable number in comparison with other previous studies; however, it seems quite limited to really assess the effect of age, gender, and bilingualism.

Future Directions and Clinical Implications

The main use of nasalance scores is to evaluate the quality of surgical or conservative treatment in cleft palate patients and its progress over time (Vallino-Napoli & Montgomery, 1997). However, nasometry measures are useful for supplementing the speech-language therapist's perception of hypernasal resonance in patients with VPD (Dalston et al., 1991). Nasalance scores and perceptual ratings of nasality are complementary and should be used together for a better reproducibility of results over time (Sweeney & Sell, 2008). Nasometry is considered an acoustic-instrumental assessment of hypernasality and may be used as a diagnostic or monitoring tool after surgery or speech therapy. It may also be useful to compare results from one centre to another or to help clinicians in borderline cases. For all these uses, the determination of cut-off scores is essential to applying the Nasometer in medical practice and decide when nasalance is normal or abnormal. However, as Dalston et al. (1991) highlighted, any treatment decision should be based upon cumulative evidence gathered from various sources, including instrumental assessment and clinical perceptual evaluation.

Conclusion

Nasometry implies normative nasalance scores specific to every language. In the present study, we report a nasometric protocol that is simple, rapid-to-use, and applicable for all children, irrespective of their first language. This protocol can be recommended as an evaluation tool, as well as a quality control following surgery and/or speech therapy. The evaluation of VPD, particularly resonance and speech assessment, remains challenging and the choice of therapy will essentially depend on the type and severity of the clinical manifestations and patient expectations. Instrumental assessment of nasality by nasometry is one of the cornerstones of this evaluation.

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Authors' Note

Correspondence concerning this article should be addressed to Jelena Todic, Hôpitaux universitaires de Genève, 4 Rue Gabrielle Perret-Gentil 1211 Geneva 14, Switzerland. Email: **jelena.todic@hotmail.ch**

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Processing-Dependent Measures Sensitive to Language Performance Differences in Arabic-Speaking English Language Learners Compared to Children with Developmental Language Disorder

Mesures de traitement de l'information sensibles aux différences de performances langagières des apprenants de langue anglaise arabophones lorsque comparées à celles d'enfants ayant un trouble développemental du langage

Areej M. A. Balilah
Lisa M. D. Archibald

KEYWORDS

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PROCESSING-DEPENDENT MEASURES

Areej M. A. Balilah[1] and Lisa M. D. Archibald[2]

[1] Childhood Studies, King Abdulaziz University, Jeddah, SAUDI ARABIA

[2] School of Communication Sciences and Disorders, The University of Western Ontario, London, CANADA

Editor-in-Chief:
David McFarland

Abstract

To address concerns regarding the utility of language measures that depend on linguistic knowledge to distinguish English language learners from those with developmental language disorder, this study compared the performance of Arabic-speaking English language learners with diverse language experiences to the performance of age-matched monolingual children with and without developmental language disorder on processing-dependent measures. The group of 6- to 9-year-old English language learners (n = 59) whose first language was Arabic, and who had been learning English as the language of instruction in Canada, and two monolingual groups from Saudi Arabia, typically developing Arabic-speaking children (n = 369) and Arabic-speaking children with developmental language disorder (n = 52), completed processing-dependent measures of short-term and working memory. No differences were found between the groups of English language learners and typically developing children on the short-term and working memory measures, with the exception of the Arabic nonword repetition task. The performance of the English language learners group was comparable to that of the Arabic-speaking children with developmental language disorder group on the Arabic nonword repetition task and significantly lower than the typically developing group. The English language learners group scored significantly higher than the typically developing and Arabic-speaking children with developmental language disorder groups on only the digit recall subtest. The findings suggest that processing-dependent measures may be valid assessment tools that minimize the role of linguistic knowledge and experiences.

Abrégé

Afin de répondre aux réserves relatives à l'utilité des mesures langagières qui dépendent des connaissances linguistiques pour distinguer les apprenants de langue anglaise ayant un trouble développemental du langage et de ceux qui n'en ont pas, la présente étude a comparé les performances à des mesures reposant sur le traitement de l'information d'apprenants de langue anglaise arabophones ayant différentes expériences linguistiques avec celles d'enfants unilingues appariés sur l'âge avec et sans trouble développemental du langage. Les mémoires à court-terme et de travail d'un groupe d'apprenants de langue anglaise âgés de 6 à 9 ans (n = 59) dont la langue maternelle était l'arabe et dont la langue d'enseignement était l'anglais, ainsi que deux groupes d'enfants arabophones unilingues habitant en Arabie Saoudite (c.-à-d. un groupe de 369 enfants au développement typique et un groupe de 52 enfants ayant un trouble développemental du langage) ont été évaluées. Aucune différence n'a été relevée entre les performances du groupe d'apprenants de langue anglaise et du groupe d'enfants au développement typique aux mesures de mémoires à court terme et de travail, exception faite entre les performances de ces enfants à la tâche répétition de non-mots arabes. La performance du groupe d'apprenants de langue anglaise s'est révélée comparable à celle du groupe d'enfants arabophones ayant un trouble développemental du langage à la tâche de répétition de non-mots arabes et significativement inférieure à celle du groupe d'enfants au développement typique. Uniquement à la tâche de répétition de chiffres, le groupe d'apprenants de langue anglaise a obtenu des scores significativement plus élevés que les groupes d'enfants arabophones au développement typique et ayant un trouble développemental du langage. Les résultats suggèrent que les mesures reposant sur le traitement de l'information pourraient être des outils d'évaluation valides permettant de minimiser l'influence des connaissances linguistiques et des expériences antérieures.

The number of English language learners (ELLs), meaning children whose first language is not English and who attend schools taught in English, is significantly increasing in Canada (Paradis et al., 2010) and the United States (Goldstein, 2004). Identifying children with language disorders in culturally and linguistically diverse communities, such as the United States and Canada, is challenging. On one hand, many studies have found that knowledge-based assessment tools, such as English standardized tests of language, are not accurate in identifying language disorder among ELLs who are in the process of learning English as a second language and have more limited language knowledge than their monolingual peers (e.g., Blom & Boerma, 2017; Chu & Flores, 2011; Sandberg & Reschly, 2011). The reduced language proficiency of ELLs can result in lower reliability and validity of assessments and be a source of measurement error when assessing ELLs (Abedi, 2006). On the other hand, processing-dependent measures, or measures that assess general cognitive abilities, have been hypothesized to contribute to processing and language learning (Park et al., 2021). Such measures probe the abilities supporting language learning and may be less dependent on ELLs' linguistic knowledge (Blom & Boerma, 2017; Park et al., 2021). Studies have investigated the utility of processing-dependent tasks, such as measures of verbal short-term memory, in distinguishing ELLs from children with underlying language impairment (Kohnert et al., 2006; Paradis et al., 2013; Wealer & Engel de Abreu, 2021). The purpose of the current study was to compare Arabic-speaking ELLs with diverse language experiences to children with underlying language impairment, using tests of verbal short-term and working memory.

Children with significant and persistent limitations in their language ability despite average educational and experiential opportunities are referred to as children with developmental language disorder (DLD, also known as specific language impairment; Bishop et al., 2017). The language deficits in children with DLD can affect all areas of language (Stothard et al., 1998), although the profile of language deficits can be unique for each child with DLD. Grammatical deficits in particular have been described as a hallmark deficit in DLD (Leonard et al., 1997). To identify children with DLD, speech-language pathologists (S-LPs) commonly use standardized tests that have been normed with a monolingual population. Children scoring significantly below age expectations on such tests may be identified as having DLD.

Another group of children who may appear to have weak language skills at school is ELLs, that is, those children who are receiving instruction in their second language (English) or in a language other than their minority first language. Research suggests that it can take 4 or 5 years for ELLs to gain English proficiency comparable to their monolingual peers (Hakuta et al., 2000). According to Paradis (2010), there is considerable overlap in the linguistic features of typically developing (TD) ELLs who are in the early stage of developing their second language (within the first two years in particular) and those of monolingual children with DLD, as both groups tend to have errors in vocabulary choice and grammatical morphemes (Tabors, 2008). Receiving instruction in English can also impact ELLs' learning of their first language. Children whose first language is a minority often receive minimal community support in that language, and the opportunities to hear and use it are diminished once they start schooling (Anderson, 2012). As proficiency in ELLs' second language grows, their skills in their first language often do not develop further or even reduce and diminish across time, a phenomenon termed *incomplete acquisition* or *first-language loss* (Anderson, 2012). First-language loss impacts lexical and grammatical systems (Anderson, 2012), two areas of language commonly affected in DLD.

As a result of being in the early stages of English acquisition and potential first-language loss, ELLs may have weak language skills in each of the languages they are learning, which poses challenges when concerns arise regarding language development and language learning. Several studies reported that S-LPs commonly use English norm-referenced standardized tests to assess ELLs' linguistic abilities (Caesar & Kohler, 2007; Gillam et al., 2013). Evidence suggests that administering knowledge-based assessment tools such as English standardized language tests and interpreting scores based on monolingual norms may lead to overdiagnosis of DLD among ELLs (Bedore & Peña, 2008; Klingner & Artiles, 2003).

Even assessment in their first language may underestimate language skills in ELLs. Lexical-semantic knowledge in ELLs is often distributed across languages with, for example, some vocabulary items being experienced mostly at school in English and other vocabulary items experienced mostly at home in the child's first language (Gollan et al., 2008; Pearson et al., 1993; Umbel et al., 1992). The lower frequency of exposure and practice for individual words may result in weaker links between semantic and phonological representations in ELLs (Gollan et al., 2008). As a result, even TD ELLs have been found to score below their monolingual peers on vocabulary measures in both English (e.g., Bialystok et al., 2010) and their first language (Jackson et al., 2014). Indeed, on single language vocabulary measures, TD ELLs often show performance comparable to monolingual children with DLD (Umbel et al., 1992; Windsor

& Kohnert, 2004). Similarly, performance on grammatical language tasks has not been found to distinguish TD ELLs with diverse language backgrounds from monolingual children with DLD (Paradis, 2005; Paradis et al., 2008). Clearly, ELLs' language performance is affected by their limited knowledge and experience with each target language examined (Blom & Boerma, 2017).

Given concerns regarding the utility of any language knowledge measures to discriminate ELLs from those with DLD, attention has turned to the use of processing-dependent measures, especially those found to differentiate monolingual groups with and without DLD, such as processing speed, temporal integration, and immediate memory (Archibald & Gathercole, 2006a; Miller et al., 2001; Windsor & Hwang, 1999; Windsor & Kohnert, 2004). The theory is that processing-dependent measures may be less dependent on ELLs' linguistic knowledge and, therefore, directly tap abilities underlying language learning (Kohnert et al., 2006; Paradis et al., 2013; Park et al., 2021). Recent studies have reported that focusing on processing-dependent measures or supplementing language knowledge measures with processing-dependent measures helped distinguish between ELLs with and without DLD (Park et al., 2021; Wealer & Engel de Abreu, 2021).

Multiple theories have been put forward to explain the disproportionate linguistic deficit found among children with DLD. For example, domain-general theories contend that children with DLD have deficits in the domain-general cognitive processes known to support language learning. When children with DLD present with a limitation in domain-general information processing, it is often connected with reduced space or capacity (Bishop, 1992), or slower speed (Kail, 1994). Working memory, defined as the ability to retain and manipulate information for a short period of time in the current focus of attention, is one domain-general resource that can limit information processing speed or capacity. Nevertheless, none of the DLD theories effectively explain DLD, indicating that DLD is, in fact, a multifactorial disorder (Bishop, 2003). The language features of children with DLD are heterogeneous and the characteristics of the disorder can overlap with other neurodevelopmental disorders (Bishop, 2017).

A number of studies have reported deficits in two aspects of immediate memory in DLD: verbal short-term memory and working memory (Archibald & Gathercole, 2006a; Henry et al., 2012). Short-term memory tasks engage temporary storage; verbal versions require serial recall of words, letters, or digits, whereas visuospatial versions involve recall of visual patterns or sequences of movement (Baddeley, 2000; Conway et al., 2005). Verbal short-term memory has been found to be a key indicator of new-word learning (Majerus et al., 2006; Masoura & Gathercole, 2005) and vocabulary acquisition (Gathercole, 2006; Gathercole et al., 1992) Working memory tasks, on the other hand, impose demands on processing in addition to storage, and are generally assessed by complex memory span paradigms (Engel de Abreu, 2011). Examples of verbal complex span tasks are counting recall and backwards digit recall, in which a participant recalls numbers after counting or reversing the order, respectively. Examples of corresponding visuospatial tasks involve recalling locations or orientations after identifying a different shape or mentally rotating an image, respectively (Alloway et al., 2009). Working memory has been associated with complex cognitive activities, such as language comprehension and word decoding (Cain et al., 2004; Engel de Abreu & Gathercole, 2012). Some researchers have reported comparable performance between monolingual children with DLD and TD peers on visuospatial short-term and working memory measures (e.g., Archibald & Gathercole, 2006b; but see Vugs et al., 2013), suggesting disproportionately smaller DLD deficits in the visuospatial than verbal domain (Archibald & Gathercole, 2006b).

Given that short-term and working memory measures emphasize the storage and processing of new information (Engel de Abreu et al., 2013), the influence of previous knowledge has been considered to be minimal. It has been suggested that processing-dependent measures such as verbal short-term memory and working memory measures may pose similar challenges and be equally familiar (or unfamiliar) to all children, regardless of the language they speak (Engel de Abreu & Gathercole, 2012). It should be noted that the majority of research comparing ELLs with monolingual children with DLD on processing-dependent measures has focused on nonword repetition measures, a task involving the immediate recall of made-up or nonsense words. Although nonword repetition has been argued to be a verbal short-term memory task imposing demands for storage only (Gathercole & Baddeley, 1990), research has identified additional factors influencing nonword repetition and perhaps imposing a load on working memory (Bishop et al., 1996; Graf Estes et al., 2007). Nevertheless, nonword repetition is expected to minimize the role of prior language knowledge and experience given the use of phonological forms novel to all participants.

Accumulated evidence from ELL studies of nonword repetition, however, shows that even previous sublexical phonological knowledge and experience can influence children's performance. For example, Kohnert et al.

(2006) found that the performance of TD ELLs and monolingual English-speakers with DLD did not differ on an English nonword repetition task. Sensitivity and specificity calculations for the English nonword repetition task, however, indicated that such a task was useful for ruling out children with DLD in the ELL group but not for identifying them. In the case of TD children, Engel de Abreu et al. (2013) similarly reported an advantage for monolingual over bilingual children on nonword but not number-based repetition tasks. The researchers suggested that the digits represented highly frequent lexical stimuli of equal familiarity to all school-age children, eliminating any advantage of language familiarity. In summary, although the nonword repetition task is considered a less biased form of assessment than knowledge-based measures (Paradis et al., 2013), nonword repetition does not completely eliminate the effect of children's experience with the target language (Kohnert et al., 2006).

The majority of research comparing ELLs with monolingual children with DLD on processing-dependent measures has focused on nonword repetition measures, and few studies have used different verbal short-term and complex memory measures. For example, Boerma and Blom (2020) and Blom and Boerma (2017) compared the performance of monolingual and bilingual children with DLD to TD peers on verbal short-term and working memory tasks. The results indicated that monolingual and bilingual children with DLD had lower performance on verbal short-term and working memory tasks than their bilingual TD peers. Moreover, Cockcroft (2016) compared 67 English monolingual and 53 bilingual Grade 1 students whose first language was an African language (isiZulu or isiXhosa), and who were educated at English schools, on verbal short-term and verbal working memory tasks. The study reported that there were no group differences on any measures of working memory. Engel de Abreu (2011) compared the performance of 22 simultaneous bilingual children (Luxembourgish and one other European language) and 22 Luxembourgish monolingual peers on verbal short-term and verbal working memory tasks. When controlling for expressive vocabulary, no significant differences were observed between the 6- to 8-year-old monolinguals and bilinguals on verbal short-term and verbal working memory tasks. Similarly, Engel de Abreu et al. (2013) compared 7-year-old Portuguese-speaking language minority children from Luxembourg to majority Portuguese-speaking children from Brazil and multilingual children from Luxembourg. No difference was found between the Portuguese-speaking language minority children and their majority language peers from Brazil and from Luxembourg on three of the four working memory tasks administered.

On the other hand, higher immediate memory scores in bilingual groups have been reported in several studies. Broadly speaking, bilingualism is associated with increased cognitive abilities, including working memory, as reported in a meta-analysis study (Adesope et al., 2010; but see Engel de Abreu, 2011). For instance, Blom et al. (2014) found that when controlling for socioeconomic status and vocabulary, 68 bilingual Turkish–Dutch children showed cognitive advantage in verbal working memory compared to 52 monolingual controls. Moreover, Morales et al. (2013) reported a bilingual advantage on working memory tasks in two studies. The first study found that 27 ELL 5-year-olds from diverse language backgrounds outperformed 29 of their monolingual peers in executive functioning tasks that manipulated different working memory demands. In the second study, 62 ELLs (5- and 7-year-olds) from diverse language backgrounds outperformed 62 of their monolingual peers on visuospatial span tasks that manipulated different executive function components. Nevertheless, findings of equivalent performance by 22 TD ELLs (Spanish–English-speaking) and 28 monolinguals with DLD on a task involving judging the veracity of a sentence while retaining the final word (Kohnert et al., 2006) suggested that some verbal working memory tasks could be influenced by previous language experience (Kohnert, 2010). The present study employed both highly familiar and unfamiliar verbal stimuli as well as verbal and visuospatial stimuli in immediate memory tasks to evaluate group differences associated with a range of processing demands.

In any consideration of bilingual development, the specific languages being learned must be considered. The present study was concerned with the development of Arabic–English learners. Arabic is a Semitic language with a nonconcatenative morphology. The morphology, phonology, and orthography of Semitic languages are distinct from Indo-European languages such as English. Arabic has 28 consonants and six vowels. Arabic is a root and pattern language with complex interaction between syntax, morphology, and phonology. Word roots mostly consist of three consonants that represent the lexical meaning (triliteral root; Beeston, 1970), and the pattern is primarily composed of vowels inserted between the root consonants. The roots carry a semantic meaning shared to various degrees by the derivative words associated with the same root (Bakalla, 1979). Moreover, the verbal inflection system of Arabic is relatively rich. Verbs are morphologically inflected for tense and mood, and the verb agrees with the subject for aspects of person (first, second, and third), number (singular, dual, and plural), and gender (feminine and masculine; Bakalla, 1979). Arabic has many diverse colloquial dialects across Arabic countries, and most

countries have their own dialect (Aljenaie, 2001). In general, Arabic colloquial dialects are mutually intelligible, with few being mutually unintelligible (Al-Tamimi, 2011).

Only a few studies have focused on monolingual/bilingual Arabic children, especially in regard to DLD. The epidemiological trends in language and cognitive development in Arabic-speaking children with DLD show many parallels to those reported for other linguistic and cultural groups. For example, Abdalla and Crago (2008) found that Arabic-speaking children with DLD have a specific difficulty with tense and subject-verb agreement forms. Moreover, difficulty in repeating nonsense phonological forms has been reported in Arabic-speaking children with DLD (Shaalan, 2010). Comparing Arabic-speaking ELLs to monolingual Arabic children with DLD is important in order to examine whether there are group differences between these groups on processing-dependent measures.

The present study compared the performance of Arabic-speaking children (ELLs) with diverse language experiences on processing-dependent measures to that of two monolingual peer groups: 1) typically developing Arabic-speaking children (A-TD), and 2) Arabic-speaking children with DLD (A-DLD). Given the shortcomings of knowledge-based measures in differentiating the language performance profiles of children with DLD and ELL, it is important to examine whether there are group differences between ELLs and children with underlying language impairment in verbal short-term and working memory measures. At least equivalent performance by ELL and A-TD groups, and higher scores by the ELL than the A-DLD groups was expected on the processing-dependent immediate memory tasks. However, this prediction was expected to be modified by the verbal demands of the task, such that tasks with higher verbal demands (i.e., nonword repetition) would be less likely to differentiate the three groups than those with low verbal demands (i.e., digit recall) or no verbal demands (i.e., visuospatial short-term or working memory tasks).

Method

Participants

Permission to conduct this study was granted by The University of Western Ontario Research Ethics Board for Non-Medical Research Involving Human Subjects (number: 103912). There were 480 children (M_{age} = 7;9, *SD* = 1.12; 187 males) participating in three groups in this study: (a) 59 unselected ELLs whose first language was Arabic and who were learning English as the language of instruction in Canada (M_{age} = 7;11, *SD* = 1.16; 29 males), (b) 369 typically developing monolingual Arabic-speaking children (A-TD) from Saudi Arabia (M_{age} = 7;11, *SD* = 1.12; 139 males), and (c) 52 monolingual Arabic-speaking children with DLD (A-DLD) from Saudi Arabia (M_{age} = 8;4, *SD* = 1.00; 19 males). The two monolingual Arabic-speaking groups from this study were drawn from a sample of 421 monolingual Arabic-speaking children who participated in other completed studies (Balilah & Archibald, 2018). The language, nonverbal intelligence, and maternal education measures administered in order to characterize the monolingual Arabic participants overlap with previous studies (Balilah & Archibald, 2018). The current study included analysis of new working memory measures as well as comparison to the ELL group who were recruited for this study. All the children who participated in this study ranged from Grade 1 to Grade 4 (i.e., children 6–9 years of age). Children in the ELL group were recruited from a school providing instruction in both English and Arabic (*n* = 27) and from an extracurricular Arabic instruction class for children receiving regular schooling in English (*n* = 32). Children in the Arabic-speaking samples were recruited from 10 schools (5 male schools, 2 of which were public; 5 female, all public) in Saudi Arabia (Jeddah) based on a study invitation sent home (600 letters) to all parents of children in the relevant grades. No group differences were found in gender distribution, χ^2 (2) = 2.964, *p* = .135, or age, *F*(3, 476) = .608, *p* = .121. In addition, according to parental reports, none of the children had been diagnosed with any neurological or psychological disorders such as hearing impairment or autism spectrum disorder.

Many research studies employ a clinical cutoff of 1 *SD* to identify children with DLD (e.g., Conti-Ramsden et al., 2001; Wiig et al., 1992). In our study, the following criteria were applied to identify which of the Arabic speaking children to include in the A-DLD group based on the norms from our monolingual Arabic-speaking sample of 421 children (Balilah & Archibald, 2018): (1) Scores of at least 1 SD below the mean on two of four language measures, including the three subtests of the Arabic Language Test (ALT; Shaalan, 2010) and the Arabic Picture Vocabulary Test (APVT; Shaalan, 2010), and (2) a standard score not lower than 86 on the Test of Nonverbal Intelligence (TONI-3; Brown et al., 1997). In the APVT, a measure of receptive vocabulary, participants were shown four pictures and were then asked to indicate which photo corresponded with a specific spoken word, with a maximum possible score of 132. High test–retest reliability has been reported for the APVT, *r* = .97 (Shaalan, 2017). In the Sentence Comprehension subtest of the ALT, participants were shown three to four pictures and were then asked to indicate which picture corresponded with a specific spoken sentence. In the Expressive Language subtest of ALT, participants were provided with a sentence and then they had to create a phrase or spoken word, while referencing

a picture cue. In the Sentence Repetition subtest of ALT, participants listened to an audio recording that played sentences read by a native, adult male Arabic speaker. The participants were then asked to repeat the sentences. The total number of correct responses was counted for each subtest, with a score of 40 being the maximum possible score for the Sentence Comprehension subtest and 68 for the Expressive Language subtest. The 41 items of the Sentence Repetition subtest were scored on a 4-point scale (3 = *correct*; 2 = *1 error*; 1 = *2–3 errors*; 0 = *4 or more errors*, or *no response*), with a score of 123 being the maximum possible score. High test–retest reliability had been reported for the three subtests of the ALT (r = .95–.97; Shaalan, 2017). Raw scores were converted to standard scores based on the normative data available (Balilah & Archibald, 2018). Finally, in the TONI-3, a measure of general nonverbal cognitive abilities, children chose a picture to complete a visual pattern. Raw scores of the TONI-3 were converted to the standard scores based on published test norms.

Descriptive statistics for criterion measures for all groups are displayed in **Figure 1**. Scores were significantly lower for the ELL and A-DLD groups than the A-TD group on both the AREVT and ALST (p < .001, all cases), whereas no significant differences were found between the ELL and A-DLD groups (AREVT, p =.112; ALST, p = .158).

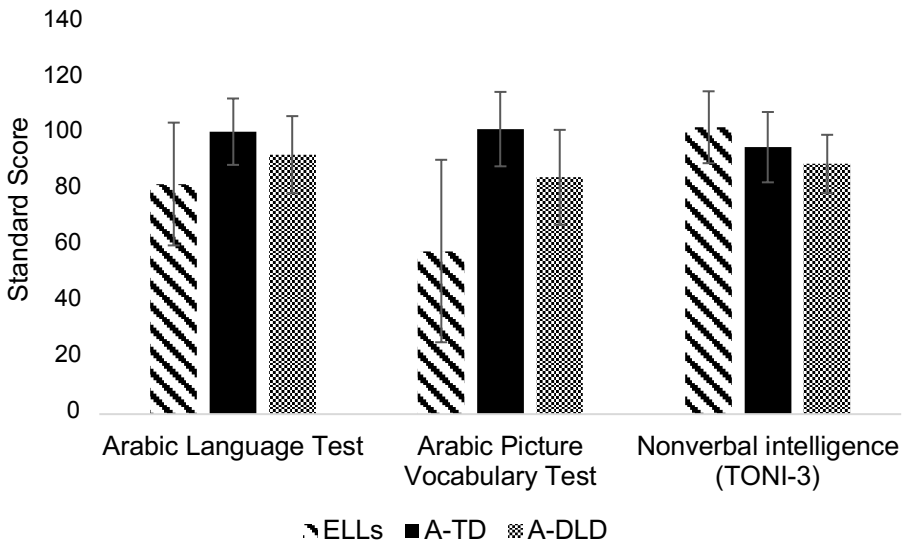
Materials and Procedure

The participants completed a variety of assessment measures individually in a quiet room in their school over 4 weekly sessions of approximately 40 minutes each. The battery included the language and vocabulary measures described above as well as processing-depending measures of verbal short-term and working memory (Arabic Nonword Repetition task [A-NWR], Shaalan, 2010; Automated Working Memory Assessment [AWMA], Alloway, 2007), and nonverbal intelligence (TONI-3, Brown et al., 1997). A fixed order was used to administer the tests so that A-NWR was completed in Session 1, the ALT in Session 2, the APVT and TONI-3 in Session, 3 and the AWMA in Session 4. Other tasks not reported here were additionally completed across sessions. A trained native Arabic speaker tested the children in the battery of assessment measures. Parents completed a questionnaire at the time of completing the study consent form.

Short-Term and Working Memory

Eight subtests from the AWMA (Alloway, 2007) were administered. Measures of verbal short-term memory (Digit Recall; Word Recall) required the immediate repetition of numbers or word forms. Measures of verbal working memory (Counting Recall; Backwards Digit Recall) required the recall of numbers after counting or reversing the

Figure 1



Standard scores for criterion measures for all groups.

Note. ELL = English language learners; A-TD = typically developing Arabic-speaking children; A-DLD = Arabic-speaking children with developmental language disorder. TONI-3 = The Test of Nonverbal Intelligence. Error bars show standard errors, standard score (M = 100, SD = 15).

order, respectively. In addition, four visuospatial short-term and working memory subtests from the AWMA were administered. Measures of visuospatial short-term memory (Dot Matrix; Block Recall) required the recall of locations. Measures of visuospatial working memory (Odd One Out; Spatial Span) required the recall of locations or orientations after identifying a different shape or mentally rotating an image, respectively. For the two monolingual Arabic groups, the AWMA was administered to each child using Arabic. For the ELL group, the AWMA was administered to each child using the child's preferred language (Arabic or English). Of the participants, 70% preferred English and 30% preferred Arabic. In order to ensure that AWMA was accurately transcribed into Arabic, three translations were performed: (1) The task was translated from English to Arabic by a native Arabic-speaker who did not work in the field; (2) The translated Arabic version of the task was then translated back into English by an expert who is a native English-speaker; and (3) The final check of the translation of the task was done through a one-to-one matching of each item of the task by another native Arabic-speaker, and the final version of the translation was written.

One additional verbal short-term memory task was administered, the A-NWR (Shaalan, 2010). In the A-NWR, participants listened to an audio recording that played nonwords read by a native, adult male Arabic speaker. The participants were then asked to repeat the nonwords. Items taken from Shaalan (2010) included 48 nonwords of different lengths (two to three syllables) and cluster type (no cluster, medial cluster, final cluster, and medial and final clusters). Each participant answer was ranked online as either incorrect or correct by a trained research assistant with a maximum possible score of 48. For all the subtests of AWMA and the A-NWR task, raw scores were converted to standard scores based on the normative data (see also, Balilah & Archibald, 2018).

Parent Questionnaire

The parent questionnaire included questions related to maternal level of education. In this study, we used maternal level of education as a proxy for socioeconomic status. Parents were asked to check the highest level of education attained by the child's mother. The descriptors included some high school, completed high school, some college, completed college (2 years), some university, and completed university (4 years or more). Responses were transposed to a 3-point scale with 1 corresponding to *some/completed high school*, 2 to *some/completed college*, and 3 to *some/completed university*. By parent report, approximately 80% of mothers had at least some college or university education in the ELL group. In comparison, approximately 58% of the mothers had at least some college or university education in each of the monolingual groups.

In addition, parents of children in only the ELL group filled out a questionnaire about their child's language background (Kaushanskaya et al., 2010). Parents were asked to provide information about their child's language immersion, history, use, and the parent's rating of their child's current language abilities in each language (on a scale from 0 = *none* to 10 = *perfect*). All parents in the study reported that Arabic was acquired by their children as a first language from birth. Moreover, the parents indicated that their children began to be exposed to English, on average, at the age of 3;3 (*SD* = 2.0, range = 8–96 months). Additionally, in terms of their child's current language abilities—both speaking and understanding—the parents rated their children as very good in Arabic (*M* = 8.00, *SD* = 2.03) and in English (*M* = 8.00; *SD* = 2.11). None of the parents reported that their child's current speaking and understanding abilities were a 3 (*low*) or lower in Arabic and English. Notably, the parents of six participants did not indicate the time when their child was first exposed to English. In addition, complete data were available for all but three children from the ELL group who did not complete all the Arabic language tasks.

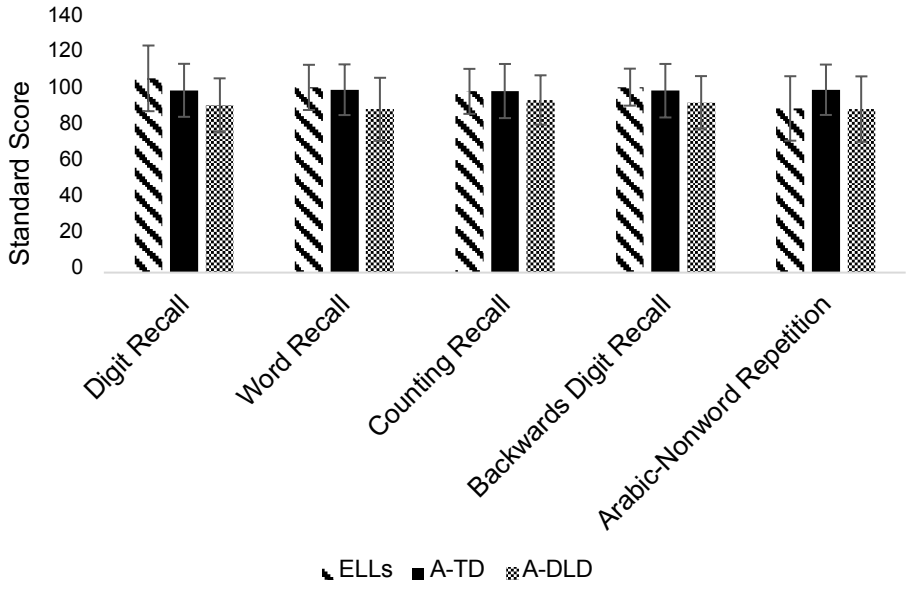
Results

Verbal Short-Term and Working Memory

Figure 2 provides standard scores for the Verbal Short-Term and Working Memory subtests of the AWMA (Digit Recall, Word Recall, Counting Recall, and Backwards Digit Recall) and the A-NWR task for the three groups: ELL, A-TD, and A-DLD. The performance of the A-DLD group was lower than the A-TD and ELL groups on all measures, whereas the performance of the ELL group was similar to, or numerically higher than, the A-TD group (except on the nonword repetition task, A-NWR).

In order to compare the performance of the ELL, A-TD, and A-DLD groups on the verbal short-term and working memory subtests of AWMA, a multivariate analysis of variance was completed on the standard scores of the verbal short-term and working memory measures (A-NWR, Digit Recall, Word Recall, Counting Recall, and Backwards Digit Recall). Between-group analyses indicated that there was a significant group effect: Hotelling's *T*, $F(10, 938) = 8.19$, $p < .001$, $\eta^2_p = .080$. Significant group effects were observed in univariate comparisons for Digit Recall, $F(2,474) = 12.91$, $p < .001$, $\eta^2_p = .052$, Word Recall, $F(2,474) = 13.97$, $p < .001$, $\eta^2_p = .056$, Backwards Digit Recall, $F(2,474) = 5.51$, $p < .001$, $\eta^2_p = .023$, A-NWR, $F(2,474) = 20.67$, $p < .001$, $\eta^2_p = .080$, but not for Counting Recall, $F(2,468) = 2.63$, $p = 0.073$.

Figure 2



Standard scores on the Verbal Short-Term and Working Memory subtests of the Automated Working Memory Assessment (AWMA) and the Arabic Nonword Repetition task (A-NWR).

Note. ELL = English language learners; A-TD = typically developing Arabic-speaking children; A-DLD = Arabic-speaking children with developmental language disorder. Error bars show standard errors, standard score (M = 100, SD = 15).

Pairwise comparisons of the significant AWMA subtests revealed significantly higher scores for the ELL group compared to the A-TD group on the Digit Recall subtest only (p = .007; all remaining cases: p = 1.000). The A-DLD group, on the other hand, had significantly lower scores than either the A-TD groups (in all cases, p < .001; except for Counting Recall, p = .068) and ELL groups (in all cases, p < .001; except for Counting Recall, p = .273). For the A-NWR task, however, the ELL and A-DLD groups had significantly lower scores than the A-TD groups (p = .001), and there was no significant difference between the ELL and A-DLD groups (p = 1.000). It should be noted that in the corresponding analysis of covariance with maternal education as a covariate, the same pattern of results was observed for all the verbal short-term and working memory measures.

Visuospatial Short-Term and Working Memory

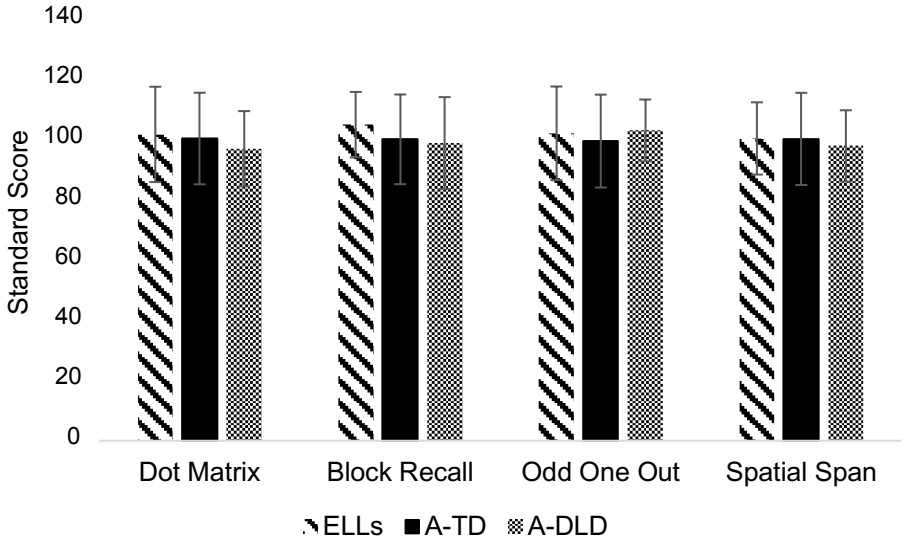
Figure 3 provides standard scores for the visuospatial short-term and working memory subtests of the AWMA (Dot Matrix, Block Recall, Odd One Out, and Spatial Span) for the three groups: ELL, A-TD, and A-DLD. The three groups had almost identical performance on all visuospatial short-term and working memory subtests.

To compare the performance of the ELL, A-TD, and A-DLD groups on the visuospatial short-term and working memory subtests of AWMA, a multivariate analysis of variance was completed on the standard score of the visuospatial short-term and working memory subtests of AWMA (Dot Matrix, Block Recall, Odd One Out, and Spatial Span). The results revealed no significant group effect: Hotelling's T, $F(8, 946) = 1.628$, p = .113. It should be noted that in a corresponding analysis of covariance with maternal education as a covariate the result was unchanged.

Discussion

This study compared the performance of Arabic-speaking ELLs with diverse language experiences on processing-dependent measures to two monolingual peer groups: typically developing A-TD children and A-DLD children. The primary objective of this study was to compare ELLs and monolingual peers with and without DLD on processing-dependent measures (short-term and working memory measures). On the Arabic measures (vocabulary and language), the ELL group scored significantly more poorly than the A-TD group and did not differ from the A-DLD group (see **Figure 1**). On the processing-dependent measures, however, no differences were found between the ELL and A-TD groups on the short-term and working memory measures (see **Figure 2** and **3**), with the exception of the Arabic nonword repetition and counting recall tasks. The performance of the ELL group on the Arabic nonword

Figure 3



Standard scores of the Visuospatial Short-Term and Working Memory subtests of the Automated Working Memory Assessment (AWMA)

Note. ELL = English language learners; A-TD = typically developing Arabic-speaking children; A-DLD = Arabic-speaking children with developmental language disorder. Error bars show standard errors, standard score (M = 100, SD = 15).

repetition task was comparable to that of the A-DLD group and significantly lower than the A-TD group. Interestingly, the ELL group scored significantly higher than the A-TD and A-DLD groups on only one number-based verbal short-term memory measure (Digit Recall).

On all the verbal memory tasks tapping short-term and working memory (with the exception of Arabic Nonword Repetition), the performance of the ELL group was comparable to the A-TD group, whereas the performance of the A-DLD group was lower than the A-TD and ELL groups on the majority of these measures (with the exception of Counting Recall). These results, on the whole, are consistent with previous evidence suggesting that processing-dependent measures in ELLs are less sensitive to differences in language experience than knowledge-based measures (Blom & Boerma, 2017; Engel de Abreu et al., 2013; Wealer & Engel de Abreu, 2021). The present findings regarding the reduced performance of the A-DLD group but not the ELL group on the majority of the verbal short-term and working memory subtests suggests that processing-dependent rather than knowledge-based measures may hold promise for differentiating between children with DLD and ELLs. A critical finding here is that the current study adds to the literature by showing that one verbal working memory subtest of the AWMA (Backwards Digit Recall), in addition to two verbal short-term subtests of the AWMA (Digit Recall and Word Recall), may be viable options for reducing assessment bias in ELLs.

Importantly, the results of the verbal short-term and working memory measures in this study are consistent with previous evidence suggesting that the nature of the verbal stimuli involved in verbal short-term and working memory tasks possibly account for the considerable difference observed in the ELLs' performance. There were group differences between the ELLs and A-DLD groups on verbal short-term and working memory measures in this study that involved the recall of highly familiar lexical stimuli, such as number words and basic words. These tasks involve familiar lexical stimuli that are generally acquired at an early age by ELLs in both their first and second languages, and that may be equally familiar to all children and less affected by verbal long-term memory (Engel de Abreu et al., 2013; Wealer & Engel de Abreu, 2021). On the other hand, because nonword repetition tasks involve unfamiliar phonological forms, it has been suggested that children's performance on these tasks relies on long-term phonological and lexico-semantic knowledge (Engel de Abreu et al., 2013). Indeed, the findings add to the growing body of evidence indicating that phonological structure and language experience impact ELLs' performance on nonword repetition tasks

(Kohnert et al., 2006; Shaalan, 2010; Windsor et al., 2010). Unlike nonword repetition, therefore, verbal short-term and working memory tasks involving familiar lexical stimuli may be sensitive to the underlying differences between children with DLD and ELLs. Such measures may assist in differentiating language difference from language impairment. Moreover, the results indicated that not all processing-dependent measures are equally effective in reducing the role of prior knowledge or experience in ELLs. Searching for effective assessment measures in ELLs requires careful choice among verbal short-term and working memory measures.

The ELL group in this study scored significantly higher than the A-TD group on only the Digit Recall measure of verbal short-term memory. Although consistent with other studies suggesting a bilingual advantage on working memory tasks (Blom et al., 2014; Morales et al., 2013; but see Engel de Abreu, 2011), the lack of a consistent advantage across a range of measures weakens the finding. In fact, there was no group effect observed for another number-based task involving counting, Counting Recall. Although unexpected based on previous findings (Engel de Abreu, 2011), the consistent group effects over multiple measures in the present study provide stronger evidence of a difference between the ELL and A-DLD groups on these tasks.

Finally, the ELL group in this study did not differ from their monolingual peers (A-TD and A-DLD) on all visuospatial short-term and working memory subtests (see **Figure 3**). Neither, however, did the A-DLD group. As a result, performance on the visuospatial immediate memory groups did not differentiate the ELL and DLD groups in the present study. This finding is in line with evidence suggesting relative visuospatial processing strengths in children with DLD (Archibald & Gathercole, 2006b). As such, these results provide substantial evidence that the immediate memory deficit in Arabic-speaking children with DLD primarily involves the verbal domain, a suggestion consistent with observations for monolingual English DLD speakers (Archibald & Gathercole, 2006a, 2006b).

Study Limitations

The performance of monolingual Arabic children from Saudi Arabia was compared to Arabic-English speakers from Canada in the present study. It must be assumed that significant cultural differences exist across these groups, which could have impacted performance on the study tasks. Importantly, monolingual Arabic-speaking school-age children do not exist in Canada, necessitating the recruitment of a sample from an Arabic-majority country. Arabic, however, has a number of colloquial dialects, which may have differed across the monolingual and ELL groups. Nevertheless, the impact of this variation on the current findings may have been limited. The Arabic language skills of the ELL group were weaker than those of the typically developing monolingual speakers. It is possible that this gap was overestimated in our sample, however, the large effect (8–14 standard score points on average) suggests a true group difference especially in light of the lack of group differences on the majority of processing-dependent measures. Certainly, as Arabic-speaking children use the colloquial dialect in their daily oral communication, language assessment measures should address the acquisition of the colloquial dialect (Al-Tamimi, 2011). Unfortunately, there are no available assessment measures in the majority of Arabic colloquial dialects. In this study, dialectical variations were matched with the participants' spoken output and commonly observed variations were considered correct. Future studies could examine the effects of dialectical variations in greater detail. Another limitation of the study is that the examiners administered the AWMA to each child using the child's preferred language (Arabic or English). Evaluating children's language skills by administering tests in one language can be more convenient. Unfortunately, evidence of parallel forms for the English and Arabic immediate memory measures was unavailable. Future studies should assess the impact of administration processing-dependent measures in two different languages.

Conclusion and Future Directions

In this study, the performance of 6- to 9-year-old ELLs whose first language was Arabic and who had been learning English as the language of instruction in Canada was compared to two monolingual groups: typically developing Arabic-speaking children and Arabic-speaking children with DLD, on processing-dependent measures of short-term and working memory. The primary objective of this study was to compare ELLs with diverse language experiences and monolingual peers with and without DLD on processing-dependent measures (short-term and working memory measures). With the exception of the Arabic nonword repetition task, the performance of the ELL group was comparable to the A-TD group on all the verbal short-term and working memory subtests, whereas the performance of the A-DLD group was lower than the A-TD and ELL groups on these tasks.

The findings of this study suggest that tasks that focusing on the cognitive processes that underlie language learning rather than children's opportunities or experiences with the test language may provide a more accurate representation of ELLs' linguistic abilities. However, it is clear from the verbal short-term and working memory results in this

study that not all processing-dependent measures are equally effective in reducing the role of prior knowledge or experience in ELLs' performance. For example, the present study's findings add to the growing body of evidence that indicates that ELLs' performance on nonword repetition is affected by their previous sublexical phonological knowledge and experience in the target language (Kohnert et al., 2006; Thorn & Gathercole, 1999; Windsor et al., 2010). Furthermore, the present study indicates that verbal short-term and working memory tasks involving familiar lexical stimuli may help distinguish ELLs from children with underlying DLD and assist with the identification of children with DLD in culturally and linguistically diverse communities.

Recommendations

S-LPs often use English norm-referenced standardized tests to assess ELLs' linguistic abilities (Caesar & Kohler, 2007; Gillam et al., 2013). However, the evidence suggests that using knowledge-based assessment tools to assist with the diagnosis of ELLs may result in biased assessment and, therefore, using these tools may not be an effective approach. The findings of the present study suggest that S-LPs could also consider administering verbal short-term and working memory tasks involving familiar lexical stimuli, as they may assist in making a diagnosis in linguistically diverse settings. However, it is clear that further investigation on the use of verbal short-term and working memory tasks as assessment tools to recognize children with DLD among ELLs is warranted. More work needs to be done before these tools can be used with ELL populations for screening/diagnosis.

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Author's Note

Correspondence concerning this article should be addressed to Dr. Lisa Archibald, School of Communication Sciences and Disorders, Elborn College, Western University, London, Ontario, Canada, N6G 1H1. Email: **larchiba@uwo.ca**

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Mean Length of Utterance and Use of Subordination Among First Nations School-Aged Children

Longueur moyenne des énoncés et emploi de subordonnées chez les enfants d'âge scolaire des Premières Nations

Patricia Hart Blundon

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Patricia Hart Blundon

University of Victoria, Victoria, BC, CANADA

Abstract

Many First Nations children speak a variety (i.e., dialect) of English. Grammar distinctions related to their variety may affect their Mean Length of Utterance. Also, anecdotal observations suggest that such students may use fewer subordinate clauses as a feature of their variety, further affecting their utterance length. Because utterance length and subordination rates are used along with standardized tests to determine if a child presents with a language disorder, children who speak varieties might be pathologized unnecessarily if speech-language pathologists are not aware of these differences. Also, because it is unknown how utterance length typically changes through the grades, it is difficult for educational professionals to determine whether a child is developing language as expected or needs specialized support. This study aimed to investigate the Mean Length of Utterance of and use of subordination by children who spoke a variety. Ten children in Grades 1 to 6 were asked to retell a story. As predicted, the analysis indicated that their Mean Length of Utterance was shorter than that obtained from peers who spoke more standard English, likely related to varietal differences. The analysis also indicated they used fewer subordinate clauses and that this style preference was also likely a feature of their variety. Analysis of 15 students' Mean Length of Utterance in video-tell/retell language samples showed that it increased from Kindergarten to Grade 7. This study cautions the use of Mean Length of Utterance and Subordination Index scores normed on standard English to understand the development of variety English.

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David H. McFarland

Abrégé

De nombreux enfants des Premières Nations parlent une variante (c.-à-d. un dialecte) de l'anglais. Les distinctions grammaticales associées aux variantes parlées par les enfants des Premières Nations pourraient avoir un effet sur la longueur moyenne des énoncés. De plus, des observations anecdotiques suggèrent que ces élèves pourraient avoir moins souvent recours à des subordonnées, une caractéristique spécifique à leurs variantes qui affecterait d'autant plus la longueur de leurs énoncés. Puisque la longueur moyenne des énoncés et le nombre de subordonnées par phrase sont des informations complémentaires aux tests standardisés et que ces mesures sont fréquemment utilisées pour déterminer la présence d'un trouble du langage, il est possible que les enfants parlant des variantes de l'anglais se voient inutilement attribuer un trouble par des orthophonistes n'ayant pas conscience des différences entre l'anglais standard et ses variantes. De plus, comme aucune information concernant l'évolution de la longueur des énoncés d'une année scolaire à l'autre n'est disponible pour les enfants parlant une variante de l'anglais, il est difficile pour les professionnels de l'éducation de déterminer si le développement du langage d'un enfant se situe dans les limites de la normale et si un enfant a besoin d'un soutien spécialisé. La présente étude visait ainsi à examiner la longueur moyenne des énoncés et l'emploi de subordonnées chez les enfants parlant une variante de l'anglais. Il a été demandé à 10 enfants d'âge scolaire (entre la première et la sixième année) de raconter une histoire qu'on leur avait précédemment présentée par vidéo. Conformément aux prédictions, les résultats de cette analyse ont révélé que les enfants des Premières Nations avaient des longueurs moyennes des énoncés plus courtes que leurs pairs parlant un anglais plus standard, ce qui est probablement lié aux différences spécifiques de leur variante. Les résultats de cette analyse ont également indiqué que les enfants des Premières Nations employaient moins de subordonnées, suggérant que cette préférence stylistique est une caractéristique de leur variante. De plus, les longueurs moyennes des énoncés de 15 élèves ont été calculées à partir d'échantillons de discours recueillis dans une tâche où les enfants étaient invités à raconter une histoire leur ayant été précédemment présentée par vidéo. Les résultats de cette analyse ont indiqué que la longueur des énoncés augmentait de la maternelle à la 7e année. Les résultats de la présente étude invitent à faire preuve de précaution lors de l'utilisation de normes s'appuyant sur l'anglais standard pour comprendre le développement du langage des enfants parlant une variante de l'anglais à l'aide de la longueur moyenne des énoncés et du nombre de subordonnées par phrase.

Among scholars of language variation, it is broadly accepted that children who speak varieties may be at an educational disadvantage (see, for example, Fletcher, 1983, for English as spoken by "American Indians"; Gatlin & Wanzek, 2015; Labov, 1982, 2003; Rickford & Rickford, 1995, on African American language and other varieties in the United States; Malcolm, 2007, on Australian Aboriginal English). Differences in pronunciation (Labov, 2003), grammar (Siegel, 2010), and vocabulary (Charity Hudley & Mallinson, 2011) can affect literacy development (N. P. Terry et al., 2010) and learning in math and science (J. M. Terry et al., 2015). Cultural differences in the way language is used can lead to teacher and student misunderstandings and change teacher perspectives about students, which may negatively influence academic outcomes (Siegel, 2010). Teachers' lack of understanding about varieties may cause them to underestimate children's abilities (Mallinson & Charity Hudley, 2017). Moreover, the use of assessment tools designed for speakers of standard varieties can result in unnecessary pathologization and ineffective pedagogical approaches (Baugh, 2015; Crago & Westernoff, 1997).

The Mean Length of Utterance (MLU) metric is one of the tools a speech-language pathologist might use to assess language development. MLU is commonly measured by calculating an average number of morphemes or words per utterance in a language sample (Craig & Washington, 2006). Brown (1973) used morphemes as his unit of measurement when studying preschool children's morphological and syntactic development. He created age-related stages of language development, with each age and stage associated with a range of MLU. Loban (1976) used words when studying the language development of school-aged children from Grade 1 to 12. He segmented utterances into *communication units*; he defined a communication unit as an independent clause and its modifiers. Once a sample was segmented into communication units, Loban calculated the length of each utterance in words and an average mean length of communication unit for the sample. Just as Brown found that an increased MLU was associated with increased language development and age for preschoolers, Loban found that an increased mean length of communication unit was associated with increased language development, syntactic complexity, and school grade level.

MLU remains an effective measure to match peers for language complexity for research (Craig & Washington, 2006). Researchers also use MLU segmentation rules to count utterances in a standardized way. For instance, Van Hofwegen and Wolfram (2010) segmented utterances into communication units when studying children's African American language. They used the Systematic Analysis of Language Transcripts (SALT) software to do so. SALT "standardizes the process of eliciting, transcribing, and analyzing language samples. It includes a transcription editor, standard reports, and reference databases for comparison with typical peers" (SALT, 2019, About Us section, para. 1). SALT (Miller & Iglesias, 2012) segments utterances by communication unit and can calculate mean utterance length in words and morphemes. Rather than referring to these measures as mean length of communication unit in words and morphemes, SALT uses MLU in words and morphemes. SALT software was used to analyze the language samples collected for this study.

Speech-language pathologists also use MLU and mean length of communication unit for evaluation purposes because they are associated with age and grade (Brown, 1973; Loban, 1976). Speech-language pathologists might use MLU as a criterion-referenced method of assessment, along with other methods such as standardized tests, to decide whether a child's expressive language is developmentally typical (i.e., MLU or mean length of communication unit falls within a predicted age range) or is disordered (i.e., MLU or mean length of communication unit falls below the predicted age range; Miller et al., 2011). Because SALT provides comparison databases of MLU obtained from samples of typically developing children in other locations in North America, speech-language pathologists can use SALT to help them decide whether a child needs their specialized help. However, it lacks specificity and sensitivity measures regarding the accuracy with which it predicts language disorder.

Pearce and Flanagan (2019) raised concerns about using MLU as an assessment tool with students who may speak a variety. Their study of narrative language samples produced by typically developing Indigenous and non-Indigenous Australian children in their first year of school found that Indigenous students' sentence length was significantly shorter than that of non-Indigenous students. They suggested that their shorter MLU may be related, in part, to factors associated with their Australian Aboriginal English variety, such as less frequent use of subordinate clauses.

The use of MLU to assess First Nations students living in Canada may also be questionable because there is increasing consensus that many children of First Nations ancestry may also speak a variety of English (Ball & Bernhardt, 2008; Battisti et al., 2014; Epstein & Xu, 2003; Eriks-Brophy, 2014; Genee & Stigter, 2010; Hart Blundon, 2016; Heit & Blair, 1993; Kay-Raining Bird, 2014; Peltier, 2009; Sterzuk, 2011; Toohey, 1986; Wawrykow, 2011; Wiltse, 2011).

Toohey (1986) was one of the first scholars to propose the existence of First Nations English varieties. Reviewing the work of researchers of Native American Englishes, she

noted that Canadian educators also assumed that many First Nations children spoke distinct varieties of English. She cited the British Columbia's Ministry of Education's reference to "Indian English" in their "Language Arts for Native Indian Students" resource book as evidence of this assumption (Toohey, 1986, p. 134). Epstein and Xu (2003), Heit and Blair (1993), and Sterzuk (2011) listed differences in pronunciation, spelling, grammar, and discourse patterns that they observed being used by children in Saskatchewan. Peltier (2008), a First Nations speech-language pathologist, provided observations regarding what she thought were pronunciation, conceptual, and grammatical features of her Nation's variety in Northern Ontario. Genee and Stigter (2010) listed grammatical features that appeared in the writing of Blackfoot Elders and college students in Alberta. Ball and Bernhardt (2008) summarized potential morphological, syntactical, and phonological features based on anecdotal reports from participants of a First Nations English forum held in British Columbia. Wawrykow (2011) observed that many of her First Nations students on Vancouver Island in British Columbia did not often use conjunctions, which are used to form complex sentences.

Hart Blundon's (2019, 2022) research supported the anecdotal observations of Canadian scholars, namely that many First Nations children who attended a school in a small town in Northern British Columbia spoke an English variety. At least 23 grammatical features characterized their variety (see Appendix). For example, children did not always include the copula or auxiliary in their speech (e.g., "They ___ waiting"), or they did not always produce final <ed> audibly when forming past tense (e.g., "He **look** there yesterday"). Distinctions such as these could lower a student's MLU. At the same time, words not typically included in standard Canadian English might be included in their variety (e.g., use of "then here" instead of "then"). A distinction such as this would result in a higher MLU score because of the word "here."

Hart Blundon (2019, 2022) also observed that children tended to speak in single-clause sentences, or they tended to "string" single clauses together to form multiclause sentences (e.g., "And then they come out then help and sit down and have more apples") rather than use subordination and embedding (e.g., "The bull, **who helped the girl out of the water**, sat down with her and shared some apples"). Their lack of complex sentence construction appeared to be related to style preference and a feature of their variety rather than an indicator of language disorder. A tendency to avoid complex sentence constructions could also affect MLU.

Currently, there is no information regarding how children who speak First Nations English varieties develop their language. While this author's anecdotal observations suggested that MLU did increase over time, the language development of children who speak varieties has not been studied in any systematic way. Lack of information about how their language changes provides a problem for educators and educational professionals; it is difficult to determine whether a child is developing language as expected or requires specialized support.

This present study was undertaken to begin to address these gaps in knowledge. It was part of a larger exploratory study of the First Nations English variety spoken by children in a school in Northern British Columbia (Hart Blundon, 2019). In the larger study, Hart Blundon (2019, 2022) first documented the presence of at least 23 grammatical features appearing in oral narratives by retrospectively analyzing kindergarten samples collected for speech-language pathology purposes. Then, using a cohort sequential design, Hart Blundon (2019) found that children used features at high rates at school entry, lower rates in Grade 3 and 4, and increased rates as they entered middle school. Features that appeared in their oral language also appeared in their writing. The larger exploratory study concluded with an investigation of the student's MLU, their use of subordination, and the change in their MLU over grades. This latter study is the focus of this paper.

The author's questions were:

- Do school-aged children who speak a variety of English have a different MLU than those of age-matched peers who speak a more standard variety of English?
- Do these children use subordination of clauses less frequently than age-matched peers who speak a more standard variety?
- How does the children's MLU change as they advance through the grades?

Given Hart Blundon's (2019, 2022) observations, it was hypothesized that the MLU of First Nations students who spoke a variety would likely be shorter than the MLU of children who spoke a more standard variety, owing to word and morphemes omissions. It was also hypothesized that the students used fewer subordinate clauses as a feature of a variety rather than as an indicator of language disorder. Finally, it was hypothesized that children did develop their language over time.

Positioning the Researcher

When researchers study issues that affect First Nations people, they must position themselves so their biases are transparent. The author is a non-Indigenous speech-

language pathologist who was raised in a white middle-class home in New Brunswick, Canada. While never experiencing racial discrimination, the author's Maritime accent has been judged, which may explain the author's interest in varieties. Indigenous research methodology was used in this study, such as personal contact with participants' guardians and community members, rather than written communication alone. However, primarily Western methods of data collection and analysis were applied.

Method

After describing the study site and community consultation, the methods used to address the research questions are presented in the order in which data were collected in the larger study carried out by Hart Blundon (2019). Study 1 addresses the third research question and Study 2 addresses the first and second research questions.

Study Site

The study took place in a small school in Northern British Columbia. Due to potential negative stereotyping of this community's unique way of speaking English, Elders and community members requested that the school and community remain confidential. Thus, only limited information has been shared about it. The community has been fictitiously referred to as "Bigton" and the school, "Bigton School." This research received ethical approval from the University of Victoria's Human Research Ethics Board (Protocol Number 13-260).

Community Consultation

Parents, the school district, and the Bigton community were consulted regularly both by in-person contact and written documents. Two Indigenous consultants helped ensure that the project was carried out in ways that were culturally safe and respectful of local protocols. Regular presentations were made to numerous groups, including the Parent Advisory Council, Bigton School staff, the Bigton community, the Band Council, and the committee that oversees the Nation's language and culture.

Study 1: Change in MLU as Children Advance Through the Grades

To answer the research question, "How does MLU change as children advance through the grades," the oral narrative language samples collected to study the use of grammatical features over grades in the larger exploratory study (Hart Blundon, 2019) were also used to calculate MLU over grades.

Recruitment

An attempt was made to recruit 27 Bigton School children whom the author had previously identified as *English as a second dialect* (British Columbia Ministry of Education, 2021) in her role as speech-language pathology consultant. The author had designated these students per British Columbia Ministry of Education guidelines that defined English as a second dialect students as those who "speak a dialect of English that differs significantly from Standard English used in school and in broader Canadian society (i.e., significant variations in oral language vocabulary and sentence structure from those used in Standard English)" (British Columbia Ministry of Education, 2021, p. 9). In British Columbia, English as a second dialect students fall under the umbrella of English language learners. Allocated funds are intended to be used by districts to acquire resources to support students who speak varieties to learn standard Canadian English. Most students designated are Indigenous.

The learning resource teacher first mailed a letter asking parents or guardians to permit the researcher to contact them about the project. This third-party approach was intended to mitigate any pressure families might feel about having their child participate, because the researcher was also speech-language pathologist consultant to the school. The school's receptionist then made reminder phone calls to families as necessary. Families of the 15 children who gave their permission to be contacted were sent a letter and follow-up phone call, if necessary, that described the project, its goals, and intentions. All families who agreed to be contacted also agreed to allow their children to participate.

Participants

Fifteen participating students were in kindergarten to Grade 5 at the onset of the 3-year study. They included six typically developing students (NOSPED) and nine students who had received speech-language pathology or special education services or designations (SPED). In British Columbia, students who are designated may fall into the following categories: physically dependent; deafblind; moderate to profound intellectual disability; physical disability or chronic health impairment; visual impairment; deaf or hard of hearing; autism spectrum disorder; intensive behaviour intervention or serious mental illness; mild intellectual disabilities; learning disabilities; moderate behaviour support or mental illness (British Columbia Ministry of Education, 2002). No students with a gifted designation participated in this study. Because the school was small with small class sizes, to protect their privacy and as agreed upon with their parents, no further details will be released concerning individual children such as their date of birth, gender, or details regarding their special education designation or the support they needed in school. SPED students were included in the analysis because they

also speak dialects (Oetting et al., 2016). Also, because some SPED students have language disorders, which are associated with shorter MLU and less use of subordination, their data were analyzed separately to investigate whether language disorder was a potential factor in their MLU and use of subordination.

Experimental Design, Data Collection, Interrater Reliability, and Statistical Analysis

A cohort sequential design was used (see **Table 1** for the number of participants and a schematic of the research design). Narrative language samples were collected in May and June each year for 3 years. Written samples were also obtained, with the task order (i.e., oral-first or written-first) being counterbalanced to control for carryover effects. Only the analysis of oral samples is presented in this paper (see Hart Blundon, 2019, for details concerning the analysis of written samples). Witnessed child assent was obtained for each sample.

Three short videos were used to obtain narrative language samples. These were *Balloons* (Kim, 2008; Year 1), *Fantasia Taurina* (Pérez González, 2009; Year 2), and *Wasabi Guy* (Ushko, 2013; Year 3). These videos were selected because they had been particularly successful in eliciting productive language samples for kindergarteners (Hart Blundon, 2019, 2022). Two school principals had vetted the videos to ensure their appropriateness for use with these school children. None of the videos featured Indigenous characters or themes. However, in the author's role as speech-language pathology consultant to the school, children indicated that they were familiar with non-Indigenous-themed YouTube videos. To mitigate any potential difficulties with unfamiliar vocabulary, students were trained on vocabulary items. A complete description of elicitation protocols is available at Hart Blundon (2019).

Table 1

Experimental Design: Number of Participants

Grade	Year 1 *n*	Year 2 *n*	Year 3 *n*	Total
K	1			1
1	2	1		3
2	4	2	1	7
3	3	4	1	8
4	2	2	4	8
5	3	2	2	7
6		3	1	4
7			3	3
Total	15	14	12	41

Note. K = kindergarten.

Each year, a different video was used to maintain student interest. Using a different video also mitigated potential practice effects that might reduce processing demands and thus enhance a child's word fluency and sentence length and complexity (see Dollaghan et al., 1990, on the language effects of familiarity of videotaped events). Varying videos also made it possible to determine whether grammatical patterns persisted in subsequent years under conditions of new vocabulary and new content. The persistence of grammatical patterns, despite changed conditions, provided evidence that observed grammar differences were features of a local variety of English (Wolfram & Adger, 1993). While videos had been viewed previously by some older participants, to the author's knowledge, none had been viewed more recently than 2.5 years before data collection. Miller et al. (2011), experts in language sample analysis, suggested that language sampling can be repeated sooner than the 6-months-to-1-year elapsed time usually recommended for standardized testing. Thus, a 2.5-year elapsed time further ensured a reduction in practice effects.

To collect oral samples, children were asked to watch a video and then tell the author and researcher the story of what had happened. Because the aim of this research was also to study the children's use of features (see Hart Blundon, 2019), including possible differences in verb tense, the children were also asked to tell the author what was happening while watching the video and to predict what would happen next. Elicitation protocols were also designed to encourage the production of other forms identified as characteristic of the local variety of English. These included the production of pronouns, articles, determiners, prepositions, plurals, possessive, negation, conjunctions, as well as differences in the way utterances were constructed.

Instructions were placed on a table to use as a reference but were not read. Instead, they were given orally to create a relaxed, fun, familiar, natural, non-test-like atmosphere. They were rephrased or broken into smaller units depending on the child's ability level and age. Additionally, in some instances, comments like, "Now we're going to do something special," or "Look at me" were included to motivate the child to continue or gain their attention. Some direct response or conversation was used to establish rapport; otherwise, comments and conversation were kept to a minimum.

Language samples were collected in a small office in the school. Students were audio-recorded using a Sony IC Recorder ICD-UX70 (recording format: MP3; sampling frequency: 44.1 kHz; bit rate: 128 kbps; microphone sensitivity set at a low level suitable for small spaces) that was held approximately 46 cm from each child's mouth.

After completing SALT training, the author assessed her ability to reliably code transcripts of the collected language samples with SALT conventions necessary to calculate MLU in words and morphemes by comparing her SALT-coded transcripts with those of professional transcriptionists from SALT Software. Word-by-word agreement on 2 of 15 (13.33%) transcripts collected in Year 1 was 93.35%, on 2 of 14 (14.69%) collected in Year 2 was 93.94%, and 2 of 12 (16.67%) collected in Year 3 was 94.73%. Agreement on conventions needed to calculate MLU, including utterance segmentation, applicable SALT codes, identification of complete and intelligible verbal utterances, and maze placement for Years 1, 2, and 3 was 87.85%, 88.71%, and 87.15%, respectively. Comparing the author's transcription and coding to those of SALT transcriptionists, the author was 97.64% and 98.23% accurate in calculating MLU in words and morphemes respectively for Year 1, 96.29% and 95.37% for Year 2, and 96.74% and 97.41% for Year 3. The author then used SALT scoring conventions to segment utterances and code orthographically transcribed language samples (Miller et al., 2011) and SALT to measure MLU in words and morphemes.

IBM SPSS descriptives and Microsoft Excel were used for descriptive analyses of NOSPED, SPED, and all students (i.e., NOSPED and SPED students combined). Given the small sample size, parametric tests were not used to analyze results. Neither were nonparametric assessments such as the Kruskal-Wallis assessment, which require a minimum group size of five to be valid. Instead, Monte Carlo assumption-free permutation analyses using R statistical software were used with 100,000 simulations to generate a probability distribution (p). In addition, the 95% confidence limits for the mean of the simulated differences were calculated.

To determine whether changes in the dependent variables MLU in words and morphemes between grades were statistically significant, simulations were carried out for Grades 1 and 4 and Grades 4 and 7 for the dependent variables MLU in words and morphemes. Comparisons for Grades 1 and 4 and Grades 4 and 7 were carried out because observations for Grades 1, 4, and 7 were independent, whereas observations for comparisons of other grades were not. In addition, Grade 1 can represent a mid-early elementary school grade, Grade 4 a mid-late elementary school grade, and Grade 7 a mid-middle school grade in British Columbia. Independent variables were Grade (1, 4, and 7). To assess whether there were significant differences between NOSPED and SPED groups, Monte Carlo simulations were carried out for Grade 1, 4, and 7 using R statistical software for dependent variables MLU in words and morphemes. Monte Carlo simulations could not be completed for the interaction of grade by SPED due to the presence of groups with an n of 1 with 0 degrees of freedom. Instead, Monte Carlo simulations were carried out to determine overall differences in the MLU between NOSPED and SPED students.

Study 2: Exploration of MLU and Use of Subordination

Study 2 was carried out to answer the first two research questions, "Do school-aged children who speak a variety of English have a different MLU than those of age-matched peers who speak a more standard variety of English?" and "Do children who speak a variety of English use subordination of clauses less frequently than age-matched peers who speak a more standard variety?"

Participants

Ten children were randomly selected from the pool of 15 students who participated in Study 1. Only 10 students were selected to participate in this study to ease the demands on the other five students and still gather enough data to discuss trends. Data for one SPED student of the 10 participating students were removed from the analysis because the student's scores were more than 3.29 SD from students' mean score in the comparison group (Tabachnick & Fidell, 2014). Five participants were NOSPED students, and four were SPED students. Samples were collected in Year 2 of the cohort sequential study.

Data Collection

Students were asked to complete SALT's narrative story retell task (Miller et al., 2011, pp. 197–204). The narrative story retell task was selected because SALT provided a Subordination Index score and comparison groups for all participating students. A Canadian source, the Edmonton Narrative Norms Instrument (ENNI; Schneider, Dubé, & Hayward, 2005) was considered because it provided comparison groups for special education students. It was not selected because it did not provide normative data for the older participants in this study or information on the rate of use of subordination (Miller et al., 2011). In SALT's narrative story retell task, the child listens to a story and then retells it while looking at illustrations in a version of the storybook that does not contain text. This particular elicitation protocol was selected for this study because comparison groups for all participants' grades are provided in the SALT database. Protocols were followed as outlined in Miller et al. (2011). For kindergarten and Grade 1 students, the author followed administrative procedures outlined in Option 1 and used a script rather than an audiotape of the story. Miller et al. (2011) stated, "There are three options for eliciting the samples. Use whatever option you prefer as they all elicit similar narratives" (p. 198). As in Study 1, language samples were collected in a small office in the school. Samples for

Study 2 were collected in the spring of Year 2 of the cohort sequential study, using the same recording techniques.

Interrater Reliability and Statistical Analysis of MLU

The author assessed her ability to reliably code transcripts with SALT conventions needed to calculate an MLU in words and morphemes by comparing her SALT-coded transcripts with those of professional transcriptionists from SALT Software (Miller & Iglesias, 2012). Word-by-word agreement on 1 of 10 (10%) transcripts was 91.47%. Agreement on conventions needed to calculate MLU, including utterance segmentation, relevant SALT codes, identification of complete and intelligible verbal utterances, and maze placement on 1 of 10 (10%) transcripts was 91.49%. Comparing the author's transcription and coding to SALT transcriptionists, the author was 97.66% and 97.70% accurate in calculating MLU in words and morphemes, respectively.

Upon completing reliability assessment, SALT computer software was used to calculate MLU in words and morphemes for each participant. Then, replicating a procedure that a speech-language pathologist might carry out to help determine whether a student needed specialized support, the standard deviation of each participant's result from the MLU of age-matched peers in SALT comparison groups was determined. Comparison groups were comprised of "English-fluent" (Miller et al., 2011, p. 197) age-matched (+/- 6 months) students from Wisconsin and California. Students from Wisconsin came from homes representing a range of socioeconomic statuses. They were typically developing as measured by their expected progress in school and absence of special education services. Students in California were of average ability as per their performance in class and on standardized tests and their non-use of special education services. They were balanced for "race, ethnicity, gender, and socioeconomic status" (Miller et al., 2011, p. 198). Monte Carlo simulations were then used to determine whether there were differences between NOSPED and SPED students' standard deviations from the mean of their comparison groups.

Interrater Reliability and Statistical Analysis of Use of Subordination

SALT's Subordination Index scoring system was also applied to utterances in nine story retell language samples. The Subordination Index produces a ratio of the total number of clauses to the total number of communication units (Miller et al., 2011). The author subsequently assessed her ability to reliably determine Subordination Index scores by comparing her transcripts with those of transcriptionists from SALT Software. There was 100% agreement on 1 of 9 (11%) transcripts. After completion of interrater reliability assessment, SALT computer software was used to calculate each participant's Subordination Index score. Then, the standard deviation of each participant's result from the Subordination Index scores of age-matched peers was determined. Monte Carlo simulations were used to determine whether there were differences between NOSPED and SPED students' standard deviations from the mean of comparison groups.

Results

Study 1: Change in MLU as Children Advance Through the Grades

Table 2 shows the mean, standard deviation, and sample size of MLU words and morphemes for Grades for NOSPED, SPED, and all students. **Figures 1** and **2** illustrate these data graphically. **Table 2** and **Figures 1** and **2** show that MLU in words and morphemes declined for all students from kindergarten to Grade 1. There appeared to be a levelling in MLU in words and morphemes between Grades 1 and 2, and then an increase from Grade 2 to Grade 5. Between Grades 5 and 6, there was a slight decrease in MLU in words but a levelling in MLU in morphemes. A jump in MLU in words and morphemes occurred between Grades 6 and 7. As for NOSPED and SPED students, the MLU in both words and morphemes of NOSPED students appeared to be longer than the MLU of SPED students from Grade 1 to 3. From Grade 3 to 5, the two groups merged. Then, from Grade 4 to 7, the MLU of SPED students surpassed the MLU of NOSPED students.

Monte Carlo analysis found that the null hypothesis that the observed difference of 0.62 between the means of all students in Grades 1 and 4 for MLU in words could be produced by chance alone was accepted (p = .33), with a simulated mean of 0.49 with 95% confidence interval (CI; [0.03; 1.24]). That is to say, the MLU in words of all students in Grade 1 and Grade 4 was likely not different. Similarly, for MLU in morphemes, the null hypothesis that the observed difference of 0.63 between the means of all students for Grades 1 and 4 could be produced by chance alone was accepted (p = .34), with a simulated mean of 0.52 with 95% CI [0.02; 1.31]. In other words, the MLU in morphemes of all students in Grades 1 and 4 was likely not different. However, for the difference between Grades 4 and 7, Monte Carlo analysis found that the null hypothesis that the observed difference of 2.07 between the means of all students for MLU in words for Grades 4 and 7 could be produced by chance alone was rejected (p = .02), with a simulated mean of 0.74 with 95% CI [0.01; 1.88]. In other words, the MLU in words of all students in Grades 4 and 7 was likely different. Similarly, for MLU in morphemes, the null hypothesis that the observed difference of 2.60 between

Table 2

Descriptive Statistics for NOSPED, SPED, and All Students: Video Retell

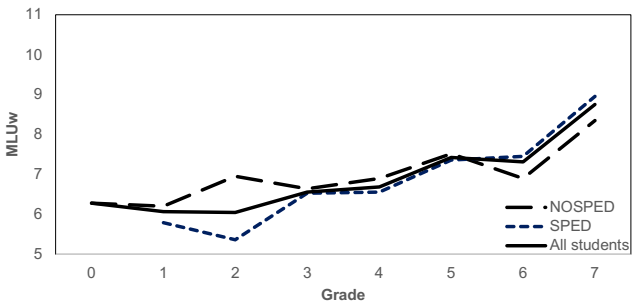
Group	MLUw	*SD*w	MLUm	*SD*m	*n*
Grade K					
NOSPED	6.28		7.16		1
SPED					
All students	6.28		7.16		1
Grade 1					
NOSPED	6.21	0.19	7.01	0.25	2
SPED	5.79		6.70		1
All students	6.07	0.28	6.91	0.25	3
Grade 2					
NOSPED	6.96	0.55	7.90	0.37	3
SPED	5.37	0.48	6.18	0.59	4
All students	6.05	0.97	6.92	1.03	7
Grade 3					
NOSPED	6.64	1.15	7.36	1.26	2
SPED	6.53	0.94	7.42	0.91	6
All students	6.56	0.91	7.40	0.91	8
Grade 4					
NOSPED	6.90	0.33	7.77	0.28	3
SPED	6.56	1.28	7.40	1.36	5
All students	6.69	1.00	7.54	1.06	8
Grade 5					
NOSPED	7.52	1.23	8.48	1.23	3
SPED	7.36	1.45	8.33	1.52	4
All students	7.43	1.25	8.39	1.29	7
Grade 6					
NOSPED	6.90		7.78		1
SPED	7.45	1.20	8.59	1.63	3
All students	7.31	1.02	8.39	1.39	4
Grade 7					
NOSPED	8.35		9.84		1
SPED	8.96	1.21	10.30	1.10	2
All students	8.75	0.92	10.14	0.82	3

Note. NOSPED = typically developing students; SPED = students who required speech-language pathology and/or special education support; All students = total NOSPED and SPED students combined; K = kindergarten; MLUw = mean length of utterance in words; MLUm = mean length of utterance in morphemes

the means of all students for Grades 4 and 7 could be produced by chance alone was rejected (p = .01), with a simulated mean of 0.85 with 95% CI [0.03; 2.11]. In other words, the MLU in morphemes of all students in Grades 4 and 7 was likely different.

Monte Carlo analysis showed that the null hypothesis that the observed difference of 0.15 between the means of NOSPED and SPED for MLU in words could be produced by chance alone was accepted (p = .84), with a simulated mean of 0.57 with 95% CI [0.02; 1.47]; the MLU in words of the NOSPED and SPED groups was likely not different. The null hypothesis that the observed difference of 0.17 between the means of NOSPED and SPED for MLU in morphemes could be produced by chance alone was accepted (p = .84), with a simulated mean of 0.65 with 95%

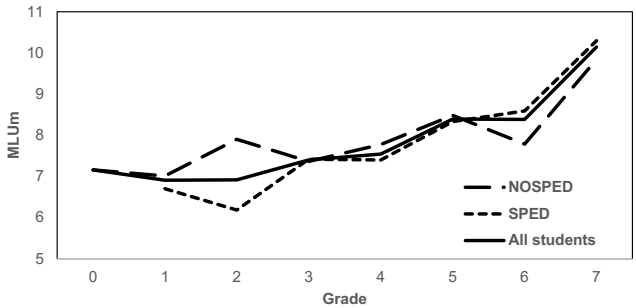
Figure 1



Mean Length of Utterance in Words for NOSPED, SPED, and All Students by Grade: Video Retell

Note. MLUw = mean length of utterance in words; NOSPED = typically developing students; SPED = students with history of special education or speech-language pathology support; All students = total NOSPED and SPED students.

Figure 2



Mean Length of Utterance in Morphemes for NOSPED, SPED, and All Students by Grade: Video Retell

Note. MLUm = mean length of utterance in morphemes; NOSPED = typically developing students; SPED = students with history of special education or speech-language pathology support; All students = total NOSPED and SPED students.

CI [0.03; 1.71]; the MLU in morphemes of the NOSPED and SPED groups was likely not different.

In summary, the MLU for all students in Grades 1 and 4 was likely the same, whereas the MLU for all students in Grades 4 and 7 was likely different. As for the behaviour of NOSPED and SPED students, descriptive analysis indicated that in the early grades, the MLU of NOSPED students exceeded the MLU of SPED students. In Grade 4, the two groups performed similarly, but by Grade 7, the MLU of the SPED students appeared to surpass the MLU of the NOSPED students. Overall, there was likely no difference between the NOSPED and SPED students.

Study 2: Exploration of MLU and Use of Subordination

Table 3 shows individual NOSPED (*n* = 5) and SPED (*n* = 4) students' MLU in words and morphemes on the story retell task, the mean and standard deviation of the SALT database comparison group, each participant's standard deviation from the SALT database comparison group for both words and morphemes, and the n of the SALT comparison group. From an examination of **Table 3**, of the remaining nine participating students, the standard deviation of participating students' MLU in words compared to SALT's database of typically developing English-speaking students ranged from −0.39 to −2.43. The standard deviation of students' MLU in morphemes ranged from −0.32 to −2.26. In summary, all participating children's standard deviations of their MLU in words and morphemes were negatively skewed compared to the MLU's of age-matched peers in SALT's databases. This was the case regardless of whether students had a history of receiving speech-language pathology or special education services or not.

A Monte Carlo analysis showed that the null hypothesis that the observed difference of 0.30 between the average standard deviation from the mean of comparison groups of NOSPED and SPED students' MLU in words could be produced by chance alone was accepted (p = .55), with a simulated mean of 0.38 with 95% CI [0.02; 1.01]. That is to say, the mean standard deviation of the MLU in words of the NOSPED and SPED groups was likely not different. Similarly, the null hypothesis that the observed difference of 0.27 between the average standard deviation from the mean of comparison groups of NOSPED and SPED students' MLU in morphemes could be produced by chance alone was also accepted (p = .60), with a simulated mean of 0.36 with 95% CI [0.03; 0.95]. That is to say, the standard deviation of MLU in morphemes of the NOSPED and SPED groups was likely not different. In summary, contrary to what might be expected, the negatively skewed results obtained by the typically developing students were like the SPED students' results.

Table 4 shows individual participant's SALT Subordination Index scores; the mean, standard deviation, and n of the SALT database comparison group; and each participant's standard deviation from the mean of the SALT comparison group for NOSPED students (*n* = 5) and SPED students (*n* = 4). **Table 4** shows that 33% (3 of 9) of students' Subordination Index scores were more than 1 standard deviation below the mean of age-matched peers in SALT comparison groups. Twenty-two percent (2 of 9) students obtained scores above the mean, while the remaining 78% (7 of 9) obtained scores below the mean. Thus, most scores appeared to be negatively skewed compared to the scores obtained by fluent speakers of mainstream American English in SALT comparison groups. This was the case for all students, including those with no history of receiving special education services.

Table 3

Individual Students' MLUs and Standard Deviations From Comparison Group Means; Comparison Group Means, Standard Deviations, and Sizes: Story Retell

MLUw	Mean (*SD*) of CG	*SD* from CG	MLUm	Mean (*SD*) of CG	*SD* from CG	CG *n*
Group NOSPED						
7.35**	10.32 (1.45)	−2.05	8.14**	11.29 (1.57)	−2.01	83
7.26**	10.59 (1.54)	−2.17	7.85**	11.63 (1.68)	−2.26	37
9.19	9.72 (1.38)	−0.39	10.09	10.56 (1.49)	−0.32	46
7.24*	8.24 (0.96)	−1.04	8.04*	9.26 (1.08)	−1.13	82
6.68	7.66 (1.22)	−0.80	7.23	8.42 (1.36)	−0.88	58
Group SPED						
8.84	10.27 (1.46)	−0.98	9.60*	11.25 (1.60)	−1.04	91
7.85*	10.30 (1.47)	−1.66	8.63*	11.28 (1.61)	−1.65	88
5.72*	7.19 (1.14)	−1.29	6.40*	8.23 (1.29)	−1.42	24
6.17**	8.37 (0.90)	−2.43	7.10**	9.42 (1.02)	−2.26	50

Note. NOSPED = typically developing students; SPED = students who required speech-language pathology and/or special education support; MLUw = mean length of utterance in words; MLUm = mean length of utterance in morphemes; CG = comparison group data from Systematic Analysis of Language Transcripts database using selection criteria of ± 6 months.
* At least 1 SD from CG mean. ** 2 *SD* or greater from CG mean.

A Monte Carlo analysis showed that the null hypothesis that the observed difference of 0.41 between the average standard deviation from the mean of comparison groups of NOSPED and SPED students' Subordination Index scores could be produced by chance alone was accepted (p = .40), with a simulated mean of 0.40 with 95% CI [0.01; 1.05]. That is to say, the mean standard deviation of the Subordination Index score of the NOSPED and SPED groups was likely not different.

These results suggest that students appeared to speak in sentences that contained fewer subordinate clauses than those of mainstream fluent speakers of English who live elsewhere in North America. Their less frequent use of clauses is likely not an indicator of language disorder. In fact, typically developing children used fewer subordinate clauses (mean standard deviation = −0.77) than the SPED students (mean standard deviation= −0.36) compared to age-matched peers in the SALT comparison groups.

When comparing **Table 3** to **Table 4**, sentence complexity as measured by a Subordination Index score was not as negatively discrepant as sentence complexity measured by MLU in words and morphemes compared to SALT's comparison groups. The explanation for the difference likely lies in the way the two metrics are calculated. The Subordination Index measures the use of subordination, and MLU considers both the use of subordination and

Table 4

Individual Students' Subordination Index Scores and Standard Deviations From Comparison Group Means; Comparison Group Means, Standard Deviations, and Sizes: Story Retell

SI	Mean (*SD*) CG	*SD* from CG	CG *n*
Group NOSPED			
1.27*	1.51 (0.15)	−1.56	83
1.29*	1.53 (0.20)	−1.20	37
1.35	1.43 (0.12)	−0.64	46
1.29	1.27 (0.12)	0.18	82
1.07	1.14 (0.10)	−0.62	58
Group SPED			
1.59	1.51 (0.16)	0.52	91
1.50	1.51 (0.16)	−0.08	88
1.20	1.24 (0.11)	−0.35	24
1.12*	1.30 (0.12)	−1.52	50

Note. SI = Subordination Index score; SALT = Systematic Analysis of Language Transcripts; CG = comparison group from SALT database using selection criteria of ± 6 months. NOSPED = typically developing students; SPED = students who required speech-language pathology and/or special education support;
* At least 1 *SD* from CG mean.

the number of words used in grammatical structures. Participating school children used less subordination and fewer words in their grammatical constructions. Therefore, it stands to reason that their MLU would be more negatively discrepant than their Subordination Index scores.

In summary, participating students appeared to use fewer sentences with subordination in their utterances than are used by age-matched fluent speakers of mainstream American English. Their MLU was even more discrepant than the MLU obtained by age-matched peers who are fluent speakers of mainstream American English in comparison groups. They use fewer words and fewer clauses with subordination, owing to their different English grammar and way of constructing sentences; MLU measures both factors. This was the case regardless of whether students had a history of receiving speech-language pathology or special education services or not.

Discussion

This investigation of the MLU of students who speak a First Nations English variety suggests that they spoke in shorter utterances than the MLU obtained by age-matched peers when retelling stories. This result supports the hypothesis that students who speak varieties speak in sentences different from fluent speakers of mainstream English. It also corroborates Pearce and Flanagan's (2019) results. They found that Indigenous children in Australia demonstrated a shorter MLU than students who spoke standard Australian English. Differences in the MLU shown by students who participated in this study and English speaking students from elsewhere in North America may be due at least in part to grammar differences between their variety of English and the standard English variety (e.g., the copula or auxiliary was not always included in their speech [e.g., "They ___ waitin'."], final <ed> was not always included when forming past tense [e.g., "He look there yesterday."], and so on).

Additionally, the Subordination Index scores of students appeared to be lower than scores obtained by age-matched mainstream English-speaking peers in the United States, indicating that they used subordination less frequently. This result supports the hypothesis that students who speak varieties use subordinate clauses less frequently than speakers of more standard English. This result is also like that obtained by Pearce and Flanagan (2019). They found that Indigenous Australian students tended to use subordinate clauses less frequently, which they felt contributed to students' shorter sentence length.

Both MLU and Subordination Index scores are measurements of standard English syntactic complexity (Loban, 1976; Miller et al., 2011). Failure to acquire standard English grammar and complex utterance construction has been considered an indicator of language disorder (Miller et al., 2011). However, this may not be the case for students who speak a variety in this school, and it may not be the case for other students who speak other varieties. Instead, their MLU may be shorter due to their different English grammar. Also, their frequent use of simple sentences without subordination may be a stylistic feature of a local variety, reflective of the speakers' laconic way of speaking, and not symptomatic of language disorder.

As for the students' language behaviour as related to their special education status, in the early grades, the MLU of NOSPED students appeared to exceed the MLU obtained by SPED students on the video retell task. This is not surprising given that a shorter MLU is associated with language disorder; at least some SPED students may have had difficulty expressing themselves. However, language disorder may not be the only explanation for this result. In a study of children's use of grammatical varietal features over grades, Hart Blundon (2019) found that SPED students used features at higher rates than NOSPED students. Because the use of grammatical features may be associated with fewer English words and morphemes, the shorter MLU produced by SPED students may be related to their increased use of grammatical features. As for the students' performance relative to age-matched peers, contrary to what might be expected, there were no statistically significant differences between the groups regarding their MLU or rate of use of subordination. This suggests that there is another explanation for the typical students' performance. It is suggested that they spoke in shorter sentences and used fewer subordinate clauses than age-matched peers who spoke a more standard variety because that is typical for their community variety.

Given the results of this study, it is suggested that speech-language pathologists and other educational professionals avoid using MLU and Subordination Index scores when trying to determine whether students who speak varieties need specialized support. Until assessment tools are developed that are normed on each English variety in Canada, it is suggested that speech-language pathologists avoid all assessments not standardized on the local population.

In the meantime, however, speech-language pathologists and educational professionals must not underdiagnose. A test-intervene-test type dynamic assessment may be a best practice at present. That is, first carrying out an assessment, then providing evidenced-based respectful interventions such as recasting or contrastive analysis, and then reevaluating to determine whether the interventions have been at least introductorily successful. Recasting involves rephrasing the child's utterances without correction. It is an effective approach with children who speak varieties in the United States (Edwards & Rosin, 2016) and has been recommended for use among First Nations children (Larre, 2009). Contrastive analysis and code-switching are also effective approaches (Edwards & Rosin, 2016; Wheeler & Swords, 2004). For contrastive analysis, the educator systematically teaches the points of contrast between the two varieties. Code-switching involves teaching the student to "choose the language variety appropriate to the time, place, audience, and communicative purpose" (Wheeler & Swords, 2004, p. 471).

Another approach may be the use of linguistically unbiased tests that do not rely on prior knowledge. Instead, they "explore children's ability to conduct psycholinguistic processing operations that are minimally dependent on prior knowledge or experience" (Campbell et al., 1997, para. 3). Bias has been reduced in nonword repetition tasks that require the child to repeat nonsense syllables. Bias has also been reduced in token tests. They require a student to perform commands using coloured geometric objects of different sizes.

Even though students in this community who spoke a variety of English appeared to speak in utterances shorter than those of age-matched peers or tended not to subordinate clauses in their utterances, their sentence length increased as they progressed through the grades. This was also the case for speakers of African American language (Craig & Washington, 2006), with older students using longer sentences. Because MLU is a measure of language development, it follows that the language of variety-speaking students who attended Bigton School in British Columbia also developed over time, albeit in a way that may be unique to their community variety. More research should be carried out to develop community-based norms for other children who speak varieties.

Limitations

Language samples were collected by a standard English-speaking adult, which may have influenced the way the students spoke English and their resultant sentence length. Because the samples were collected in just one context, no comment can be made on the students' language behaviour in other contexts, such as when they participate in community gatherings or interact with their family or peers, other than to make comments derived from anecdotal observations. Future research should focus on studying children's MLU and use of subordination in conversational and expository speech in a wider variety of contexts with a broader variety of communicative partners.

To explore the relationship between Bigton students' MLU and use of subordination compared to their age-matched peers who spoke more standard English, a story retell sample was collected in addition to an oral and written video retell sample. This third sample needed to be collected within a 2-to-3-day period. Because story retell was the third sample collected, fatigue may have influenced the results. However, when questioned, many students indicated that they enjoyed the story retell task. It was novel in that they had not completed this type of protocol before, which may have increased their motivation and counteracted fatigue.

As discussed in the Methods, Study 1, Participants section, SPED students' data were included in this analysis. Some SPED students may have presented with language disorder, and language disorder is associated with shorter MLU and less use of subordinate clauses. Determining whether their shorter MLU is related to language disorder or their English variety's grammar can be difficult. Their data were included because SPED students also speak varieties (Oetting et al., 2016). More importantly, their data were included to support the argument that typically developing students speak a variety. Statistical analysis indicated no overall difference in the MLU or rate of use of subordination for NOSPED and SPED students, nor was there an overall significant difference in their MLU over grades. Because typically developing NOSPED students behaved similarly to SPED students, another factor may have caused the NOSPED students' lowered MLU and reduced use of subordination. That factor is likely variety.

Another limitation concerns generalizability. Even though over half of the eligible students in Bigton School were recruited, absolute statements cannot be made about the language behaviour of other First Nations students in British Columbia and Canada based on data collected from 15 students. However, the results obtained in this study are like those obtained by Pearce and Flanagan (2019). They also found that Indigenous children in Australia who may speak English differently have a shorter MLU than non-Indigenous children. Therefore, it is argued that there is enough overlap that, at the very least, speech-language pathologists and educators should have a heightened awareness of the need to avoid using MLU and Subordination Index norms not standardized on their local populations of First Nations students. The issue of generalizability also speaks to the need for more research. It is hoped that this work inspires others to investigate whether varieties are being spoken in other communities and explore the MLU and use of subordination by its speakers.

Summary

This study showed that children in this community who spoke a variety of English produced utterances with a shorter MLU and fewer subordinate clauses than peers who spoke a more standard English variety, likely related to their different way of speaking English. Despite these differences, their expressive language developed over time. If educational professionals such as speech-language pathologists are not aware of these differences, they are at risk of incorrectly concluding that the variety-speaking child may have a language disorder. Additionally, if educational professionals are not aware of how the language of students who speak varieties develops over time, they cannot know if a student is developing language as expected or needs specialized support. It is critically important that we learn more about First Nations Englishes to cease pathologizing students for their way of speaking English and, instead, celebrate their variety as a linguistic marker of their community.

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Author's Note

Dr. Hart Blundon is now at Fireweed Speech and Language Supports.

Correspondence should be addressed to Patricia Hart Blundon, Fireweed Speech and Language Supports, 2898 Ilene Terrace, Victoria, BC, CANADA, V8R 4P1.
Email: **hartblun@uvic.ca**

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Appendix

Grammatical Features of First Nations School-Aged Children

Feature type	Examples
Verbs	Present for past: *He **look** there yesterday; Then this kid **comes** over and looked like she was coming from a party*
	Absent copula or auxiliary: *They __ waitin'*
	Regularization: *She **blowed** the balloon; She **poppeded** the balloon*
	Absent 3rd person singular <s>: *He **kick** the ball*
	Absent -ing: *The girl is **bounce** all over*
	Absent "to": *She was waiting for the girl __ come back*
	Subject–verb agreement: *They **was** coming*
	Gots/has: *The woman **gots** a …*
Pronouns	Undifferentiated pronoun case: ***Her** blew that to him*
	Absent 3rd person singular gender distinction: ***He** (referring to a female) catches it*
Articles, determiners	Use of "that" for "the": *He got in **that** lake*
	Pronoun/determiner; absent determiner: ***Them** bees are going to get him; Then __ bull breathe in her face*
	Indefinite article: *He gots **a** glasses; **a** apple tree; The girl is tryin' get _ apple*
Prepositions	Different or absent use of preposition: *The girl got **along/out of** the way*
Non-verb-related morphology	Absent possession: *The **bull** horns are stuck in the tree*
	Absent plural: *The **bee** are gonna come out*
	Negation: *I **not** know; Now they're **ain't**; He **never** took his nose; He **don't** want him to see*
Conjunctions	Use of "and here" or "then here" for "and then":
	***Then here** he is bouncing all over; **And here** the bus came*
Utterance-level features	Absent phrase: *___ waiting for her to come (the auxiliary is also absent in this example)*
	String: *And then they come out, then help, sit down, and have more apples*
	Topicalization: *That bull, he was mad*
	Repetition: *He got really mad and really, really mad; They were jumping out and jumping back in and jumping out and jumping back in and jumping out*
	Different word order: *That you see she have a balloon*

Exploring Practice-Based Clinical–Research Partnerships in Speech-Language Pathology: A Scoping Review

Exploration des partenariats de recherche clinique axée sur la pratique en orthophonie : une revue exploratoire

Meghan Vollebregt
Lisa M. D. Archibald
Julie Theurer
Janis Oram Cardy

KEYWORDS

PRACTICE-BASED RESEARCH

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COLLABORATION

PARTNERSHIP

Meghan Vollebregt[1], Lisa M. D. Archibald[2], Julie Theurer[2], and Janis Oram Cardy[2]

[1]Graduate Program in Health and Rehabilitation Sciences, Western University

[2]School of Communication Sciences and Disorders, Western University

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Abstract

Collaborative partnerships between speech-language pathologists and researchers present an opportunity for practice-based research. For practice-based research to become more widely used in speech-language pathology, a crucial step is outlining the potential purposes and outcomes of these partnership projects. The current article is two-fold. First, we describe a model for practice-based partnerships between researchers and speech-language pathologists. The practice-based research cocreation model developed for this project includes three distinct partnership outcomes: (a) creating practice, (b) capturing current practice, and (c) changing practice. Then, informed by our model, we completed a scoping review to explore the extent and type of practice-based research in the field of speech-language pathology to date. A literature database search identified 3510 articles meeting our inclusion criteria. Two independent readers reviewed abstracts and titles to determine articles for further review. Fifty-three articles were reviewed in full and 18 of these were excluded. Data were extracted from the remaining 35 articles. Level of partnership (creating, capturing, or changing) and type of partnership (collaborative or consultative) were coded. A thematic analysis revealed that three of the 35 articles involved creating practice, 19 captured current practice, and 13 were aimed at changing practice. Of the 27 articles in which details were provided about the partnerships between researchers and clinicians, 18 partnerships were collaborative and 9 were consultative. This review offers an initial step in examining the use of practice-based research in speech-language pathology, thereby demonstrating to researchers and clinicians how they can support each other to cocreate clinically relevant research.

Abrégé

Les collaborations et partenariats entre les orthophonistes et les chercheurs représentent de belles opportunités de faire de la recherche axée sur la pratique. Afin que l'utilisation de la recherche axée sur la pratique se généralise en orthophonie, il est crucial de d'abord définir les objectifs et les résultats potentiels pouvant découler de ces projets de partenariat. Le présent article comporte deux volets. Dans un premier temps, nous décrivons un modèle de partenariat de recherche axée sur la pratique unissant orthophonistes et chercheurs. Celui-ci a été développé pour la présente étude et caractérise les partenariats selon trois types de résultats pouvant en découler : (a) création de pratiques, (b) évaluation des pratiques actuelles et (c) modification des pratiques. Dans un second temps, en nous appuyant sur notre modèle, nous avons réalisé une revue exploratoire de la littérature afin de cerner l'étendue et le type de la recherche axée sur la pratique réalisée dans le domaine de l'orthophonie. Une recherche dans des bases de données a permis de recenser 3510 articles répondant à nos critères d'inclusion. Deux lecteurs indépendants ont révisé les abrégés et les titres pour déterminer quels articles se qualifiaient pour un examen approfondi. Cinquante-trois articles ont été lus en entier et 18 ont été exclus des analyses. Les données des trente-cinq articles restants ont été extraites, puis codées selon le niveau de partenariat (création, évaluation ou modification) et le type de partenariat (collaboratif ou consultatif). Une analyse thématique a révélé que, parmi les 35 articles, 3 traitaient de la création de pratiques, 19 de l'évaluation de pratiques actuelles et 13 de modification des pratiques. Parmi les 27 articles contenant de l'information au sujet des partenariats entre les chercheurs et les cliniciens, 18 partenariats étaient collaboratifs et 9 étaient consultatifs. Cette revue constitue un premier pas dans l'évaluation du recours à la recherche axée sur la pratique en orthophonie et indique par le fait même de quelle façon les chercheurs et les cliniciens peuvent s'entraider dans la cocréation de recherches pertinentes sur le plan clinique.

It has long been recognized that laboratory-based research findings with presumed clinical relevance may have little impact on practice. Difficulty translating knowledge from research into practice arises for a variety of reasons related to both research pipelines and clinical experiences (Crooke & Olswang, 2015). Practice-based research (PBR) is an approach to systematic inquiry that involves gathering information from clinical practice to answer questions arising from practice to inform future practice (Epstein, 2002). As a promising approach to knowledge creation, PBR addresses many of the limitations discussed in the field of knowledge translation. Crucially, PBR involves practicing research "without the gap" because the research question is embedded directly in practice. By cocreating knowledge at the point of consumption, PBR has the potential to directly impact practice with little need for knowledge translation. PBR is well suited to the field of speech-language pathology given the importance of applied research questions and objective clinical approaches in the field, however, the extent to which clinicians and researchers are engaged in this type of research is unknown. The purpose of the present study was to examine PBR in the field of speech-language pathology with the two-fold goal of (a) describing potential PBR goals in a cocreation model including *capturing practice, changing practice,* and *creating practice,* and (b) reporting a scoping review on published research broadly consistent with a PBR approach in the field of speech-language pathology and categorized according to our model.

The Research–Practice Gap

Knowledge generated through systematic research has important implications for service providers whose goals are to improve the health, education, and well-being of individuals. The traditional research pipeline of creating knowledge involves researchers outside of the clinical provision pathway deciding upon a research question, designing a research study, collecting and analyzing data, and sharing results. One problem noted with this knowledge creation process has been that the shared research results often fail to impact practice at the level of service providers (clinicians, educators, etc.; Graham et al., 2006; Green et al., 2009; Morris et al., 2011; Straus et al., 2009). Observations of this research–practice gap gave rise to the field of knowledge translation (Canadian Institutes of Health Research, 2008; Straus et al., 2009), which centres on moving research from the laboratory into practical use. The full knowledge-translation cycle is captured in the knowledge-to-action framework (Graham et al., 2006; Straus et al., 2009), which specifies both knowledge-creation and action cycles. The knowledge-to-action framework provides a means of focusing attention on research, practice, and the gap between them.

Despite nearly 2 decades of effort, closing the gap between research and practice has proven a perplexing challenge (Olswang & Prelock, 2015). This research–practice gap is maintained by various barriers faced by both researchers and clinicians (e.g., time, resources, research useability, support). In the knowledge-creation cycle, researchers experience delays in producing efficacious and effective research (Ovretveit et al., 2014) and can encounter further delays when publishing their findings (Morris et al., 2011; Olswang & Prelock, 2015). As well, avenues valued by researchers for sharing their findings, such as scholarly journals, are not necessarily accessible to practitioners (Grimshaw et al., 2012). In addition, scholarly publications are often not written for a practice-based audience, requiring clinicians to interpret the findings and determine the implications for practice (Olswang & Prelock, 2015). Considerable time, resources, knowledge expertise, and motivation are required to engage in such interpretative activities and implement potential changes (Green et al., 2009). Although critical, necessary organizational support may not be available to enable such activities within everyday practice.

Beyond the challenge of sharing and translating available research, another barrier in addressing the research–practice gap is a lack of overlap between research priorities and clinical concerns. Researchers and clinicians often operate in relative isolation from one another. As a result, researchers may focus on questions that are not relevant to clinical practice or develop solutions that are not feasible within the economic or contextual constraints of practice (Olswang & Prelock, 2015). Although clinician scientists present another solution to the research–practice gap by conducting research as part of practice, the focus of the current review is on the partnership between researchers and clinicians.

Moving Research Into Practice

Situated within knowledge translation is the field of implementation science, which has been a recent focus in communication sciences and disorders (Douglas & Burshnic, 2019). Focused on the action cycle, implementation research is the study of methods that promote the uptake and integration of evidence into health policies, health care, and education (Bauer et al., 2015; Proctor et al., 2013). Specifically, implementation science uses methods and techniques to systematically address barriers that hinder the integration of new research into practice (Eccles et al., 2009; Olswang & Prelock, 2015).

In describing the process of implementation science, Curran (2020) identified three components in the simplest terms: *the thing, how to do the thing,* and *the stuff*. The thing refers to an intervention, or innovation for which the knowledge creation phase of effectiveness research has been completed and the effectiveness established. The question of how to do the thing, on the other hand, is the purview of implementation research, which focuses on applying the product of effectiveness research in practice. Implementation researchers develop and investigate implementation strategies, referred to as the stuff, that aim to help people do the thing. These implementation strategies, or the stuff, may improve the uptake of the thing by adding supports or may remove barriers allowing for more ease to do the thing. Thus, although implementation science is aimed at minimizing the research–practice gap (Greenhalgh et al., 2004), this area of research persists as a framework where researchers push their established findings into practice for application and integration (Olswang & Prelock, 2015). Implementation science can be expected to be particularly effective when congruency exists between research outcomes, clinical interests, and practice requirements.

Unfortunately, research priorities and clinical practicalities sometimes fail to align (Olswang & Prelock, 2015). Myriad problems arise when a large gap exists between research outcome requirements and what can feasibly be achieved in practice. This disconnect between research outcomes and practice is not addressed by approaches to knowledge translation. One solution to this problem is for the point of partnership between researchers and practitioners to begin much earlier and work bidirectionally. In collaborative partnerships, knowledge creators and knowledge users work together to codesign theoretically sound things that are relevant to practice and seamlessly implemented within practice (Greenhalgh et al., 2016; Jull et al., 2017).

The Use of Partnerships

In recognition of the intractability of the research–practice gap, there has been a growing trend in many fields to use partnerships to help align research priorities and clinical needs. Indeed, in knowledge-translation approaches, the use of partnerships is widely acclaimed and seen as a fundamental component of the approach (Gagliardi et al., 2015; Greenhalgh et al., 2016; Jull et al., 2017; Nguyen et al., 2020). The timing of partnership initiation, however, may vary. According to the knowledge-to-action framework (Graham et al., 2006), the boundaries between knowledge creation and action are fluid to allow both for the influence of one aspect on the other and for collaboration among stakeholders to be initiated at any point in the framework. Although collaboration at the action phase can support implementation, engaging in collaborative partnerships earlier in the process better supports rapid creation and integration of evidence (Gagliardi, et al., 2015; Jull et al., 2017). In fact, it has been suggested that the research–practice gap is caused by issues in knowledge production rather than knowledge transfer (Bowen & Graham, 2013; Jull et al., 2017). Engaging in partnerships throughout the knowledge-to-action framework repairs this issue as collaborators cocreate and apply new knowledge together.

Cocreation partnerships have been described using many terms (i.e., research–practice partnerships, PBR networks) and are found within a variety of paradigms (design-based research, integrated knowledge translation, community-based participatory research, organizational participatory research, and PBR). As emerging fields under the broad umbrella of knowledge translation, considerable overlap exists between terms and paradigms related to partnered research. Although the need to include a variety of terms when searching for research broadly consistent with PBR was identified, the term *evidence-based practice* was considered too general and broad to be useful in focusing the search on PBR. The term *practice-based evidence* describes an approach that is particularly important when high-quality evidence is lacking, does not relate to an individual client, or does not provide clear recommendations. A clinician scientist generates practice-based evidence often through single-case experimental designs or case studies (Lemoncello & Ness, 2013). Many clinicians have played a dual clinician-researcher role conducting research on their own practice (Owen et al., 2004; Wight & Miller, 2015). However, our focus for the review was on PBR that incorporated a practitioner–researcher partnership.

Creating Research in Practice: PBR

PBR refers to a researcher–practitioner partnership where the initiation of partnership starts early in the knowledge-creation phase. From the beginning, researchers and practitioners work together to identify a problem currently experienced in practice and design an applicable solution. By situating the knowledge-creation phase directly in practice, the action cycle is either reduced or eliminated. By gathering data in practice to later inform that practice (Epstein, 2002), PBR creates research without the need for translation across the gap. Certainly, PBR does not replace the need for traditional research, but it provides a valuable complement to traditional research. PBR represents the pull from practice by addressing questions that arise from practice (Crooke & Olswang, 2015). It is the lived

experiences of clinicians, educators, and stakeholders that influence all aspects of the project.

The potential power of PBR was first recognized by Epstein (2002), who reported that social workers routinely collected large quantities of clinical information about clients. Most researchers deemed this information as unreliable, but Epstein (2002) argued that these data could be mined to reveal valuable information for that clinical setting. Comparing a randomized control trial (Beder, 2000) and a PBR study (Dobrof et al., 2000), each conducted with end-stage renal dialysis patients, Auslander et al. (2002) showed comparable findings across studies. However, the PBR study (Dobrof et al. 2000) provided insight into service patterns that could not have been captured by the randomized trial. Both Beder's (2000) and Dobrof et al.'s (2000) studies answered questions about clinical practice, but only Dobrof et al.'s PBR project answered questions without adding to the workload of the clinicians and exposed service patterns that would not have been recognized otherwise. Both evidence of enhanced knowledge outcomes and reduced research-related workload highlight the value of PBR.

An important attribute of PBR is that it uses an inductive rather than deductive approach with key concepts coming from practical insight (Epstein, 2002). PBR approaches can use nonexperimental or quasi-experimental data designs, include descriptive and correlational findings, be collected retrospectively or prospectively, and include both quantitative and qualitative information. PBR studies also employ instruments from practice and recruit participants from their point of care without random assignment to alternate treatments or control groups. Similarly, unlike research-based practice trials, standardized assessments can be used in an unstandardized way if that is best for clinical practice. PBR is a collaborative science based in practice, and as such, practice requirements are of greater importance than research considerations (Epstein, 2002).

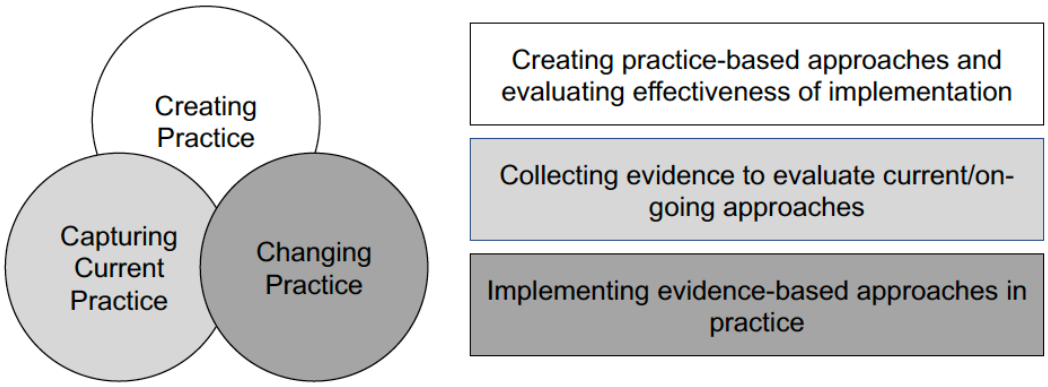
For the most part, PBR is built on partnerships between clinicians working primarily as service providers and researchers working primarily to carry out scientific investigation (e.g., Arcuri et al., 2016), although other models where a clinician scientist carries out both roles exist (e.g., Owen et al., 2004). Given the different expertise the partners bring to the partnership, a willingness to acknowledge the valuable contribution of other members is necessary. Researchers offer knowledge and skills that enhance the scientific rigour of the study design while ensuring high fidelity to the protocol, and clinicians possess insight into which research outcomes will be most significant to clinical practice and ensure the protocol is sustainable in practice (Crooke & Olswang, 2015). Specifically, by involving clinicians in developing the research question, knowledge is created that is highly practical and sustainable for practice settings. It can be expected that PBR partnerships will vary in the degree of engagement between researchers and clinicians. Some partnerships may be more *consultative*, such that partners meet at specific timepoints throughout the process to discuss and make changes, but the partnership between the two parties is not constant. Other partnerships might be more *collaborative*, with clinicians and researchers working together on an ongoing basis to design, implement, solve problems, and make changes as needed. The extent to which partnerships are fully collaborative is often not reported clearly in the literature (Gagliardi et al., 2016). Nevertheless, where possible, the partnerships were characterized as either consultative or collaborative based on descriptions of partnerships reported in relevant studies of our scoping review.

Development of a Cocreation Model to Support Clinical–Research Partnerships

Although PBR has a long-standing history, its utility for the field of speech-language pathology has not been fully explored yet. For those interested in engaging in collaborative partnerships, there is little guidance in the literature regarding the types of research that can be conducted using this approach. Further, documentation of partnerships is inconsistent and is not systematic (Drahota et al., 2016), leading to little consensus on how best to engage in a partnership. For PBR and the use of PBR partnerships to become more widespread and accepted in speech-language pathology, a crucial step is to outline the potential purposes or outcomes of these partnership projects. As a first step and to capture our emerging thinking in this area, we created the cocreation model (**Figure 1**) based on our experiences with PBR, the utility of PBR in other fields (Candy & Edmonds, 2018), and attributes described in the literature (Epstein, 2002). This model broadly identifies the potential outcomes for partnership projects in which the goal is to answer clinical questions originating from practice and informing future practice.

The creation of the model was informed by the discussions of Epstein (2002), who identified that clinicians gather large amounts of information about their practice and about their clients. This information provides the potential to understand current practice, which could, in turn, motivate changes in practice. Further, PBR involves initiating the partnership as a first inquiry step that could contribute to the design of new practice. The model was also informed by our experiences as practice-based

Figure 1



The practice-based research cocreation model

researchers in the areas of preschool (Kwok, 2020) and school-age language development (Vollebregt et al., 2019), and motor speech and swallowing (Theurer et al., 2013). Ongoing partnerships and projects provided insight into the outcomes achievable through PBR. Compiling these possible outcomes from the literature reinforced our ideas and experiences working in PBR, bringing about the cocreation model to represent how these partnerships can produce sustainable clinical practices. Our PBR cocreation model (**Figure 1**) describes three distinct purposes or outcomes related to PBR: (a) creating practice, (b) capturing practice, and (c) changing current practice.

Creating practice refers to a cocreation partnership aimed at designing or creating a new practice and evaluating its effectiveness. In a practice-creation project, clinicians and researchers may work together to integrate or adapt evidence-based practices from traditional research within the constraints of a particular practice setting. In this way, an evidence-informed practice is created and evaluated. For example, a creating-practice study might involve designing a new phonological awareness program, incorporating the best available evidence with modifications to suit a particular context, and then evaluating program effectiveness.

Capturing practice describes a cocreation partnership that evaluates ongoing practice to inform both the clinicians and researchers. By studying current practice directly, researchers and clinicians can build the evidence base for effective practices in speech-language pathology across a range of settings and implementation schedules. This purpose aligns most closely with the concept of practice-based evidence, although the present review focused on studies based specifically on a practitioner–researcher partnership. An example of research designed to capture practice could include evaluating the effectiveness of a preschool program building social communication skills in children with autism that is being delivered in a community clinic.

Changing practice describes a cocreation partnership whose goal is to implement evidence-based approaches either arising from practice-based or traditional research activities. This purpose of PBR aligns most closely with the view of knowledge translation and implementation science as taking action to move knowledge into practice or studying the implementation process. An example of changing practice could include a researcher working with a clinician to implement an alternative therapeutic approach in their clinical practice.

The PBR cocreation model was used in a scoping review to further our exploration of the extent to which researchers in the field of speech-language pathology are engaged in PBR. Unlike systematic reviews, scoping reviews allow the assessment of emerging evidence and serve to provide an overview of a broad topic (Peterson et al., 2017). Scoping reviews consider diverse related literature and use a systematic methodological approach (Arksey & O'Malley, 2005). As such, scoping reviews are an appropriate alternative to systematic reviews when the literature is

vast and complex or when the identified topic is emerging or evolving. Given the emerging nature of PBR in the field of speech-language pathology, a scoping review was considered an appropriate approach to explore the extent of research completed in the area.

Scoping Review Examining PBR in Speech-Language Pathology

The scoping review was conducted to provide an overview of PBR in the field of speech-language pathology broadly. Because this is a relatively new area of research, no limits were placed on the population or disorder types studied. The aim of this review was to acquire a general sense of the available research that could be broadly defined as using a PBR approach and consider it in relation to our PBR cocreation model. A first goal was to determine whether research involving cocreation partnerships could be identified that corresponded to our three hypothesized purposes of creating, capturing, and changing current practice. Finding studies addressing the three distinct research partnerships would provide validation to the model. A second goal was to categorize these partnerships as either collaborative or consultative to determine how partnership collaboration was being documented and if examples of these partnerships could provide insight into how these partnerships exist. Partnerships were coded as collaborative if there was evidence of an ongoing partnership throughout the research process. Partnerships were coded as consultative if there was some engagement between researchers and stakeholders, but there was no evidence of ongoing partnership.

Method

Searches were conducted in the following database search engines: Web of Science, PubMed, CINAHL, and Psych Info. Articles were included if published in English in peer-reviewed journals between 1980 and April 2020. A hand-search was completed on the journal Implementation Science. Keywords were selected to reflect the possibility of terms used to describe relevant clinician–researcher partnerships and included *implement* science*, or *knowledge translat**, or *practice-based research*, or *practice-based evidence*, or *design research*, and *speech language path**, or *speech therap**, or *speech path**. Evidence-based practice was excluded as a search term to focus the search on articles that involved an ongoing partnership between clinicians and researchers. In communication sciences and disorders, the term evidence-based practice is widely used to describe many clinical activities, so its inclusion would have produced too many irrelevant results.

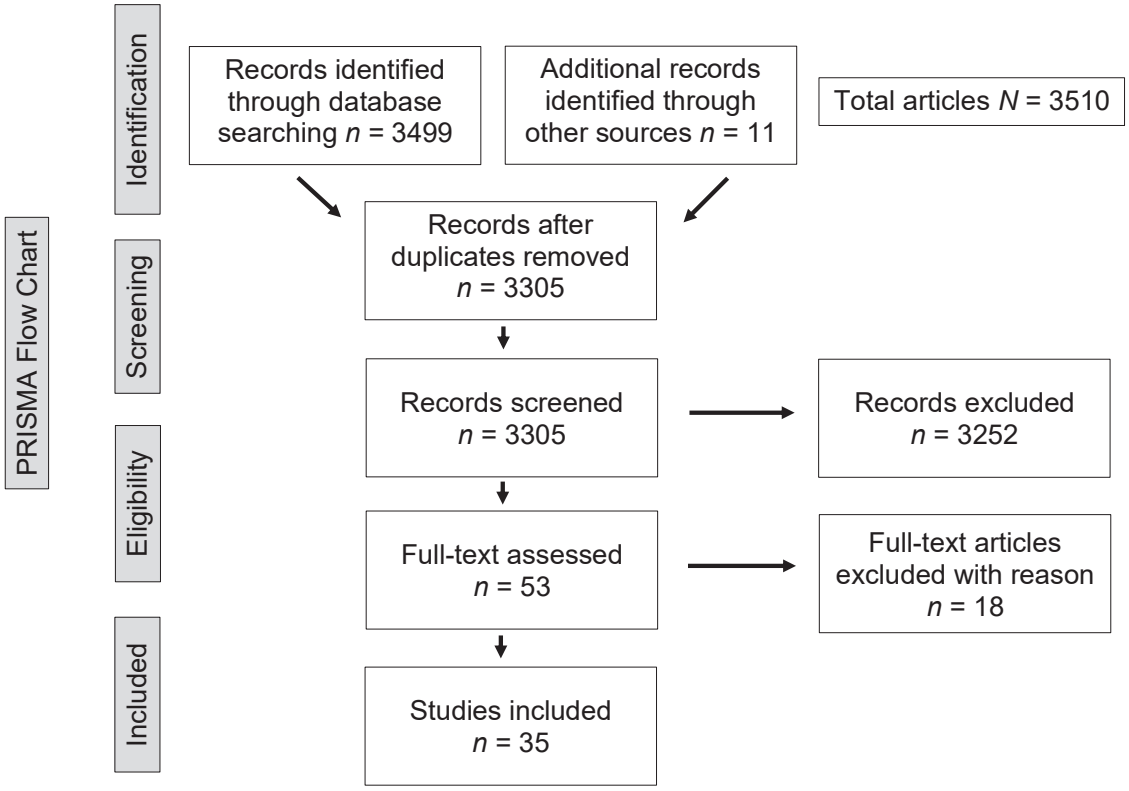
Articles were eligible for this scoping review if they were related to the field of speech-language pathology and described the movement of scientific knowledge from research to practice or practice to research using one of the following terms: *implementation science, knowledge translation, practice-based research*, or *practice-based evidence*. The initial search yielded 3510 articles. The titles and abstracts of these articles were independently reviewed by two readers (author MV and an additional, trained research assistant). Any disagreement about which articles should be included led to discussion until consensus for included articles was reached (n = 53). After that, articles were excluded if they were systematic reviews or editorials. Articles meeting the inclusion criteria were read in full by the first author. An additional 18 articles were excluded upon full text review because they outlined the importance of cocreation partnerships but did not present research data. A PRISMA flow diagram outlines the study selection process (**Figure 2**).

For all studies meeting the inclusion criteria, data were extracted using a Microsoft Excel chart developed by the authors. To develop the extraction sheet, one author (MV) completed data extraction of an article using the general extraction inventory outlined by the Joanna Briggs Institute (Peters et al., 2015). Over the course of the data extraction, the four authors met twice to discuss what information should be extracted from the articles. In the first meeting, information regarding the details of the study were discussed (e.g., participants, location). The second meeting was dedicated to creating consensus amongst the group about how to categorize partnerships using the cocreation model (changing practice, creating practice, or capturing current practice). Following the second meeting, a portion of the articles were read by each of the authors and information extracted from the articles was compared across authors to ensure accuracy. Data extraction included a chart outlining: journal title, authorship, year, participants, service context, and setting (see **Table 1**). An additional chart was used for extraction of location of research, study design, data source, type of analysis, level of cocreation, and type of partnership (see **Table 2**).

Results

The scoping review yielded 35 articles from six countries. Fourteen articles were from Australia, nine from the United States, nine from Canada, one from Sweden, one from South Africa, and one from the Netherlands. Included articles were published between 2010 and 2020.

Figure 2



PRISMA flow diagram for the scoping review process

Participants, Disorder Area, and Setting

Consistent with our purpose of examining PBR in the field of speech-language pathology, S-LPs were involved in every study except one where S-LPs were invited to participate but none responded to the call for participants (Boudreau et al., 2019). Multiple studies included more than one group of participants. For example, Francis et al. (2019) collected data from patients, caregivers, and S-LPs. S-LPs were not always the primary participants, in that they were not always the source of data for the research studies. However, S-LPs were the primary participants in the majority of the included articles (20/35). In other studies, participants were allied health professionals (e.g., occupational therapists, physiotherapists) who provided feedback on the implementation of a specific intervention program (10/35). Other studies included parents and caregivers as participants (4/35), patients (4/35), educators (2/35), nurses (1/35) and master of education students (1/35).

A variety of populations, disorder types, and settings were represented across the reviewed articles. Populations included both adults (17/35) and children (18/35).

Setting was only collected from an article if explicitly stated in the text. For adult participants, the settings included rehabilitation settings (9/35), acute hospital settings (5/35), skilled nursing facilities (2/35), long-term care settings (1/35), the home (1/35), university clinic (1/35), and community-based programs (1/35). The disorders examined included stroke (10/35), cognitive communication impairment (2/35), dysphagia (1/35), hypokinetic dysarthria (1/35), dementia (1/35), traumatic brain injury (1/35), and spinal cord injury (1/35). PBR involving children occurred in community-based programs such as preschool speech and language programs (5/35), children's treatment centres (3/35), schools (3/35), home care (1/35), a pediatric rehabilitation centre (1/35), and a nongovernment organization (1/35). Children in the studies presented with language impairments (4/35), preschool speech and language needs (4/35), cerebral palsy (3/35), physical disability (1/35), significant developmental delay (1/35), autism spectrum disorder (1/35), voice concerns (1/35), speech sound disorder (1/35), and augmentative and alternative communication needs (1/35).

Table 1

Articles Included in Scoping Review: Authors, Title, Year, Participants, Disorder Area, and Setting

Author(s)	Article title	Year	Participants	Disorder area	Setting
Lavesson et al.	"Development of a Language Screening Instrument for Swedish 4-Year-Olds"	2018	4-year-old children	Child language	Child health centres
Olswang & Prelock	"Bridging the Gap Between Research and Practice: Implementation Science"	2015	S-LPs, occupational therapists, physiotherapists	Children with physical disabilities	Children's treatment centre
Vallila-Rohter et al.	"Implementing a Standardized Assessment Battery for Aphasia in Acute Care"	2018	Patients with aphasia, their caregivers, and S-LP assistants	Aphasia	Hospital
Allen et al.	"Implementing a Shared Decision Making and Cognitive Strategy-Based Intervention: Knowledge User Perspectives and Recommendations"	2020	Interprofessional teams of stroke rehabilitation hospitals	Cognitive impairments following a stroke	Rehabilitation hospitals
Arcuri et al.	"Perceptions of Family-Centred Services in a Paediatric Rehabilitation Programme: Strengths and Complexities from Multiple Stakeholders"	2016	Parents and allied health professionals	Children with significant developmental delays	Pediatric rehabilitation centre
Cunningham et al.	"Barriers to Implementing Evidence-Based Assessment Procedures: Perspectives From the Front Lines in Pediatric Speech-Language Pathology"	2019	S-LPs	Pediatric S-LP-Children who are deaf and hard of hearing	Preschool speech and language services
Dada et al.	"Augmentative and Alternative Communication Practices: A Descriptive Study of the Perceptions of South African Speech-Language Therapists"	2017	S-LPs	Augmentative and alternative communication	
Douglas	"Organizational Context Associated With Time Spent Evaluating Language and Cognitive-Communicative Impairments in Skilled Nursing Facilities: Survey Results Within an Implementation Science Framework"	2016	S-LPs	Cognitive communication impairment	Skilled nursing facility
Farquharson et al.	"Using Hierarchical Linear Modeling to Examine How Individual S-LPs Differentially Contribute to Children's Language and Literacy Gains in Public School"	2015	S-LPs	Children with language impairment	Public school
Foster et al.	"'That Doesn't Translate': The Role of Evidence-Based Practice in Disempowering Speech Pathologists in Acute Aphasia Management"	2015	S-LPs	Stroke care (aphasia)	Acute hospital

Table 1 (continued)

Articles Included in Scoping Review: Authors, Title, Year, Participants, Disorder Area, and Setting

Author(s)	Article title	Year	Participants	Disorder area	Setting
Greenspan et al.	"Clinician Perspectives on the Assessment of Short-Term Memory in Aphasia"	2020	S-LPs	Aphasia	Rehabilitation hospital, acute care hospital with outpatient services, professional conference, and university speech clinic
Hadely et al.	"Speech Pathologists' Experience With Stroke Clinical Practice Guidelines and the Barriers and Facilitators Influencing Their Use: A National Descriptive Study"	2014	S-LPs	Stroke care	Rehabilitation
Hartley et al.	"Practice Patterns of Speech-Language Pathologists in Pediatric Vocal Health"	2017	S-LPs	Pediatric voice	
Imms et al.	"Improving Allied Health Professionals' Research Implementation Behaviours for Children With Cerebral Palsy: Protocol for a Before-After Study"	2015	Allied health professionals	Children with cerebral palsy	Nongovernment organizations
Jeng	"Clinical Decision Making in Skilled Nursing/Long Term Care: Using and Generative Evidence in the Field"	2015	S-LPs	Hypokinetic dysarthria	Long-term care
Justice et al.	"Designing Caregiver-Implemented Shared-Reading Interventions to Overcome Implementation Barriers"	2015	Parents and their children	Children with language impairment	Home environment
Miao et al.	"Factors Affecting Speech Pathologists' Implementation of Stroke Management Guidelines: A Thematic Analysis"	2015	S-LPs	Stroke care	
Nitsch et al.	"Integrating Spinal Cord Injury - Quality of Life Instruments Into Rehabilitation: Implementation Science to Guide Adoption of Patient-Reported Outcome Measures"	2021	Allied health professionals	Spinal cord injury	Rehabilitation Institute of Chicago
Poulin et al.	"Identifying Clinicians' Priorities for the Implementation of Best Practices in Cognitive Rehabilitation Post-Acquired Brain Injury"	2020	Interdisciplinary teams and clinical coordinators, occupational therapists, neuropsychology, special education, S-LP	Traumatic brain injury/acquired brain injury	Stoke rehabilitation centre, inpatient and outpatient rehabilitation centre, acquired brain injury rehabilitation centre
Shrubsole et al.	"Barriers and Facilitators to Meeting Aphasia Guideline Recommendations: What Factors Influence Speech Pathologists' Practice?"	2018	S-LPs	Aphasia	Acute and rehabilitation settings

Table 1 (continued)

Articles Included in Scoping Review: Authors, Title, Year, Participants, Disorder Area, and Setting

Author(s)	Article title	Year	Participants	Disorder area	Setting
Sugden et al.	"Service Delivery and Intervention Intensity for Phonology-Based Speech Sound Disorders"	2018	S-LPs	Phonology-based speech sound disorders	
Young et al.	"Factors that Influence Australian Speech-Language Pathologists' Self-Reported Uptake of Aphasia Rehabilitation Recommendations From Clinical Practice Guidelines"	2018	S-LPs	Aphasia	Inpatient acute, inpatient rehab, outpatient rehabilitation, community rehabilitation, university, nursing home, private practice
Brebner et al.	"Facilitating Children's Speech, Language, and Communication Development: An Exploration of an Embedded, Service-Based Professional Development Program"	2017	Early educators and S-LPs	Pediatric S-LP	Childcare centres
Boudreau et al.	"Peer-Mediated Pivotal Response Treatment for Children With Autism Spectrum Disorder: Provider Perspectives on Acceptability, Feasibility, and Fit at School"	2019	Educators and early intervention providers	Autism spectrum disorder	School board
Campbell et al.	"A KT Intervention Including the Evidence Alert System to Improve Clinician's Evidence-Based Practice Behaviour – A Cluster Randomized Controlled Trial"	2013	Allied health professionals	Children with cerebral palsy	Community-based cerebral palsy services
Cunningham et al.	"Promoting Consistent Use of the Communication Function Classification System (CFCS)"	2016	S-LPs	Preschool speech and language	Preschool speech and language program
Cunningham et al.	"Moving Research Tools Into Practice: The Successes and Challenges in Promoting Uptake of Classification Tools"	2018	S-LPs	Infants, toddlers, and school-aged children	
Cunningham & Oram Cardy	"Using Implementation Science to Engage Stakeholders and Improve Outcome Measurement in a Preschool Speech-Language Service System"	2020	S-LPs	Pediatric speech-language pathology	Preschool speech and language services
Dale et al.	"Barriers and Enablers to Implementing Clinical Treatment for Fever, Hyperglycaemia, and Swallowing Dysfunction in the Quality in Acute Stroke Care (QASC) Project – A Mixed Methods Study"	2015	Registered nurses, clinical nurse consultants, nurse unit manager, endorsed enrolled nurse	Stroke care	
Francis et al.	"The Use and Impact of a Supported Aphasia-Friendly Photo Menu Tool on iPads in the Inpatient Hospital Setting: A Pilot Study"	2019	Patients with aphasia, their caregivers, and S-LP assistants	Aphasia	Inpatient hospital

Table 1 (continued)

Articles Included in Scoping Review: Authors, Title, Year, Participants, Disorder Area, and Setting

Author(s)	Article title	Year	Participants	Disorder area	Setting
Imms et al.	"Efficacy of a Knowledge Translation Approach in Changing Allied Health Practitioner Use of Evidence-Based Practices With Children With Cerebral Palsy: A Before and After Longitudinal Study"	2020	Allied health professionals	Children with cerebral palsy	Five disability service organizations
Molfenter et al.	"Decreasing the Knowledge-to-Action Gap Through Research-Clinical Partnerships in Speech Language Pathology"	2009	S-LPs	Dysphagia	Rehabilitation hospitals
Smith et al.	"Memory and Communication Support in Dementia Research-Based Strategies for Caregivers"	2010	Family members and professional caregivers	Dementia	Home care
Weiss et al.	"Transdisciplinary Approach Practicum for Speech-Language Pathology and Special Education Graduate Students"	2020	4 S-LP participants and master students in special education	Autism spectrum disorder	School board
Wielaert et al.	"ImPACT: A Multifaceted Implementation for Conversation Partner Training in Aphasia in Dutch Rehabilitation Settings"	2016	Rehabilitation professionals	Aphasia	Rehabilitation centres, nursing homes with rehabilitation units

Note: S-LP = speech-language pathologist. This table outlines title, year, participants, disorder area, and setting from included articles. Articles in Table 1 are presented in order corresponding to Table 2.

Data Source and Analysis

Across the included studies, data collected were related to implementation of the program, current practices, or what needed to be adjusted about a program. Regarding the type of data collected, 11 articles reported quantitative data, 10 articles reported qualitative data, 11 articles reported mixed-method data, and 3 articles could not be classified. Multiple means of data collection were reported. The use of surveys (13/35), particularly online surveys, was most frequent. In one study conducted to assess barriers and facilitators to implementing a clinical treatment protocol, clinicians first participated in preimplementation workshops to identify perceived barriers (Dale et al., 2015). Postimplementation, clinicians completed a mixed-method survey to determine what barriers still existed and what barriers were addressed through the preimplementation workshops.

Other commonly reported practices included interviews (8/35), focus groups (7/35), participant outcomes (6/35), and questionnaires (5/35). Foster and colleagues (2015) completed in-depth interviews with S-LPs to gain an understanding of the role of evidence-based practice and its implementation in poststroke aphasia. Fewer studies reported participant reflections (3/35), patient information (3/35), and collecting information regarding the acceptability and feasibility of implementation (2/35). One article used an existing scale, the Change on Goal Attainment Scale to capture quantitative data about how PBR influenced progress towards achieving goals (Campbell et al., 2013).

Level of Cocreation

The final stage of extraction involved classifying the articles using our PBR cocreation model. All studies were able to be classified according to the model. Three studies were classified as creating practice. In one of these studies, clinicians and researchers adopted a series of single-subject feasibility studies and a randomized control trial into a triadic gaze intervention for children (Olswang & Prelock, 2015). As the intervention was adopted into practice, they

Table 2

Articles Included in Scoping Review: Authors, Location, Data Source, Analysis, Level of Cocreation, and Partnership

				Level of cocreation			Type of partnership	
Author	Location	Data source	Type of analysis	Creating practice	Capturing practice	Changing practice	Collaborative	Consultative
Lavesson et al., 2018	Sweden	Child language screening tool	Quantitative, (discrepancies resolved though qualitative information)	✓				
Olswang & Prelock, 2015	United States	Mixed methods assessed acceptability, adoption, and fidelity	Mixed	✓			✓	
Vallila-Rohter et al., 2018	United States	Retrospective medical review	Mixed	✓		✓	✓	
Allen et al., 2020	Canada	Semistructured focus group	Qualitative		✓		✓	
Arcuri et al., 2016	Canada	Parent questionnaire responses	Quantitative		✓			
Cunningham et al., 2019	Canada	Online survey	Quantitative		✓		✓	
Dada et al., 2017	South Africa	Online survey	Quantitative		✓		✓	
Douglas, 2016	United States	Survey responses			✓			
Farquharson et al., 2015	Australia	Questionnaires	Quantitative		✓			
Foster et al., 2015	Australia	Interview responses	Qualitative		✓			
Greenspan et al., 2020	United States	Semistructured interview in focus group	Qualitative		✓		✓	
Hadely et al., 2014	Australia	Survey responses	Mixed		✓			✓
Hartley et al., 2017	United States	Online survey	Mixed		✓			✓
Imms et al., 2015	Australia	Survey responses and client outcomes	Mixed		✓		✓	

Table 2 (continued)

Articles Included in Scoping Review: Authors, Location, Data Source, Analysis, Level of Cocreation, and Partnership

				Level of cocreation			Type of partnership	
Author	Location	Data source	Type of analysis	Creating practice	Capturing practice	Changing practice	Collaborative	Consultative
Jeng, 2015	United States	Client performance			✓			
Justice et al., 2015	United States	Interview/survey responses	Mixed		✓			
Miao et al., 2015	Australia	Interview responses	Qualitative		✓			✓
Nitsch et al., 2021	United States	Focus group	Qualitative		✓		✓	
Poulin et al., 2020	Canada	Cross sectional electronic survey and focus group	Quantitative		✓			✓
Shrubsole et al., 2018	Australia	Semistructured interviews	Qualitative		✓			✓
Sugden et al., 2018	Australia	Online survey	Quantitative		✓			✓
Young et al., 2018	Australia	Online survey	Quantitative		✓			✓
Brebner et al., 2017	Australia	Focus group and individual semistructured interviews	Qualitative			✓	✓	
Boudreau et al., 2019	Canada	Semistructured interviews	Qualitative			✓	✓	
Campbell et al., 2013	Australia	Change on Goal Attainment Scaling	Quantitative			✓	✓	
Cunningham et al., 2016	Canada	Pre–posttest intervention responses	Mixed			✓		
Cunningham et al., 2018	Canada	Pre–post survey responses	Qualitative			✓	✓	
Cunningham & Oram Cardy, 2020	Canada	Pre–post survey	Quantitative			✓	✓	
Dale et al., 2015	Australia	Pre–post survey responses	Mixed			✓		✓

Table 2 (continued)

Articles Included in Scoping Review: Authors, Location, Data Source, Analysis, Level of Cocreation, and Partnership

				Level of cocreation			Type of partnership	
Author	Location	Data source	Type of analysis	Creating practice	Capturing practice	Changing practice	Collaborative	Consultative
Francis et al., 2019	Australia	Each participant acted as own control switching the menu, questionnaires, reflective logs, and focus groups	Mixed			✓		✓
Imms et al., 2020	Australia	Data collected during sessions at 6, 12, and 24 months, questionnaires, and check-up tool. Child data collected via health records.	Quantitative			✓	✓	
Molfenter et al., 2009	Canada	Interview responses	Qualitative			✓	✓	
Smith et al., 2010	Australia					✓	✓	
Weiss et al., 2020	United States	Pre–post questionnaires, reflections, and focus groups	Mixed			✓	✓	
Wielaert et al., 2016	Netherlands	Data collected from the recruitment administration, questionnaires, consensus notes from meetings with S-LP groups	Mixed			✓	✓	

Note: S-LP = speech-language pathologist. This table outlines the location, type of data collected, type of analysis, level of partnership, and level of cocreation that were identified for each included article. Table 2 is organized according to level of cocreation and then articles are organized alphabetically within each level of cocreation.

assessed the clinician's views on acceptability, adoption, and feasibility, and addressed implementation barriers. Nineteen studies were classified as capturing practice. As an example, Justice et al. (2015) sought to understand barriers that parents face in using caregiver-implemented shared reading interventions. Parents completed weekly logs to document their maintenance to the intervention schedule and completed an exit interview to discuss implementation barriers. Thirteen studies were classified as changing practice. In an example study aimed at standardizing S-LPs' use of a language assessment tool, S-LPs completed a pretest survey, reviewed online intervention materials, and then completed a postsurvey (Cunningham et al., 2016).

Where possible, the level of partnership was coded as either collaborative (evidence of ongoing partnership) or consultative (evidence of some engagement between researchers and stakeholders). Only 27 of 35 studies could be classified relative to the type of partnership; in the remaining articles, authors did not define the type of partnership or did not provide sufficient information to allow for characterization. Of these 27 studies, 18 were classified as incorporating a collaborative partnership and 9 were classified as consultative. For example, studies using a collaborative model described their partnerships as ongoing and researchers engaged with clinicians at multiple time points throughout the project to collect implementation data (Olswang & Prelock, 2015). Further, they

described their partnerships as collaborative throughout all stages of implementation (Cunningham et al., 2018). As an example of a study using a consultative model, one study (Miao et al., 2015) described an organization, the National Stroke Foundation, receiving input on guidelines from S-LPs. As an example of a study where the type of partnership could not be classified, one study described a project using implementation science with researchers and S-LPs, but the extent of the partnership was not described in the article and therefore not classified as collaborative or consultative (Farquharson et al., 2015).

Discussion

This scoping review investigated the emerging area of PBR in the field of speech-language pathology. The objective in the present study was to examine PBR with the two-fold goal of (a) describing potential PBR outcomes in a cocreation model including capturing practice, changing practice, and creating practice, and (b) reporting a scoping review of published research consistent with a PBR approach in the field of speech-language pathology and categorized according to our model. As described by our PBR cocreation model, PBR includes research aimed at creating practice, capturing practice, and changing practice. PBR partnerships were expected to vary, with some being highly collaborative involving researchers and clinicians working together throughout the process and others being more consultative with points of contact at only specific junctures. Our review yielded 35 articles reporting PBR involving S-LPs, other allied health professionals, caregivers, patients, and other professionals. Of these articles three were categorized as creating practice, 19 as capturing practice, and 13 as changing practice. Eighteen studies were classified as collaborative and 9 were classified as consultative. In this discussion, a broad overview of PBR in speech-language pathology is provided and the utility of PBR in speech-language pathology is outlined. Further, attention is drawn to existing gaps in the literature and ways PBR can reduce the gap between practice and research are described.

Levels of Cocreation

The PBR cocreation model for this scoping review was designed using experiences of cocreation partnerships and the existing literature of PBR in health care related fields (Davis et al., 2020; Epstein, 2002). The model outlines three distinct levels of cocreation that can exist within PBR: creating practice, capturing current practice, and changing practice. One purpose of this review was to examine available PBR in relation to our proposed model. More studies were classified as capturing practice than changing practice. Studies involving capturing practice may be somewhat more straightforward to carry out because no practice change is required. It is also possible that capturing current practice is the first step to determining if the services are meeting current needs before services are changed or created. It may also be the case that more research involves capturing practice because capturing practice closely aligns with Epstein's (2002) original work in PBR. This type of capturing practice aligns with practice-based evidence where clinicians are acting as dual clinicians and scientists conducting research on their own practice (Lemoncello & Ness, 2013).

PBR involving creating practice seems to be particularly rare given that only three studies were classified as such, and one of the three articles reported the practice creation incidentally as part of a PBR discussion. It is possible that with PBR in its infancy in speech-language pathology, those engaged in partnerships have not yet envisioned a level of partnership where new practice is being created. Another possibility is that creating practice represents a particularly challenging research purpose. Creating practice might place high demands on collaboration due to the need to work together on all aspects of both practice and research design. Further, given these high demands, another possibility is that S-LPs have limited time to engage in these types of partnerships because their workloads are very high. As potentially more S-LPs begin to engage in this type of work, one possibility is the use of a knowledge broker who collaborates with both the researchers and S-LPs to lessen the demands placed on them, support interactions, and increase capacity for partnerships (Dobbins et al., 2009). Addressing both clinical concerns and implementation aims in one study requires addressing the priorities and methods specific to each component, which can quickly become a large undertaking. It is not surprising, then, that there are few articles reporting this type of work (see Curran et al., 2012, for a discussion of different approaches).

Our second goal was to characterize the collaborative nature of PBR partnerships. Several articles reported insufficient information to allow classification of their partnerships as either collaborative or consultative. This finding is in line with reports from other knowledge translation approaches that observed the need for more consistent and systematic reporting of collaborative research (Drahota et al., 2016). One reason that reporting partnerships has not become a consistent practice may be due to the lack of common language amongst knowledge translation fields and between clinicians and researchers. One hope for the PBR cocreation model is that it provides a common language for researchers and clinicians to describe the goals of their partnership. In addition, a common

language may support an explicit conversation that identifies the type of partnership, thereby making labelling the partnership in dissemination activities easier (Frisby et al., 2004).

Two thirds of the classifiable studies were coded as collaborative partnerships. This is no doubt due to the strong interest in collaborative partnerships to build cocreated knowledge (Greenhalgh et al., 2016; Filipe et al., 2017). It is also possible that successful PBR is facilitated by more collaborative partnerships. Twelve of the studies classified as collaborative practice were coded using the PBR cocreation model as changing practice. This signifies that the partnerships were ongoing through the research project and as the change was incorporated into clinical practice. Less is known about the six collaborative studies that were coded as capturing practice. Most of these projects involved only taking a snapshot of clinical practice, making it difficult to know if the collaboration continued after capturing the current practice. Nevertheless, the value of collaborative partnerships is clear and well supported across knowledge translation approaches (Nguyen et al., 2020).

What areas of speech-language pathology are using PBR most frequently? Our scoping review included articles from a wide range of journals and encompassed all areas of speech-language pathology. In our search of the literature, there was equal representation of research articles focusing on adults and on children. Partnerships occurred in all areas included within the scope of speech-language pathology, although no substantial number of articles were found in any one disorder area. Most of this research was occurring in hospitals, treatment centres, and rehabilitation centres. Less frequent locations included public schools, home care, and long-term care centres. It is difficult to interpret (the lack of) differences in disorder areas or settings around which PBR has been reported because the importance of PBR has been recognized only relatively recently. It is possible that PBR is occurring more frequently in certain disorder areas or settings but not yet being reported in the literature. An increase in reporting on composition, types, and purposes of cocreation partnerships will support a better understanding of the practice settings and contexts best suited for PBR. The recency of PBR is illustrated in the publication dates of the included articles in the current review. The earliest article was published in 2010, and most of the articles found in this search appeared after 2017. The presence of PBR in speech-language pathology, and the recognition of the value that partnerships bring to research, is a new and unique approach to our field. In discussion about knowledge translation and implementation science, a focus on PBR would support understanding of how partnerships can propel our field into creating research that fits the needs of researchers and clinicians.

How are data collected? Our review indicated that qualitative, quantitative, and mixed methods were employed to understand the changes and revisions being made to the various speech, language, and swallowing therapies and protocols under study. The most common method of data collection was through surveys or interviews designed to seek evaluative opinion on the effectiveness of new or changed practice. Typical interviews focused on clinicians' experiences with a specific tool or program, asked questions surrounding clinical decision making, and assessed barriers to providing clinical treatment. In our most recent search year, 2019–2020, the number of studies using participant outcomes increased compared to prior years (Francis et al., 2019; Imms et al., 2020). Prior to 2019, only one PBR study included such a measure (Jeng, 2015). Another relatively new PBR outcome measure is the use of participant qualitative reflections (Weiss et al., 2020).

Limitations

This scoping review assessed the range of available evidence related to PBR. Our search was limited to research involving a practitioner–researcher collaboration in a knowledge translation framework and situated as a study within the field of speech-language pathology. Practice-based studies without evidence of a partnership and those that did not reference speech-language pathology/speech therapy were not captured in the search process. In addition, if articles did not include data and only described theories and/or the utility of implementation science, PBR, practice-based evidence, etc., they were not included in the review. Further, studies involving program evaluation, quality assurance, codesign, participatory action research, and quality improvement were not captured in this search.

The earliest study included in the present review was from 2010, suggesting that prior practice-based evidence that did not reference a knowledge-to-action framework may not have been represented. In the field of speech-language pathology, practice-based evidence has a long tradition (Wambaugh, 2007). For example, Mecrow and colleagues (2010), who are clinicians and researchers, partnered to collect evidence for a speech and language program in schools, but their article did not describe a partnership or identify a knowledge-translation approach and therefore was not captured in the search. Because earlier practice-based evidence would align most closely with capturing practice in our model, our finding that capturing practice was the most prevalent design is accurate but possibly underestimated. An additional

limitation includes a lack of calculated interrater reliability during the article extraction. A small portion of the articles were read by all authors to confirm accurate extraction. However, further research may consider a more rigorous review, such as a systematic review, to examine PBR partnerships with a reliability coder to add strength to the data extraction.

Conclusion

The goal of the current scoping review was to examine published research broadly consistent with a PBR approach in the field of speech-language pathology. PBR involves intentional collaboration between researchers and clinicians (Epstein, 2002), and represents the pull from practice whereby knowledge is created in a clinical context and this knowledge informs future clinical practice (Crooke & Olswang, 2015). This scoping review revealed that, to date, research in speech-language pathology involving partnerships between clinicians and researchers using a PBR framework is emerging. However, inconsistencies in the terminology to define this type of research were noted. The PBR cocreation model was developed to describe the range of research questions that can be addressed using this approach. Clinicians and researchers are encouraged to determine the desired outcome (i.e, creating practice, capturing current practice, or changing practice) to establish the mutual goal of the partnership. The introduction of this model for clinical–research partnership can initiate conversations between clinicians and researchers interested in engaging in this type of research, bring new terminology to those doing this type of work, and in doing so, help connect those engaging in partnerships. Developing a community for those engaged in this work will create new knowledge surrounding the best ways to build successful PBR partnerships. Clinicians and researchers alike can use the model to define the goal of their research, align themselves with others using similar methods, and encourage use of PBR to mitigate the gap between research and practice.

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Authors' Note

Correspondence concerning this article should be addressed to Meghan Vollebregt, Graduate Program in Health and Rehabilitation Sciences, Western University, Elborn College, 1201 Western Rd., London, ON, CANADA, N6G 1H1. Email: **mvollebr@uwo.ca**

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Les pratiques d'intervention en orthophonie auprès des enfants francophones ayant un trouble des sons de la parole : résultats d'un sondage québécois

Speech-Language Pathology Intervention Practices for French-Speaking Children with Speech Sound Disorders: Results of a Québec Survey

MOTS-CLÉS

TROUBLE DES SONS DE LA PAROLE

APPROCHES D'INTERVENTION

SONDAGE

ENFANTS

PROVINCE DE QUÉBEC

Laurie Montembeault
Véronique McDuff
Marie-Pier Gingras
Louise Duchesne

Laurie Montembeault, Véronique McDuff, Marie-Pier Gingras et Louise Duchesne

Département d'orthophonie, Université du Québec à Trois-Rivières, QC, CANADA

Abrégé

Plusieurs approches d'intervention existent pour traiter le trouble des sons de la parole et l'efficacité de certaines d'entre elles a été démontrée par la recherche. Cependant, l'absence de lignes directrices concernant les meilleures approches à utiliser complique l'intégration des principes scientifiques dans la pratique des orthophonistes, bien qu'elles y soient tenues par leur ordre professionnel. L'objectif général de cette étude était de recenser les approches utilisées par les orthophonistes du Québec et d'en discuter selon une pratique fondée sur les preuves scientifiques. Cent six orthophonistes québécoises travaillant auprès d'enfants ont répondu à un questionnaire. Les résultats ont montré que les quatre approches d'intervention les plus connues sont l'approche traditionnelle d'articulation, la dynamique naturelle de la parole, les paires minimales et les exercices oro-moteurs. Les trois approches les plus utilisées sont l'approche traditionnelle d'articulation, la stimulation intégrale et la dynamique naturelle de la parole. Parmi les approches dont l'efficacité a été démontrée par des études présentant un bon niveau de preuve scientifique, seule l'approche traditionnelle d'articulation est utilisée par la majorité des répondantes. Plusieurs questions peuvent être soulevées concernant la disponibilité des recherches scientifiques et leur applicabilité en clinique. Enfin, en comparant les résultats de la présente étude aux enquêtes menées dans d'autres pays, il est possible d'observer quelques ressemblances, mais aussi des divergences quant aux approches d'intervention préconisées : les orthophonistes québécoises ciblent davantage la production des sons alors que celles des pays anglophones ciblent la perception.

Abstract

A variety of approaches for the treatment of speech sound disorders exist, some with efficacy established by research. The absence of guidelines regarding the best approaches to use makes it difficult for speech-language pathologists to provide evidence-based practice even though professional regulations require them to do so. The aim of this study was to describe interventions that are used by speech-language pathologists in the province of Québec to treat children with speech sound disorders and to discuss whether those interventions are supported by research. One hundred and six speech-language pathologists working with children across Québec completed a survey. The results showed that they are most familiar with (a) a traditional articulation approach, (b) natural speech dynamics, (c) minimal oppositions therapy, and (d) nonspeech oral motor exercises. A traditional articulation approach, integral stimulation speech therapy, and natural speech dynamics are the most widely used. Among approaches proven to be effective, only the traditional articulation approach is commonly used by the respondents. This study addresses issues regarding the availability and applicability of research results in clinical practice. Finally, comparing the results of this survey with those conducted in different countries, we found similarities but also a discrepancy in the approaches advocated: Speech-language pathologists in Québec target sound production rather than perception, unlike those in English-speaking countries.

Le trouble des sons de la parole (TSP) est caractérisé par un développement atypique de la phonétique et de la phonologie, ce qui diminue l'intelligibilité de l'enfant (MacLeod et al., 2015). La dyspraxie verbale est un trouble affectant la planification et la programmation des mouvements associés à la parole qui peut être classé parmi les TSP (Charron et MacLeod, 2010; Williams et al., 2010). Il est en effet difficile de distinguer la dyspraxie verbale des autres types de TSP parce que les critères pour le faire ne reposent pas entièrement sur des données objectives détaillant les caractéristiques de la dyspraxie verbale en ce qui concerne leur degré de sévérité, leur fréquence et leur contexte (Murray et al., 2021). Pour ces raisons, la dyspraxie verbale est incluse dans l'appellation TSP de la présente étude. Le TSP est très répandu : jusqu'à 15,6 % des enfants d'âge préscolaire pourraient en être affectés (Campbell et al., 2003). Les enfants d'âge préscolaire présentant un tel trouble ont un risque accru de rencontrer des difficultés durant le primaire, notamment en lecture et en écriture. (Anthony et al., 2011; Bleile, 2018; Felsenfeld et al., 1992). Ils sont également susceptibles de présenter des difficultés socio-émotionnelles dues au fait qu'ils peuvent être mal compris par les personnes peu familières (McCormack et al., 2010).

En recherche et en clinique, plusieurs approches ont été développées pour traiter le TSP. Ces approches d'intervention sont supportées par différents niveaux de preuves scientifiques (Baker et McLeod, 2011a). Bien que les orthophonistes soient tenues par leur ordre professionnel d'appliquer les principes scientifiques généralement reconnus (LégisQuébec, 2020), leurs interventions ne sont pas toujours en conformité avec la recherche (Lancaster et al, 2010). En effet, les orthophonistes combinent plusieurs approches d'intervention et les appliquent de façon éclectique selon le profil de l'enfant ou elles utilisent une seule approche en diminuant le dosage démontré efficace dans la littérature scientifique (Gomez et al., 2022; Lancaster et al., 2010; Pascoe et al., 2010).

Au cours des dernières années, quelques enquêtes ont été menées concernant les modalités et les approches d'intervention utilisées par les orthophonistes pour le traitement du TSP chez les enfants anglophones, notamment au Royaume-Uni (Hegarty et al., 2018; Joffe et Pring, 2008), en Australie (McLeod et Baker, 2014) et aux États-Unis (Brumbaugh et Smit, 2013). À notre connaissance, aucune étude de ce type n'a été menée auprès d'orthophonistes exerçant en milieu francophone. Ainsi, nous nous sommes intéressées aux approches d'intervention utilisées par les orthophonistes québécoises francophones pour traiter le TSP et aux niveaux de preuves scientifiques de ces mêmes approches.

Classement des approches d'intervention pour traiter le TSP selon leur niveau de preuve scientifique

Les preuves scientifiques ne sont pas toutes de la même qualité. Dans l'optique d'avoir un vocabulaire commun à toutes les disciplines du domaine de la santé, les niveaux du modèle du *Oxford Centre for Evidence-Based Medicine Levels of Evidence Working Group* (2011) sont utilisés dans plusieurs études pour hiérarchiser les preuves scientifiques des traitements (Azer et Azer, 2018; Glickman et al., 2010). C'est également le modèle retenu pour classer les interventions en TSP de cette étude. Ce modèle est séparé en niveaux de 1 à 5, soit du plus haut niveau de preuve scientifique au plus bas. Le niveau 1 correspond principalement aux méta-analyses d'essais cliniques randomisés; le niveau 2 aux études contrôlées sans randomisation; le niveau 3 aux études de cas-témoins; le niveau 4 aux études de cas; le niveau 5 aux opinions d'experts.

Dans une revue systématique portant sur les approches d'intervention en TSP, Baker et McLeod (2011a) ont répertorié 134 études portant sur 46 approches d'intervention distinctes. Parmi ces dernières, 23 approches d'intervention pour le TSP étaient décrites à plus d'une reprise dans les études sélectionnées. Leurs résultats ont révélé entre autres que la plupart étaient des études de cas. Quant à eux, Wren et al. (2018) ont inventorié, dans leur revue systématique, 26 études portant sur les approches d'intervention pour le TSP. Leurs conclusions se sont avérées semblables à celles de Baker et McLeod (2011a) : la majorité des études présentaient de bas niveaux de preuves scientifiques. Ainsi, pour le TSP, des études de plus hauts niveaux de preuves scientifiques seraient nécessaires afin de mieux justifier l'efficacité des différentes approches d'intervention.

Le **tableau 1** détaille les 17 approches d'intervention en TSP ciblées dans le cadre de cette étude. Elles sont classées selon leur niveau de preuve scientifique, leur nombre d'études publiées portant sur la population pédiatrique présentant un TSP sans trouble associé (ex. : fente palatine ou syndrome de Down), ainsi que selon leur axe d'intervention (perception/production de la parole). Les revues systématiques de Baker et McLeod (2011a) et de Wren et al. (2018) incluent certaines des 17 approches retenues pour la présente étude : l'approche traditionnelle d'articulation, les paires minimales, le *Core vocabulary*, la perception de la parole/Speech Assessment and Interactive Learning System et l'approche cyclique. La présente étude a recensé moins d'approches d'intervention que Baker et McLeod (2011a) et, au contraire de Baker et McLeod (2011a) et de Wren et al. (2018), la plupart des 17 approches choisies ont un haut niveau de preuves scientifiques. Le **tableau 1** intègre également des

Tableau 1

Les approches d'intervention classées selon leur niveau de preuve scientifique

Approches d'intervention	Référence d'origine et référence la plus récente	Nombre d'études répertoriées	Axe d'intervention	Description de l'approche[1]
Niveau 1 : efficacité prouvée par une méta-analyse ou par une étude randomisée contrôlée				
Approche traditionnelle/ d'articulation	Van Riper (1939) Lousada et al. (2013)	14	Production	Acquisition d'un seul phonème problématique à la fois
Paires minimales	Weiner (1981) Dodd et al. (2008)	42	Perception	Contraster des mots identiques à l'exception d'un phonème, différencié par un seul trait
Oppositions maximales	Gierut (1989) Dodd et al. (2008)	8	Perception	Contraster des mots identiques par des phonèmes les plus différents
Oppositions multiples	Williams (2000) Allen (2013)	11	Perception	Établir un contraste entre un phonème cible et plusieurs autres phonèmes
Core vocabulary	Crosbie et al. (2005) Broomfield et Dodd (2005)	7	Production	Intervenir sur un nombre de mots très fréquents
Approche cyclique	Hodson et Paden (1983) Almost et Rosenbaum (1998)	17[2]	Approche combinée	Plusieurs patrons phonologiques sont traités tour à tour dans des cycles
Nuffield Centre Dyspraxia Programme	Royal National Throat, Nose and Ear Hospital (2020) Murray et al. (2015)	7	Production	Avoir le matériel et suivre le programme du même nom
Perception de la parole/SAILS	Van Riper (1963) Rvachew et al. (2004)	4	Perception	Présentation auditive de mots reliés aux patrons à traiter chez l'enfant
Niveau 2 : efficacité prouvée par des études contrôlées sans randomisation et par des études quasi-expérimentales				
Metaphon ou conscience phonologique	Howell et al. (1993) Dodd et Bradford (2000)	13	Perception	Améliorer la conscience des contrastes entre les phonèmes et l'autocorrection
PROMPT	Chumpelik (1984) Kadis et al. (2014)	12	Production	Utilisation du toucher pour guider manuellement l'articulation du patient
Approche non-linéaire	Bernhardt (1990) Edwards (1995)	6	Production	Viser les niveaux du système phonologique plutôt que des sons spécifiques
Stimulation intégrale	Milisen (1954) Gildersleeve-Neumann et Goldstein (2015)	6	Production	L'enfant doit regarder les indices fournis par le clinicien et essayer d'imiter

Tableau 1 (suite)

Les approches d'intervention classées selon leur niveau de preuve scientifique

Niveaux 3 à 5 : faibles preuves d'efficacité (cas-témoins, études de cas et opinions d'experts)				
Approche basée sur la stimulabilité	Miccio et Elbert (1996) Miccio (2009)	6	Production	Chaque consonne est associée à un personnage allitératif et à un geste
Application des principes d'apprentissage moteur	Schmidt (1993) Strand (2013)	Opinions d'experts seulement	Production	Insister sur la position de départ du mouvement, les paramètres du mouvement (p. ex. trajectoire) et rétroaction donnée à l'enfant
Approche dont l'efficacité n'est pas démontrée				
Dynamique naturelle de la parole	Dunoyer de Segonzac (1991)	Aucune étude scientifique	Production	Utilisation d'inputs auditif, visuel et/ou kinesthésique (mouvements du corps)
Approches prouvées inefficaces pour traiter les TSP				
Bombardement auditif	Hodson et Paden (1983) Gangloff (1991)	2[3]	Perception	Présentation auditive d'une liste de mots qui sont reliés aux patterns d'erreurs de l'enfant
Exercices oro-moteurs	Dworkin (1978) Lee et Gibbon[5] (2015)	3[4]	Production	Activités non langagières (ex. : souffler) qui impliquent les sens et/ou l'action des articulateurs

Note. SAIL = Speech Assessment and Interactive Learning System; PROMPT = PROMPTS for Restructuring Oral Muscular Phonetic Targets
[1] Résumé des descriptions des approches ciblées. [2] Inclut également l'approche cyclique utilisée avec certaines modifications. [3] Études concernant l'utilisation du bombardement auditif seulement. [4] Nombre d'études répertoriées dans la revue systématique mentionnée. [5] Revue systématique suggérant l'inefficacité de l'approche.

approches prouvées inefficaces et des approches pour lesquelles l'efficacité n'a pas été démontrée.

Les enquêtes menées dans les pays anglophones

Des enquêtes ont décrit les pratiques des orthophonistes intervenant auprès d'enfants ayant un TSP dans différents pays comme le Royaume-Uni (Hegarty et al., 2018; Joffe et Pring, 2008), les États-Unis (Brumbaugh et Smit, 2013) et l'Australie (McLeod et Baker, 2014). Ces études portaient sur des orthophonistes pratiquant auprès d'enfants anglophones.

Au Royaume-Uni, les trois approches les plus populaires étaient la discrimination auditive, les paires minimales et la conscience phonologique (Joffe et Pring, 2008). Les thérapies les moins utilisées étaient les oppositions maximales, l'approche cyclique, le *Core vocabulary* et le bombardement auditif. En 2018, un deuxième sondage distribué dans ce pays a indiqué des résultats similaires : les cinq approches d'intervention les plus utilisées pour traiter les troubles phonologiques étaient la discrimination auditive, les paires minimales, la conscience phonologique, l'approche traditionnelle d'articulation et l'approche psycholinguistique (Hegarty et al., 2018). Aux États-Unis (Brumbaugh et Smit, 2013), les résultats ont montré qu'environ la moitié des répondantes utilisaient fréquemment l'approche traditionnelle d'articulation et que le tiers des répondantes l'utilisait de 40 % à 60 % du temps. D'autres approches étaient aussi utilisées régulièrement, notamment la conscience phonologique, les paires minimales et l'approche cyclique. Finalement, en Australie (McLeod et Baker, 2014), les huit approches d'intervention ressorties comme étant les plus utilisées étaient : la discrimination auditive, les paires minimales, *Cued articulation*, la conscience phonologique, l'approche traditionnelle d'articulation, le bombardement auditif, le *Nuffield Centre Dyspraxia Programme* et le *Core vocabulary*. Les auteurs ont conclu que leurs résultats étaient similaires à ceux des autres pays comme le Royaume-Uni et les États-Unis en ce qui concerne les

pratiques utilisées chez les enfants ayant un TSP. Certaines approches concordaient avec une pratique basée sur les faits scientifiques alors que d'autres présentaient un bas niveau de preuves scientifiques (McLeod et Baker, 2014).

L'intervention auprès des enfants ayant un TSP étant très fréquente en clinique (Broomfield et Dodd, 2004), il est primordial pour les cliniciennes de réfléchir à leur pratique et de s'assurer que leurs connaissances sont actualisées dans ce domaine. Cette réflexion semble être commencée dans les pays anglophones nommés précédemment, mais ces résultats peuvent ne pas être applicables au contexte québécois. En effet, les pratiques cliniques québécoises et anglo-saxonnes n'ont pas les mêmes influences. Du fait de sa proximité géographique avec le Canada anglais et les États-Unis, la présence de l'anglais au Québec et l'accès à des approches d'intervention majoritairement anglophones, les orthophonistes québécoises ont les mêmes influences que les orthophonistes anglo-saxonnes. Toutefois, les orthophonistes québécoises peuvent aussi être portées à se tourner vers la France pour avoir accès à des pratiques qui tiennent compte de la structure du français. Ces facteurs pourraient différencier la pratique des orthophonistes québécoises de celles pratiquant dans les pays majoritairement anglophones. Conséquemment, des données applicables au contexte clinique québécois sont nécessaires.

En 2016, notre équipe de recherche a diffusé un sondage en ligne à destination des 106 répondantes, membres de l'Ordre des orthophonistes et audiologistes du Québec travaillant auprès d'enfants. Un premier niveau d'analyse a été réalisé dans le cadre d'un travail de recherche étudiant (McDuff, 2017). L'objectif principal de cette étude était de recenser les approches d'intervention utilisées par les orthophonistes québécoises pour traiter le TSP en lien avec une pratique basée sur les preuves scientifiques et d'examiner les facteurs qui guident leurs choix d'intervention. Plus spécifiquement, nous analysons 1) la connaissance des approches d'intervention en TSP et 2) la fréquence d'utilisation de ces approches. Un objectif secondaire est de comparer les résultats obtenus avec ceux des enquêtes menées dans les autres pays.

Méthodologie

Sélection des approches

L'étude a été approuvée par le Comité d'éthique de la recherche avec des êtres humains de l'Université du Québec à Trois-Rivières (CER-16-223-07.07). Dans un premier temps, 15 approches d'intervention ont été sélectionnées à partir d'un ouvrage de référence portant sur l'intervention du TSP (Williams et al., 2010). Dans un deuxième temps, la liste des approches d'intervention a été validée par une orthophoniste ayant une longue expérience en TSP. À la suite de ses recommandations, la stimulation intégrale et l'application des principes d'apprentissage moteur ont été ajoutées. Ainsi, nous avons sondé les orthophonistes sur 17 approches d'intervention. Pour certaines de ces approches, comme les paires minimales et l'approche cyclique, il existe des preuves scientifiques (Baker et McLeod, 2011a). Pour d'autres, il existe peu de preuves scientifiques, voire aucune. Les approches de cette dernière catégorie ont été choisies pour deux raisons : 1) leur utilisation était rapportée dans d'autres études, comme c'est le cas pour les exercices oro-moteurs (Joffe et Pring, 2008), 2) leur utilisation répandue dans différents milieux cliniques francophones du Québec avait été observée. Finalement, avant sa diffusion massive, le questionnaire a été envoyé à cinq orthophonistes proches des milieux universitaires afin de recevoir leurs commentaires sur le sondage. Notons que chaque approche d'intervention était sommairement décrite dans le questionnaire, puisque c'était une limite soulevée dans le sondage mené aux États-Unis par Brumbaugh et Smit (2013).

Participantes

Les personnes intéressées devaient répondre à trois critères afin de pouvoir participer à cette étude : 1) être membres orthophonistes réguliers de l'Ordre des orthophonistes et des audiologistes du Québec (OOAQ); 2) pratiquer au Québec auprès d'enfants; 3) pratiquer auprès d'une clientèle majoritairement francophone. Au total, 106 orthophonistes ont répondu au questionnaire. Cela représente 4,1 % des orthophonistes du Québec selon l'OOAQ (2017).

Parmi ces personnes, 95,24 % étaient des femmes. Elles provenaient de toutes les régions administratives du Québec (à l'exception de la Gaspésie–Îles-de-la-Madeleine et du Nord-du-Québec). Elles cumulaient entre 6 mois et 35 ans d'expérience dans la pratique de l'orthophonie. Environ un tiers des personnes ayant répondu avait quatre ans et moins d'expérience de travail (35,8 %, $n = 38$), un tiers avait entre 4 et 12 ans d'expérience (33,9 %, $n = 36$) et un tiers avait plus de 12 ans d'expérience (30,2 %, $n = 32$). En moyenne, elles ont complété le questionnaire en 16 minutes.

Outil de collecte : élaboration et diffusion

L'outil de collecte choisi était un questionnaire en ligne composé de 24 questions. La plupart des questions et choix de réponses étaient inspirés des quatre enquêtes menées dans les pays nommés précédemment (Brumbaugh et Smit, 2013; Hegarty et al., 2018; Joffe et Pring, 2008; McLeod et Baker, 2014). Le questionnaire était séparé en trois parties : 1) les informations démographiques, 2) la

charge de travail (*caseload*) et la prestation des services et 3) les approches d'intervention. Dans le cadre de cette étude, seules les données concernant la troisième section ont été analysées. Les participantes ont été recrutées par le biais des réseaux sociaux, de forum de discussion en orthophonie et d'association d'orthophonistes. Il était possible de répondre au sondage pendant 3 mois sur la plateforme en ligne *SimpleSondage*.

Traitement et analyse des données

Les données concernant la région de pratique des répondantes, leur connaissance et leur utilisation des différentes approches d'intervention ont été importées dans un fichier Excel. Elles ont été analysées à l'aide de statistiques descriptives. Plus précisément, les approches ont été classées selon le pourcentage d'orthophonistes qui les connaissaient et qui les utilisaient. Des comparaisons descriptives ont été réalisées.

Résultats

Connaissance des approches d'intervention

Le sondage a permis de questionner les répondantes sur leur familiarité avec les 17 approches d'intervention en TSP. Pour ce faire, les répondantes devaient indiquer si elles connaissaient l'approche en identifiant la façon dont elles en avaient entendu parler la première fois (p. ex. : formation initiale, formation continue donnée en groupe, article scientifiqus). Pour les approches inconnues, les participantes cochaient la case « cette approche ne m'est pas familière ». La **figure 1** présente les approches d'intervention, de la plus connue par les répondantes à la moins connue. Les quatre approches les plus connues sont l'approche traditionnelle/thérapie d'articulation (98 % des répondantes), la dynamique naturelle de la parole (DNP) (98 %), les paires minimales (95 %) et les exercices oro-moteurs (95 %). Les trois moyens les plus fréquents par lesquels les approches d'intervention ont été connues sont la formation initiale (63 %), la formation continue (12 %) et les collègues (9 %). Enfin, 4 % des répondantes rapportent avoir connu des approches d'intervention par la lecture d'articles scientifiques.

Utilisation des approches d'intervention

Les trois approches d'intervention les plus utilisées par les répondantes (tous les jours, quelques fois par semaine ou quelques fois par mois) sont l'approche traditionnelle/thérapie d'articulation (91 % des répondantes), la stimulation intégrale (66 %) et la DNP (55 %).

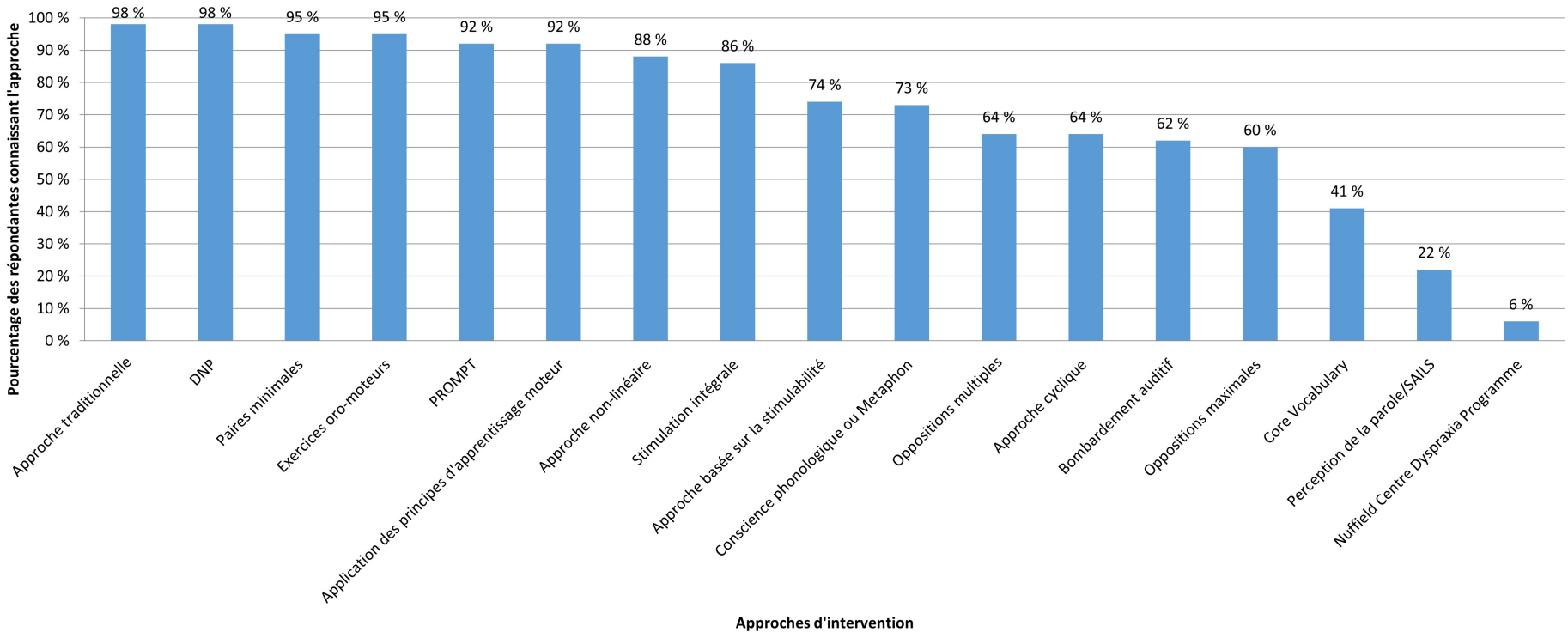
Le **tableau 2** présente les approches d'intervention, des plus utilisées aux moins utilisées. Le niveau de preuve scientifique associé à chaque intervention correspond au plus haut niveau relevé dans la littérature. Parmi les 17 approches d'intervention utilisées par les orthophonistes québécoises pour traiter le TSP, huit ont prouvé leur efficacité par le plus haut niveau de preuves scientifiques, soit par une méta-analyse ou par une étude contrôlée randomisée. Parmi ces huit approches, une seule est utilisée par la majorité des répondantes : l'approche traditionnelle d'articulation. En revanche, les oppositions multiples, *Core Vocabulary*, l'approche cyclique, les oppositions maximales, la perception de la parole, *Nuffield Centre Dyspraxia Programme* sont utilisés par moins de 25 % des orthophonistes bien que leur efficacité soit démontrée par des études scientifiques de bon niveau de preuve.

Comparaison avec les enquêtes menées dans les autres pays

Les approches d'intervention utilisées par les orthophonistes du Québec ont été comparées à celles mentionnées dans les enquêtes menées aux États-Unis, au Royaume-Uni et en Australie. Le **tableau 3** présente une comparaison des trois approches les plus utilisées par les orthophonistes au Québec, en Australie, aux États-Unis et au Royaume-Uni. Il ressort de cette comparaison que l'approche la plus utilisée par les orthophonistes du Québec (91 %), l'approche traditionnelle d'articulation, est également la plus utilisée (49 % l'utilisent souvent ou toujours) aux États-Unis (Brumbaugh et Smit, 2013). Les deux autres approches les plus populaires au Québec pour traiter le TSP, soit la stimulation intégrale et la DNP, ne sont pas présentes dans les questionnaires distribués dans les autres pays. Ces résultats ne peuvent pas être comparés.

À l'inverse, certaines approches fréquemment utilisées selon ces enquêtes ne le sont pas autant au Québec (Brumbaugh et Smit, 2013; Hegarty et al., 2018; Joffe et Pring, 2008; McLeod et Baker, 2014). C'est le cas de la discrimination auditive et de la conscience phonologique. La première est l'approche la plus utilisée en Australie et au Royaume-Uni (Hegarty et al., 2018; Joffe et Pring, 2008; McLeod et Baker, 2014), mais elle n'apparait pas dans le questionnaire québécois. La seconde fait partie des trois approches les plus utilisées aux États-Unis et au Royaume-Uni (Brumbaugh et Smit, 2013; Hegarty et al., 2018; Joffe et Pring, 2008) alors qu'elle est utilisée par 41 % des répondantes du Québec. Semblablement, les paires minimales font partie des trois approches les plus utilisées dans chacun des pays anglo-saxons (Brumbaugh et Smit, 2013; Hegarty et al., 2018; Joffe et Pring, 2008; McLeod et Baker, 2014) questionnés comparativement à 46 % chez les orthophonistes québécoises.

Figure 1



Les approches d'intervention ordonnées de la plus connue à la moins connue par les répondantes

Note. DPN = dynamique naturelle de la parole; PROMPT = PROMPTS for Restructuring Oral Muscular Phonetic Targets; SAIL = Speech Assessment and Interactive Learning System.

Discussion

Menée auprès de 106 orthophonistes du Québec œuvrant auprès d'une clientèle majoritairement francophone, cette étude a pour but de décrire les pratiques actuelles au regard des approches d'intervention connues et utilisées pour traiter le TSP, en lien avec une pratique basée sur les preuves scientifiques. Il s'agit aussi de comparer les résultats de la présente étude à ceux des études effectuées dans des pays anglo-saxons. Les résultats de cette étude permettent 1) d'établir un classement des approches les plus connues et les plus utilisées, 2) de comparer ce classement avec le niveau de preuves scientifiques qui soutiennent ces approches et 3) de noter les similitudes et les différences avec les enquêtes anglophones. Ainsi, ces résultats amorcent une réflexion concernant la disponibilité et l'applicabilité des preuves scientifiques dans la pratique auprès d'enfants ayant un TSP.

Tableau 2

Classement des approches d'intervention selon leur pourcentage d'utilisation par les répondantes et leur niveau de preuves scientifiques respectif

Approches d'intervention	Pourcentage d'utilisation [1]	Niveau de preuves scientifiques
Approche traditionnelle	91	N1
Stimulation intégrale	66	N2
Dynamique naturelle de la parole	55	Efficacité non prouvée
Approche non-linéaire	54	N2
Application des principes d'apprentissage moteur	52	N5
Approche basée sur la stimulabilité	51	N4
Paires minimales	46	N1
Conscience phonologique/Metaphon	41	N2
Bombardement auditif	29	Inefficacité prouvée
PROMPT	23	N2
Oppositions multiples	16	N1
Core Vocabulary	13	N1
Exercices oro-moteurs	13	Inefficacité prouvée
Approche cyclique	13	N1
Oppositions maximales	11	N1
Perception de la parole	4	N1
Nuffield Centre Dyspraxia Programme	0	N1

Note. PROMPT = PROMPTS for Restructuring Oral Muscular Phonetic Targets; N1 = niveau 1; N2 = niveau 2; N4 =niveau 4; N5 = niveau 5.
[1] Approches utilisées chaque jour, plusieurs fois par semaine ou plusieurs fois par mois.

Tableau 3

Comparaison des trois approches d'intervention les plus utilisées selon les différentes enquêtes

Québec (Présente étude)	Australie (McLeod et Baker, 2014)	États-Unis (Brumbaugh et Smit, 2013)	Royaume-Uni (Joffe et Pring, 2008)	Royaume-Uni (Hegarty et al., 2018)
1. Approche traditionnelle	1. Discrimination auditive	1. Approche traditionnelle	1. Discrimination auditive	1. Discrimination auditive
2. Stimulation intégrale	2. Paires minimales	2. Conscience phonologique	2. Paires minimales	2. Paires minimales
3. Dynamique naturelle de la parole	*3. Cued articulation* [1]	3. Paires minimales	3. Conscience phonologique	3. Conscience phonologique

[1] Approche d'intervention où chaque son est associé à un indice fait d'un geste de la main qui représente l'endroit et la façon dont le son est produit. Un code de couleur est également utilisé pour représenter chaque son (Passy, 2010).

Connaissance des approches

Lorsque les répondantes ont été interrogées sur la façon dont elles avaient entendu parler des approches d'intervention la première fois, ce sont les moyens d'apprentissage où il y a un contact direct entre les orthophonistes et d'autres personnes qui ressortent principalement : la formation initiale, les formations données en groupe et les échanges avec des collègues. Ces résultats rejoignent les données de la littérature qui suggèrent que les nouvelles connaissances des orthophonistes proviennent des discussions informelles avec des collègues et de

la formation continue en groupe (Denman et al., 2021; Furlong et al., 2018; McCurtin et Carter, 2015). Malgré le fait qu'il s'agisse d'un moyen privilégié pour l'acquisition de nouvelles connaissances, l'OOAQ a offert une seule formation sur l'intervention en TSP, donnée à trois reprises, en dix ans. Celle-ci portait uniquement sur le traitement de la dyspraxie verbale (OOAQ, rapports annuels 2010-2020). Également, peu de répondantes mentionnent avoir connu des approches d'intervention par la lecture d'articles scientifiques. Ce constat concorde avec les façons de faire des orthophonistes américaines qui lisent également peu d'articles (Hoffman et al., 2013). Une étude menée auprès d'orthophonistes aux États-Unis et au Canada travaillant auprès d'enfants ayant une dyspraxie verbale a identifié les principales barrières à la lecture d'articles scientifiques : les orthophonistes disent qu'elles sont trop occupées, que leur employeur a des attentes trop élevées quant à la quantité de clients qu'elles doivent voir et qu'elles arrivent difficilement à accéder aux articles scientifiques (Gomez et al., 2022). Dans notre étude, il est raisonnable de penser que les orthophonistes rencontrent des obstacles similaires à ceux décrits dans Gomez et al. (2022), comme le manque de temps et l'accès difficile aux articles scientifiques (Greenwell et Walsh, 2021; McLeod et Baker, 2014).

Utilisation des approches

Les répondantes ont été questionnées sur la connaissance et la fréquence d'utilisation des différentes approches d'intervention. Les résultats montrent que les approches d'intervention les plus connues ne sont pas nécessairement les plus utilisées. À titre d'exemple, les approches des paires minimales et des exercices oro-moteurs sont connues par 95 % des répondantes, mais elles ne font pas partie des approches les plus utilisées par les orthophonistes du Québec. À l'inverse, il arrive que d'autres approches très connues soient également très utilisées. C'est le cas de l'approche traditionnelle d'articulation et de la DNP qui se retrouvent autant parmi les approches les plus connues que parmi les approches les plus utilisées.

L'approche la plus utilisée par les répondantes a une efficacité appuyée par des études de bon niveau de preuves scientifiques (voir Lousada et al., 2013). Cependant, parmi les cinq autres approches les plus utilisées, l'efficacité d'aucune d'entre elles n'a été prouvée par le plus haut niveau de preuves scientifiques possible comme une méta-analyse d'essais cliniques randomisés.

Il faut se questionner sur l'utilisation répandue de la DNP, pour laquelle il n'existe aucune preuve d'efficacité – ni aucune étude publiée dans une revue ayant un processus de révision par les pairs. Toutefois, au cours des 15 dernières années, la DNP a été largement diffusée par de nombreuses formations de groupe au Québec. La DNP a peut-être intégré la pratique clinique parce qu'elle est soutenue par deux sources de connaissances privilégiées par les orthophonistes : la formation continue de groupe et les échanges entre collègues (en lien avec la quantité importante de formation offerte). Son haut taux d'utilisation indique que les orthophonistes ne choisissent pas leurs approches de traitement uniquement sur la base du niveau de preuves scientifiques. L'expérience personnelle des orthophonistes demeure une variable importante dans leur choix d'approche et le changement de pratique, pour adopter des interventions plus efficaces, apparaît exigeant. En effet, les cliniciennes seraient peu enclines à changer des pratiques qui donnent des résultats positifs selon leurs observations en clinique, et ce, même si une étude démontre que l'approche qu'elles utilisent pourrait être moins efficace qu'une autre (Hegarty et al., 2021; McCurtin et Carter, 2015). Selon Furlong et al. (2021), la familiarité des orthophonistes avec une approche et la facilité d'implantation d'une approche sont des facteurs pouvant influencer les décisions cliniques. Ainsi, la DNP présente ces caractéristiques : 1) l'approche est entièrement francophone ce qui la rend plus facile à implanter au Québec, 2) des formations de groupe sont fréquemment publicisées dans divers forums et réseaux sociaux. Enfin, il est possible de présumer que si les orthophonistes du Québec utilisent la DNP, c'est possiblement parce qu'elles observent des résultats positifs dans leur bureau, même si l'approche ne dispose d'aucun appui scientifique.

Par ailleurs, nos résultats montrent que plusieurs approches d'intervention sont peu utilisées par les orthophonistes du Québec, bien qu'elles aient des appuis scientifiques solides. C'est notamment le cas des paires minimales (Dodd et al., 2008), des oppositions multiples (Allen, 2013), du *Core Vocabulary* (Broomfield et Dodd, 2005), de l'approche cyclique (Almost et Rosenbaum, 1998), des oppositions maximales (Dodd et al., 2008), de la perception de la parole (Rvachew et al., 2004) et du *Nuffield Centre Dyspraxia Programme* (Murray et al., 2015).

Les participantes à la présente étude n'ont pas été questionnées spécifiquement sur les raisons pour lesquelles ces approches sont peu utilisées. En revanche, plusieurs études ont démontré qu'il existe des barrières à l'implantation d'une pratique basée sur les preuves scientifiques en clinique, notamment une difficulté à transférer directement les connaissances issues des résultats d'une étude à la réalité clinique (Furlong et al., 2018; Hegarty et al., 2021). Plusieurs raisons expliquent cette difficulté comme la fréquence de traitement

recommandée, les contraintes d'organisation des services, des résultats d'études qui se contredisent ou un faible nombre d'études, un faible potentiel de généralisation des résultats et un manque de temps des professionnels (Baker et McLeod, 2011b; Furlong et al., 2018; McCurtin et Carter, 2015; Zipoli et Kennedy, 2005). Concernant ce dernier point, le manque de temps des professionnels pour la formation pourrait expliquer, du moins en partie, la raison pour laquelle les orthophonistes du Québec utilisent peu certaines approches d'intervention alors qu'elles sont appuyées par la recherche. En effet, une étude de Furlong et al. (2018) s'intéressant au processus de décision de cliniciennes travaillant auprès d'enfants ayant un TSP a démontré que les orthophonistes n'ont pas suffisamment de temps pour s'approprier les nouvelles approches. Ce manque de temps pour implanter les nouveaux apprentissages, jumelé à la tendance des orthophonistes à conserver les pratiques qui leur sont déjà familières, peut retarder, voire empêcher l'adoption d'une nouvelle approche en clinique. Les orthophonistes pourraient se montrer plus ouvertes à changer leur pratique d'intervention si l'accès au matériel était facilité (McCabe, 2018). À titre d'exemple, le choix des cibles dans l'approche des paires minimales peut prendre du temps. L'accès au matériel peut donc être un obstacle à un changement rapide de pratiques chez les orthophonistes.

La littérature tend à démontrer qu'il faudrait une quinzaine d'années pour transférer les données de la recherche à la pratique clinique (Morris et al., 2011). Autrement dit, une approche connue n'est pas nécessairement utilisée dans l'immédiat. Pour réduire ce délai, Hegarty et al. (2021) suggèrent aux orthophonistes de réaliser des études cliniques en équipe de travail, de partager leurs connaissances sur les approches d'intervention qu'elles utilisent avec leurs collègues et de prendre part à des séances d'observation par les pairs. Ainsi, la mise en œuvre d'une pratique basée sur les preuves scientifiques pourrait être facilitée par la réflexion collective de plusieurs orthophonistes qui travaillent ensemble.

Enfin, même si les exercices oro-moteurs sont connus par 95 % des répondantes, cette approche n'est pas pour autant parmi les plus utilisées. Ce constat est encourageant étant donné que plusieurs études menées durant les années 2000 ont démontré l'inefficacité des exercices oro-moteurs pour traiter les TSP (Lof et Watson, 2008; McCauley et al., 2009; Ruscello, 2008). Les orthophonistes du Québec semblent être bien informées de l'inefficacité des exercices oro-moteurs dans le traitement du TSP grâce aux études qui se sont intéressées à cette approche d'intervention et qui ont clairement affirmé leur inutilité.

Comparaison avec les autres pays

Notre étude montre que la discrimination auditive, la conscience phonologique et les paires minimales sont un peu moins utilisées au Québec que dans les pays anglophones (Brumbaugh et Smit, 2013; Hegarty et al., 2018; Joffe et Pring, 2008; McLeod et Baker, 2014). Cette divergence peut d'abord s'expliquer par le fait que les orthophonistes québécoises n'ont pas été interrogées sur l'utilisation de la discrimination auditive, malgré sa popularité en Australie et au Royaume-Uni. Il en est ainsi, car la discrimination auditive a été considérée comme une tâche pouvant être intégrée à certaines des interventions de la présente étude (p. ex. : approche cyclique, paires minimales, oppositions maximales).

De plus, bien que répandues aux États-Unis et au Royaume-Uni, l'approche intégrant la conscience phonologique et l'approche des paires minimales sont peu utilisées au Québec. Cette différence pourrait être liée au fait que la structure de la langue française est différente de celle de la langue anglaise et que les approches créées dans cette langue sont plus difficiles à appliquer en contexte francophone. À titre d'exemple, les mots d'une seule syllabe sont particulièrement facilitants pour la constitution de paires minimales (p. ex. : *bite, bright, fight, flight*, etc.). Or, les possibilités de former des paires minimales ou maximales en français sont plus limitées parce que les mots monosyllabiques sont moins fréquents qu'en anglais (Brosseau-Lapré et al., 2018). Pour les orthophonistes francophones, l'implantation d'une approche créée et publiée en anglais présente donc un double défi. En effet, les orthophonistes doivent 1) acquérir des connaissances techniques dans une langue qui n'est pas leur langue première (Durieux et al., 2015) et 2) adapter ces nouvelles connaissances à une langue pour laquelle l'intervention initiale n'a pas été conçue à la base. Cette hypothèse est appuyée par le fait que la DNP a été créée et diffusée en langue française et qu'elle est une des trois approches les plus utilisée par les orthophonistes québécoises. La faible utilisation de l'approche des paires minimales par les orthophonistes québécoises, bien qu'elle ait prouvé son efficacité, pourrait aussi être expliquée par l'absence d'études portant sur la langue française (Williams et al., 2010).

De manière générale, il apparait que les orthophonistes du Québec utilisent des approches d'intervention ciblant davantage la production que la perception, contrairement aux orthophonistes des autres pays. En effet, au Québec, les trois approches d'intervention les plus utilisées sont l'approche traditionnelle d'articulation, la stimulation intégrale et la DNP, toutes des approches axées sur la

production. Il en est autrement aux États-Unis et en Australie où les orthophonistes utilisent majoritairement des approches axées sur la perception comme la discrimination auditive et la conscience phonologique. Au Royaume-Uni, les trois approches les plus utilisées se concentrent majoritairement sur la perception. Il est donc possible de se demander si ces différences vont au-delà des distinctions entre l'anglais et le français. Les recherches tendent à considérer que la représentation phonologique est multidimensionnelle et que les dimensions motrice/phonétique et linguistique/phonologique sont deux dimensions d'une même représentation (Farquharson, 2015; Munson et al., 2005). De plus, les enfants ayant un TSP font partie d'un groupe hétérogène : certains ont un trouble articulatoire ou un trouble phonologique, d'autres présentent les deux types (Dodd et al. 2018). Si toutes les dimensions du phonème sont à prendre en considération lors de l'intervention, il est étonnant de constater que plusieurs orthophonistes du Québec ne semblent pas familières avec plusieurs approches axées sur la perception (la perception auditive et les oppositions maximales) comme le démontre la **figure 1**.

Limites de l'étude et futurs développements

Malgré le nombre appréciable de répondantes au sondage et une distribution géographique à travers tout le Québec, les résultats ne peuvent être généralisés à l'ensemble de la pratique francophone du Canada puisque seule la province de Québec est ciblée dans cette étude. Il serait pertinent d'explorer les pratiques des orthophonistes intervenant auprès d'enfants francophones dans les autres provinces canadiennes. Une autre limite de notre étude consiste en la liste des approches utilisées qui pourrait ne pas être exhaustive, même si elle est issue d'une recherche documentaire rigoureuse et validée par une clinicienne. Il serait judicieux de faire approuver les approches d'intervention par un plus grand nombre de cliniciennes pratiquant auprès d'enfants ayant un TSP. Il est également possible que l'ensemble des répondantes n'ait pas eu la même compréhension des approches, et ce, bien que nous ayons fourni des descriptions succinctes pour chacune d'elles. En effet, il peut exister un manque d'uniformité puisque nous ne savons pas comment les répondantes les utilisent et si elles respectent les éléments-clés décrits par les auteurs des approches. Il se peut qu'une même approche ne soit pas implantée totalement de la même façon selon la compréhension de la clinicienne (Furlong et al., 2021). Une prochaine étude devrait se pencher essentiellement sur ce qui motive les choix des approches d'intervention des orthophonistes ainsi que sur les principaux obstacles et facilitateurs quant à l'utilisation d'approches scientifiquement valides, tout comme l'ont fait Hegarty et al. (2021). Pour ce faire, des études qualitatives à partir de groupes de discussion ou d'entrevues individuelles pourraient être menées.

Conclusion

Cette étude permet de détailler les approches d'intervention utilisées par les orthophonistes du Québec pour traiter les enfants ayant un TSP en lien avec une pratique fondée sur les preuves scientifiques. En comparant les résultats de l'étude aux enquêtes menées dans les autres pays, quelques ressemblances ressortent, comme l'utilisation de l'approche traditionnelle d'articulation dont l'efficacité a été prouvée par des études de haut niveau de preuves scientifiques. Cependant, l'usage répandu de la DNP, pour laquelle aucune étude scientifique rigoureuse ne démontre son efficacité, distingue le Québec des autres pays. Un écart est donc présent entre les approches supportées par des preuves scientifiques et le traitement clinique du TSP au Québec. À la lumière de ces résultats, il faut se questionner quant à la facilité d'intégrer des preuves scientifiques à la pratique orthophonique au Québec. À l'instar des orthophonistes pratiquant dans d'autres pays, les participantes attestent lire peu d'articles scientifiques. Ainsi, les sources de nouvelles connaissances sont davantage la formation en groupe et les contacts avec les collègues. Il serait donc souhaitable d'offrir aux orthophonistes québécoises des formations continues basées sur les preuves scientifiques pour le traitement du TSP. Les résultats de cette étude permettent aux orthophonistes francophones d'alimenter leur réflexion sur leur pratique, notamment, en leur faisant découvrir de nouvelles approches d'intervention avec lesquelles elles ne sont pas familières et pour lesquelles il existe des études de bon niveau de preuve scientifique. Quant aux chercheurs et chercheuses, ils peuvent se baser sur les résultats présentés pour mettre en place des études portant sur des approches d'intervention qui n'ont pas fait l'objet de recherches scientifiques rigoureuses et qui sont pourtant utilisées par les orthophonistes du Québec.

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Note des auteures

Toute correspondance concernant cet article peut être adressée à Laurie Montembeault, Département d'orthophonie, Université du Québec à Trois-Rivières, 3351,

boul. des Forges, C. P. 500, Trois-Rivières, QC, Canada, G9A 5H7. Courriel : **laurie.montembeault@gmail.com**

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613.567.9968

1.800.259.8519

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