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RUNNING HEAD: Southern Vietnamese children's speech

Consonant Accuracy and Intelligibility of Southern Vietnamese Children

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Abstract

Understanding typically developing children's speech acquisition is useful to assist speech-language pathologists' diagnosis and intervention planning for children with speech sound disorders. The aim of this research was to investigate Southern Vietnamese-speaking children's speech accuracy and intelligibility. Participants were 132 children aged 3;0-5;11 living in Southern Vietnam (Ho Chi Minh City) whose consonants, semivowels, vowels, and tones were assessed using the Vietnamese Speech Assessment (VSA) and parent-reported intelligibility was assessed using the Vietnamese version of the Intelligibility in Context Scale (ICS-VN). Participants' percentage of consonants correct (PCC) was significantly lower for the younger children compared with the other age groups. Mean PCC was 89.19 (*SD* = 7.83) at 3;0-3;5 years and 99.31 (*SD* = 1.33) at 5;6-5;11 years. Percentage of semivowels correct was higher than the percentage of initial and final consonants correct. Participants produced tones and vowels accurately even from the youngest age group. On average, the participants were reported to be usually to always intelligible and were more intelligible with their parents than other communication partners. There was a positive, weak correlation between speech accuracy (PCC) and intelligibility (ICS-VN). There was no sex effect for PCC and no significant effect for age or sex on intelligibility. These data provide information about typical speech acquisition to support the emerging speech-language pathology profession in Vietnam.

Keywords: Speech, consonant, semivowel, vowel, tone, acquisition, Vietnamese, children, Southern, Vietnam

Consonant Accuracy and Intelligibility of Southern Vietnamese Children

Vietnamese is commonly spoken throughout the world (Eberhard, Simons & Fennig, 2020), including by the 92 million people living in Viet Nam (General Statistics Office of Vietnam, 2013). There are three main Vietnamese dialects: Northern, Central, and Southern Vietnamese (Đinh & Nguyễn, 1998; Đoàn, 2003; Hoàng, 2004; Nguyễn, 1997; Phạm & McLeod, 2016; Vũ, 1982) and each dialect has many sub-dialects. One of the defining features between dialects is that each includes different consonants, semivowels, vowels, and tones. The Ministry of Education in Viet Nam supports research into Vietnamese speech acquisition and has implemented developmental standard 65 "to speak clearly" for 5-year-old children (The Viet Nam Ministry of Education and Training (MOET), 2010). To date, there has been limited research into Vietnamese children's speech acquisition, or indeed regarding speech acquisition for children who speak tone languages (cf. Cantonese, To, Cheung & McLeod, 2013). To date, there have been three studies of typically developing Vietnamese children's speech acquisition written in Vietnamese (Lưu, 1996; Nguyễn, 2011; Nguyễn & Phạm, 2014), two studies of typically developing Northern Vietnamese children's speech acquisition written in English (Phạm, McLeod, & Harrison, 2017; Phạm & McLeod, 2019) and two studies of Southern Vietnamese children with speech sound disorders, one in Vietnamese and the other in English (Hoang, et al., 2019; Tang & Barlow, 2006). These studies provide an emerging understanding of children's acquisition of Vietnamese consonants, vowels, semivowels and tones. For example, the research undertaken to describe typically developing children's speech undertaken in Northern Vietnam was the first stage of operationalizing standard assessments for use by the emerging speech-language pathology (called speech and language therapy) profession in Vietnam. Phạm and McLeod (2019) studied 195 typically developing northern Vietnamese children and described PCC, typical non-adult productions, and phonological patterns on the Vietnamese Speech Assessment

(VSA) and Phạm, McLeod, and Harrison (2017) described 182 northern Vietnamese children's intelligibility at different ages as reported by their parents using the Intelligibility in Context Scale (ICS-VN). To date, there has been limited research that has been conducted with children who speak Southern Vietnamese (Nguyễn, 2011; Nguyễn & Phạm, 2014; Tang & Barlow, 2006), despite the fact that the Southern dialect is spoken by two thirds of Vietnamese people (Hoàng, 2004) and the pronunciation of many consonants and tones is different from Northern and Central Vietnam. There is a need for more research into speech acquisition of children who speak Southern Vietnamese to increase understanding of typically developing children's speech acquisition to assist speech-language pathologists' assessment, diagnosis and intervention planning for children with speech sound disorders across the world (McLeod & Crowe, 2018).

Southern Vietnamese

Southern Vietnamese is spoken from Hai Van Pass to the Ca Mau province and includes speakers from Ho Chi Minh City (Saigon) and the Mekong Delta (Hoàng, 2004). Vietnamese words typically are monosyllabic and do not contain consonant clusters. The syllable shape for Southern Vietnamese is the same as for most other Vietnamese dialects: $C_1(w_1)V(C_2/w_2)T$ (Phạm & McLeod, 2016), where C is a consonant, V is a vowel, T is a tone and w is a semivowel. There are 23 initial consonants and eight final consonants in Southern Vietnamese (Hoàng, 2004; Huỳnh, 1999, 2014; Kirby, 2011; Phạm & McLeod, 2016). The standard initial consonants are: /b, ʈ^{h}, ʈ, d, ʈ, c, k, ʔ, m, n, ɲ, ŋ, f, v, s, ʂ, z, x, ɣ, h, l with two variants /w, j/. The standard final consonants are: /-p, -t, -k, -m, -n, -ŋ/ with two variants /-k^{p}, -ŋ^{m}/ (Table 1). The Southern Vietnamese semivowels are /w, j/. In Southern Vietnamese there are nine long vowels /i, e, ɛ, ɯ, u, o, ɔ, ɤ, ɑ/, three short vowels /ă, ɤ̆, ɔ̆/, three diphthongs /ie, uo, ɯɤ/ and variants /ɨ, ŏ, ŭ, ɔː, oː, ɛː, ɤː/ used in contexts related to semi

open, semi closed, and closed syllables. Finally, there are five tones in Southern Vietnamese: tones 1, 2, 4, 5, and 6 (Brunelle, 2009a, 2009b; Cao, 2006; Hoàng, 1989; Hoàng, 2004; Hwa-Froelich, Hodson, & Edwards, 2002; Kirby, 2010, 2011; Nguyễn & Edmondson, 1998; Phạm & McLeod, 2016).

Southern Vietnamese differs from Northern Vietnamese in the pronunciation of consonants, vowels and tones. While Southern Vietnamese has 23 initial consonants, eight final consonants and five tones; Northern Vietnamese has 20 initial consonants, ten final consonants and six tones; and Central Vietnamese has 23 initial consonants, 10 final consonants and five tones (Phạm & McLeod, 2016). Across these dialects, orthographic letters can be pronounced as different consonants. For example, *voi* (elephant) is pronounced as /jɔj^{1}/ in Southern Vietnamese and /vɔj^{1}/ in Northern Vietnamese. Similarly, *dao* (knife) is pronounced as /jɑw^{1}/ in the Southern Vietnamese but as /zɑw^{1}/ in Northern Vietnamese. That is, Southern Vietnamese includes the phoneme /j/ and Northern Vietnamese includes the phonemes /v, z/.

Theoretical framework

The ability to communicate is a fundamental human right embracing all aspects of life (McLeod, 2018). The International Classification of Functioning, Disability and Health (ICF and ICF-CY; World Health Organization, 2001; 2007) provides a biopsychosocial framework for the consideration of communication and associated disabilities by considering Body Functions and Structures, Activities and Participation as well as Environmental and Personal Factors. The ICF has been used widely to consider individuals' communication, both from a perspective of health and wellness as well as considering disability and disorder (Blake & McLeod, 2018). One of the major childhood achievements when acquiring communicative competence is the ability to speak intelligibly. This skill includes every ICF component: Body Structures such as the mouth, ears, and lungs; Body Functions including the ability to

articulate speech sounds; Activities and Participation including the ability to communicate intelligibly; Environmental Factors including the ability to relate to a range of people including family, friends, teachers and strangers; and Personal Factors including age and language spoken. The current study addresses each of these ICF components in order to support understanding of Vietnamese children's communicative capacity as well as the classification of childhood speech sound disorders by speech-language pathologists in Vietnam and countries of the Vietnamese diaspora. The current study of Southern Vietnamese speech acquisition will be combined with the study of Northern Vietnamese children's speech acquisition (Phạm & McLeod, 2019) to enable a nuanced understanding of Vietnamese children's speech and speech-language pathologists' expectations of developmental capacity (McLeod & Crowe, 2018) since mastery of consonants is one of "the most widely used metrics of typical phonological acquisition and of phonological disorder" (Edwards & Beckman, 2008; p. 937).

Aims

The aim of this research was to examine:

1. The percentage of Southern Vietnamese consonants, semivowels, vowels/diphthongs, and tones produced correctly by preschool children in Ho Chi Minh City at different ages.
2. The effect of age and sex on the percentage of Southern Vietnamese consonants, semivowels, vowels/diphthongs, and tones produced correctly.
3. Mean scores on the Intelligibility in Context Scale (ICS-VN) for preschool children in Ho Chi Minh City.
4. Whether the parent-reported intelligibility (ICS-VN) correlated with children's accuracy of consonant production (PCC on VSA).

METHOD

Ethical Approval

Ethical approval to undertake the research was granted by the Human Research Ethics Committee (2015/285) from the second author's university.

Recruitment of Participants

Participants were recruited from four *trường mầm non* ('young sprout schools' cf. preschools) in Ho Chi Minh City, Viet Nam. Three were private preschools and one was a public preschool. Principals asked teachers to distribute an information form, consent form, and questionnaire to parents of typically developing children. Parent questionnaires and consent forms were returned from 407 parents. Of these, 364 were complete and 43 were unusable since there was either no signature or the questionnaire was empty. In one section of the questionnaire, the parents were asked whether they had concerns about how their child talked and made speech sounds using the Vietnamese translation of the Parental Evaluation of Developmental Status (PEDS, Glascoe, 2000) (used with permission). There were 213 parents who indicated no concern about their child's speech and language, 81 who indicated a little concern, and 70 who indicated that they were concerned. Of the 213 children whose parents indicated no concern, 142 were assessed. The reasons for not being assessed were: participants were absent from preschool on the day of assessment (n = 11), participants cried when the volunteers led them to the assessment room (n = 3), the parent did not provide consent for the teacher to answer questions about the child (n = 26), the researcher did not have an available location in the preschool or a suitable time to undertake the direct assessment (n = 31). Of the 142 children who were assessed all passed the hearing screening test, all passed the oromuscular screening assessment (OMA), and 137 produced all the words on the direct speech assessment. At the conclusion of testing it was apparent that there were only five participants who were 6;0 or older, so these were removed from the analysis due to the small sample size of this group. Therefore, there were 132 participants in the final sample.

Participants

Participants were 132 Vietnamese-speaking preschool children living in Ho Chi Minh City in Southern Vietnam. There were approximately equal numbers of males (*n* = 64, 48.5%) and females (*n* = 68, 51.5%) (Table 2). The participants' ages ranged from 3;1 to 5;11 (37 to 71 months, *M* = 52.23 months, *SD* = 10.71). Most participants lived in Southern Vietnam all of their lives (*n* = 127, 96.2%), while some participants previously lived in Central or Northern Vietnam or other countries (*n* = 4, 3.0%). Most mothers lived in Southern Vietnam for all of their lives (*n* = 97, 73.5%), while some mothers previously lived in Central or Northern Vietnam or other countries (*n* = 34, 25.8%). Most fathers lived in Southern Vietnam for all of their lives (*n* = 93, 70.5%), while some fathers previously lived in Central or Northern Vietnam or other countries (*n* = 38, 28.8%). There was missing data for one participant, one mother, and one father.

The ethnicity of the participants was reported as belonging to the Kinh group (Vietnamese people who speak Vietnamese) (*n* = 127, 96.2%) or the Hoa group (Chinese origin living in Ho Chi Minh City from four to five generations ago who speak Vietnamese and may also speak Chinese languages) (*n* = 5, 3.8%). The majority of the participants were reported to speak Southern Vietnamese at home (*n* = 123, 93.2%). The majority of the participants were reported to listen to Southern Vietnamese at home (*n* = 117, 88.6%). The participants' mothers reported that they spoke Southern Vietnamese (*n* = 99, 75.0%), Northern Vietnamese (*n* = 28, 21.2%), Central Vietnamese (*n* = 14, 10.6%), both Southern and Northern Vietnamese (*n* = 2, 1.5%), or both Southern and Central Vietnamese (*n* = 7, 5.3%). The participants' fathers were reported to speak Southern Vietnamese (*n* = 90, 68.2%), Northern Vietnamese (*n* = 32, 24.2 %), Central Vietnamese (*n* = 16, 12.1%), both Southern and Northern Vietnamese (*n* = 4, 3.0%), or both Southern and Central Vietnamese (*n* =6, 4.5%). Additionally, one father was reported to speak both Vietnamese and a non-

Vietnamese language, and another three fathers were reported to only speak a non-Vietnamese language (n = 4, 3.0%). There was missing data for one participant (n =1, 0.8%).

Socioeconomic status was described using parents' education level and parents' occupation level (cf. Phạm & McLeod, 2019). Participants' mothers' highest education level was: postgraduate degree (n = 17, 12.9%), bachelor's degree (n = 69, 52.3%), certificate (n = 17, 12.9%), senior high school (n = 22, 16.7%), junior high school (n = 6, 4.5%); with missing data for one mother. Participants' fathers' highest education level: postgraduate degree (n = 19, 14.4%), bachelor's degree (n = 77, 58.3%), certificate (n = 11, 8.3%), senior high school (n = 17, 12.9%), junior high school (n = 5, 3.8%); with missing data for three fathers. The International Labour Office International Standard Classification of Occupations (ILO, ISCO-08, International Labour Office, 2012) was used to code parents' occupation level from jobs that required simple tasks (skill level 1) to jobs that required complex and specialist decision-making tasks (skill level 4). The mothers' skill level ranged from 1-4 with a mean of 2.18 (SD = 0.91) (n = 129, missing 3). The fathers' skill level ranged from 1-4 with a mean of 2.50 (SD = 0.89) (n = 130, missing 2). Overall, the majority of the parents had a university qualification and their occupations ranged from the lowest to highest codes, averaging in the middle of the scale.

Instruments

Speech sample.

The Vietnamese Speech Assessment (VSA, Phạm, Le, & McLeod, 2016) was used to assess 77 single words (75 monosyllabic and two bi-syllabic words) using single-word picture naming. The 77 words were selected to contain all of the Vietnamese speech sounds, have at least two words containing each phoneme, have different syllable structures for each phoneme, be within the vocabulary range of young children, be frequently used by Vietnamese people in different regions, be picturable, and be either a noun (not including

classifiers) or verb (Phạm, McLeod, Le, & 2016). The VSA was designed so that the vocabulary and pronunciation of words was equally appropriate for children from Southern, Central and Northern Vietnam and consideration was also made for the Vietnamese diaspora in countries such as Australia and the USA. The VSA was used with 195 children who speak Northern Vietnamese (Phạm & McLeod, 2019) and is currently being used in a study of bilingual Vietnamese-English speaking children in Australia (McLeod & Verdon, 2018-2020).

Intelligibility.

The Vietnamese translation of the Intelligibility in Context Scale (ICS-VN, McLeod, Harrison & McCormack, 2012) was used to consider children's intelligibly with different conversational partners. To complete the ICS-VN, parents respond to seven questions about how intelligible their child is on a 5-point Likert scale from 5 = *always intelligible* to 1 = *never intelligible*. The ICS has been translated into over 60 languages and cross-linguistic evidence regarding its validity and reliability is available in 18 studies of 4,235 children from 14 countries (McLeod, 2020) including Northern Vietnamese (Phạm, McLeod & Harrison, 2017).

Hearing.

Children's hearing was assessed at 500, 1000, 2000, and 4000 Hz (cf. American Academy of Audiology, 2011; World Health Organization, 2015) using a Maico MA1 Ultra Portable Screening Audiometer and a DD-46 headset fitted with Peltor Audiocups. Vietnamese preschools typically are noisy environments, and the ambient noise level was tested using the Decibel 10 measurement app at between 40 and 60dB; therefore, to pass the hearing screening children needed to hear at a threshold of 40dB at each Hz.

Oromotor skills.

Children's oromotor skills were assessed using an adapted version of the Robbins and Klee (1987) screening oromotor assessment (OMA). The adapted version for the Vietnamese context included assessment of oral structures (24 items) and oral functions (2 items) (see Phạm & McLeod, 2019). Children were eligible to participate in the direct speech assessment if they scored at least 21 on the oral structure items and at least 2 on the oral function items.

Procedure

The principal at each of the four preschools was given a letter explaining the research project and upon receipt, agreed that their preschool could participate in the research. Next the principals asked teachers of children aged 3 to 6 years to distribute an information form, consent form, and questionnaire to parents of typically developing children. They were asked to exclude children who had a developmental delay, language delay, speech sound disorder, hearing loss, stuttering, cleft palate, Down syndrome, autism, or other disabilities that may impact their speech production. Parents who were willing for their child to participate signed the consent form and completed the questionnaire that included questions about overall development, parents' socioeconomic background, as well as questions from the PEDS and the ICS-VN. These were returned to the researcher (first author) who arranged an assessment with the children in their preschools.

The direct assessment was undertaken by the researcher in a room in the preschool with support from volunteer university students. The research protocol matched the protocol used in Phạm and McLeod (2019) undertaken with children from Northern Viet Nam. Firstly, the researcher asked the children to provide assent that they were willing to participate in the research. When children agreed, their hearing was assessed. If they passed the hearing test, the children undertook an oromotor assessment (OMA) that was adapted for Vietnamese from Robbins and Klee (1987). If they passed the OMA, the children's speech was assessed using the VSA. A pre-determined cuing hierarchy was used to elicit the desired words: (1)

spontaneous production, (2) clue, (3) binary choice, (4) imitation. The cuing hierarchy was used in keeping with clinical practice in speech assessments to increase the chance that all words were elicited for each child and to aim for the most natural (spontaneous) production of each word. The participants' responses were transcribed online using the International Phonetic Alphabet. Each child's assessment was video-recorded with parental permission, and the VSA was also audio-recorded. After the assessment was complete, the researcher listened to the audio-recording to check and re-transcribe (if necessary) the VSA transcriptions. On a few occasions, the researcher also used the video-recordings to gain additional visual information to assist with the transcription.

Reliability

Point-to-point reliability was conducted for the transcription of consonants, semivowels, vowels, and tones on the VSA by the first and third authors who are Vietnamese speakers with expertise in phonetic transcription. Both were blinded to the original transcriptions. Inter-judge reliability was completed by the first and third authors who independently transcribed the speech of 10 randomly selected participants (7.6% of the sample) online (face-to-face) then independently checked their transcriptions via the recordings. Inter-judge reliability for the VSA data was 96.9% based on a total of 5,805 data items. Intra-judge agreement was completed by the first author who re-transcribed the VSA data from 11 randomly selected participants (8.3% of the sample) and achieved 99.3% based on a total of 6,464 data items. Both intra- and inter-judge agreement was higher than the acceptable reliability level of 85% for phonetic transcription (Shriberg & Lof, 1991) and was similar to the inter-judge reliability level achieved (96.1%) by the same two reliability judges in Pham and McLeod (2019) when examining children from Northern Vietnam.

Data Analysis

Acceptable productions.

Children's speech productions were deemed to be correct/acceptable by considering dialectal variants as described in the review of Vietnamese dialects by Phạm and McLeod (2016). Southern Vietnamese was spoken in the preschools and by the majority of the children's families at home; however, some of the participants also spoke Northern and Central Vietnamese at home. Therefore, children's productions of each word were considered based on their preschool and home dialects. The VSA score form lists possible correct productions for each word based on the Standard, Southern, Central, and Northern dialects. For example, when producing the word *nón* (cone hat), the following productions were considered to be correct depending on the child's home and preschool dialect(s): /nɔːŋ^{5}/ (Southern dialect) /nɔn^{5}/ (Standard, Northern, and Central dialects). There were more dialectal variants for consonants than for semivowels, vowels/diphthongs, or tones in Southern Vietnamese.

Information from the parent questionnaire, and scores from the VSA and ICS-VN were analysed using the Statistical Package for Social Sciences version 20.0 computer program (SPSS) (IBM, 2011). Descriptive statistics were used to determine the frequency of responses for PCC, PVC, PSVC, PTC and ICS-VN. Analyses of variance (ANOVAs) and bivariate correlations were used to examine the impact of age and sex, mean differences in ICS-VN scores, and the correlation between ICS-VN and PCC.

RESULTS

Percentage of Consonants, Semivowels, Vowels/Diphthongs, and Tones Correct

The participants' percentages of consonants (PCC), semivowels (PSVC), vowels/diphthongs (PVC), and tones (PTC) were calculated across six age groups: 3;0-3;5, 3;6-3;11, 4;0-4;5, 4;6-4;11, 5;0-5;5, 5;6-5;11 (Figure 1). PCC was calculated by combining percentage of initial consonants correct (PICC), percentage of final consonants correct (PFCC), and percentage of semivowels correct (PSVC). Acceptable productions included

dialectal variants (as described in the data analysis section; see Table 1 and Phạm & McLeod, 2016). PCC increased from a mean of 89.19 (*SD* = 7.83) at 3;0-3;5 years to 99.31 (*SD* = 1.33) at 5;6-5;11 years. Variability in the accuracy of consonants decreased for the older participants (as demonstrated by the small standard deviations) (Table 3). Children in the 4;0-4;5 age group and older achieved group means of greater than 90% accuracy for syllable-initial (PICC) and all age groups achieved means of greater than 90% for syllable-final (PFCC) consonants and semivowels (PSVC) (Table 4). On average, the participants acquired semivowels and syllable-final consonants earlier than syllable-initial consonants (Table 4). The participants' PVC was high across the age ranges: 3;0-3;5 years (*M* = 99.15, *SD* = 1.34) to 5;5-5;11 years (*M* = 99.87, *SD* = 0.40) (Table 3). Similarly, the participants' PTC was high across the age ranges: 3;0-3;5 years (*M* = 99.19, *SD* = 2.89) to 5;5-5;11 years (*M* = 100.0, *SD* = 0.00) (Table 3).

Effect of age and sex on speech accuracy.

Differences in speech accuracy scores by age were tested using a one-way ANOVA. There was a significant effect of age group for PCC (F (5, 126) = 12.38, $p < .001$). There was no significant effect for age group for PSVC, PVC, or PTC. Post-hoc comparisons for PCC showed there were significant differences between the youngest age group (3;0-3;5) and all other age groups.

The effect of sex on speech accuracy was determined using an independent-samples *t*-test. There were no significant differences between males' and females' speech accuracy scores: PCC scores for males (*M* = 94.07, *SD* = 6.55) and females (*M* = 94.73, *SD* = 6.44); PSVC scores for males (*M* = 98.45, *SD* = 3.33) and females (*M* = 98.35, *SD* = 3.67); PVC scores for males (*M* = 99.22, *SD* = 1.21) and females (*M* = 99.49, *SD* = 0.91); and PTC scores for males (*M* = 99.86, *SD* = 0.51) and females (*M* = 99.63, *SD* = 2.03). Sex differences were not tested for each age group due to the small sample sizes.

Intelligibility

Participants' intelligibility with each communication partner type was rated using the ICS-VN and the mean total score for the 132 participants was 4.55 (*SD* = 0.54). The mean scores for each conversational partner ranged from parents *M* = 4.77 (*SD* = 0.47) to strangers *M* = 4.29 (*SD* = 0.81) (see Table 5). To test for mean differences among the different communication partners repeated measure ANOVAs with Greenhouse-Geisser correction (to adjust for sphericity and correct the degrees of freedom) were conducted (F (1,126) = 11386.79, p <.001, η_p^2 = .989). Pairwise comparisons showed that parents' ratings of participants' intelligibility was the highest with themselves (*M* = 4.77) compared with all other partners: immediate family members (*M* = 4.64), extended family members (*M* = 4.45), friends (*M* = 4.58), acquaintances (*M* = 4.47), teachers (*M* = 4.64), and strangers (*M* = 4.29).

Effect of age and sex on intelligibility.

Pearson's correlation demonstrated a non-significant correlation (r = .18, *ns*) between the ICS-VN mean score and age. A t-test comparison of means demonstrated no significant difference between the ICS-VN mean score and sex (males: *M* = 4.62, *SD* = 0.46; females: *M* = 4.47, *SD* = 0.60) (t = .099, *ns*).

Correlation between the ICS-VN mean scores and PCC.

Criterion validity of the ICS-VN was tested using bivariate correlation analyses (Pearson's r) comparing ICS-VN and PCC scores on the VSA (Phạm, Le, & McLeod, 2016). The bivariate correlation between the mean ICS-VN score and PCC was (r = .29, p < .001) indicating a significant weak correlation between speech accuracy and intelligibility on the ICS-VN.

DISCUSSION

This research is the first to examine speech accuracy and intelligibility of preschool children who speak Southern Vietnamese and live in Ho Chi Minh City, Vietnam. One

hundred and thirty-two typically developing preschool children were assessed using the VSA and the parent-report ICS-VN. The participants acquired semivowels (PSVC), vowels (PVC), and tones (PTC) very early; even the youngest children in the sample achieved greater than 97 per cent correct. Mean PCC scores were lowest for the youngest children (89.19 for 3;0-3;5) and highest for the oldest children (99.31 for 5;6-5;11). Compared with the findings from previous studies that have examined speech accuracy for monosyllabic tonal languages, the current study has a similar pattern of acquisition with consonants being less accurate than semivowels, vowels and tones (Phạm & McLeod, 2019; To et al., 2013). Additionally, the findings are within the range of studies from 27 languages provided in the review by McLeod and Crowe (2018). For example, the current study demonstrated slightly higher accuracy for the younger participants. The children aged 3;0-3;5 had a mean PCC of 89.19 (*SD* = 7.83) in Southern Vietnam, compared with a mean PCC of 72.35 (*SD* = 14.64) in Northern Vietnam (Phạm & McLeod, 2019), and a mean PICC of 81.93 (*SD* = 16.41) for Cantonese-speaking children in Hong Kong (To et al., 2013). However, the scores from the current study for children aged 3;0-3;5 were within one standard deviation (SD) of the mean PCC (*M* = 86.39; *SD* = 9.14) across 14 studies and 11 languages spoken by children aged 3;0 examined in the review by McLeod and Crowe (2018). Similarly, in the current study, the children aged 3;0-3;5 had a mean PTC of 99.19 (*SD* = 2.89) in Southern Vietnam, compared with a mean PTC of 90.35 (*SD* = 2.01) in Northern Vietnam (Phạm & McLeod, 2019), and a mean PTC of 99.48 (*SD* = 1.63) for Cantonese-speaking children in Hong Kong (To et al., 2013).

These findings that younger children speaking Southern Vietnamese and Cantonese were a little more accurate than children speaking Northern Vietnamese may be influenced by the articulatory complexity of phonemes in Northern Vietnamese. Some of the most difficult phonemes in Northern Vietnamese are not produced in Southern Vietnamese. For example, /z/ is a difficult phoneme for children in Northern Vietnam (Phạm & McLeod,

2019), but is not a phoneme within Cantonese or the Southern Vietnamese dialect (instead the phoneme /j/ is used in the same Vietnamese words). Similarly, tone 3 is difficult for children in Northern Vietnam because it is complex and has two directions in the tone; whereas, tone 3 is produced as tone 4 in Southern Vietnamese. Cantonese does not have any tones that are produced in two directions. Another potential reason for the difference in scores between children in the two studies was that parental education level was higher for participants in Southern Vietnam (more parents in the current study had bachelor's degrees) than parents in the Northern Vietnam study (Phạm & McLeod, 2019).

While there was a significant age effect between the youngest age group and all older age groups for PCC there was no significant age effect for PSVC, PVC and PTC. Similarly, there was no significant effect for sex. No significant difference for sex was also found for children in Northern Vietnam (Phạm & McLeod, 2019); however, this is in contrast to the findings from Cantonese-speaking children where females generally performed better than males (To et al., 2013).

This study also provided an understanding of the children's functional intelligibility amongst different communicators in their environment, as informed by the ICF (World Health Organization, 2001). The averaged group data from the ICS-VN indicated that children were always to usually intelligible with a range of conversational partners. They were rated to be significantly more intelligible to their parents than other communication partners. The average score of 4.55 (*SD* = 0.54) was comparable with the average score of 4.43 (*SD* = 0.62) from 195 typically developing preschoolers in Northern Vietnam (Phạm, et al., 2017), 4.56 (*SD* = 0.48) from 36 typically developing pre-schoolers in Hong Kong (Ng, To, & McLeod, 2014), and 4.4 (*SD* = 0.7) from 803 typically developing pre-schoolers in Australia (McLeod, Crowe, & Shahaeian, 2015) (Table 5). Similarly, there was a significant weak correlation between the participants' scores on the ICS-VN and PCC, and these

findings were similar to other studies summarised in McLeod (2020) from Australia (McLeod et al., 2012), Germany (Neumann et al., 2017), Hong Kong (Ng et al., 2014), Vietnam (Phạm, et al., 2017) and Jamaica (Washington et al., 2017).

Limitations and Future Directions

This study is the first to examine speech accuracy and intelligibility in Southern Vietnamese-speaking preschool children. Data were collected from children in Ho Chi Minh City, and not other areas of Southern Vietnam. While the sample (n = 132) was slightly smaller than the sample gathered in Northern Vietnam (n = 195) (Phạm & McLeod, 2019), these data contribute to foundational knowledge for the emerging speech-language pathology profession in Vietnam (Atherton, Davidson & McAllister, 2017). It would be useful to gain data from more children with a wider range of ages (beginning with 2-year-old children) from other areas of Southern Vietnam who speak the Southern Vietnamese dialect, as well as from Central Vietnam. The majority of parents who responded were highly educated, which may be associated with their level of literacy and interest in research, as well as that the study was undertaken in three private preschools and one public preschool. Previous research with the Vietnamese community in Vietnam and Australia similarly has included a greater number of highly educated parents (McLeod et al., 2019; McLeod et al., 2021; Phạm & McLeod, 2019). In future research, it would be useful to analyse these data to determine typical non-adult productions and typical phonological patterns to serve as a reference for speech-language pathologists who work with children with speech sound disorders.

Conclusion

This study of 132 Southern Vietnamese speaking preschool children demonstrated that even the youngest participants could produce semivowels, vowels/diphthongs, and tones correctly. Group mean scores indicated that children produced the majority of consonants correctly. There was an age difference for PCC, but no sex difference across measures. Group

mean scores suggested these participants were always-usually intelligible with a range of conversational partners. There was a positive, weak relationship between speech accuracy (PCC) and intelligibility (ICS-VN). This study represents an important milestone in the operationalisation of speech assessments that can be used by for the emerging speech-language pathology (speech and language therapy) profession in Vietnam and provides guidance for the assessment of 5-year-old children for developmental standard 65 "to speak clearly" (The Viet Nam Ministry of Education and Training (MOET), 2010).

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Table 1.

Consonants and Semivowels Produced in Southern Viet Nam

	Manner/Place	Bilabial	Labio dental	Alveolar	Retroflex	Palatal	Velar	Glottal
Initial consonants	Plosive	b		t̪ʰ t̪ d	ʈ	c	k	ʔ
	Nasal	m		n		ɲ	ŋ	
	Fricative		f v	s	ʂ ʐ		x ɣ	h
	Lateral approximant		l					
	Approximant[a]	w (labio-velar)				j		
Final semivowels	Semivowel[a]	w (labio-velar)				j		
Final consonants[b]	Plosive	p		t		c	k	
	Nasal	m		n		ɲ	ŋ	

Note. Adapted from Phạm and McLeod (2016) with permission from the authors.

[a] /w/ and /j/ are approximants in initial positions and semi-vowels in final position.

[b] The final consonants /t, k, n, ŋ/ have variants depending on the preceding vowel.

Table 2.

Demographic Characteristics of the Participants (n = 132)

Age	Male	Female	Total
3;0-3;5	14	19	33
3;6-3;11	8	9	17
4;0-4;5	12	10	22
4;6-4;11	10	9	19
5;0-5;5	11	10	21
5;6-5;11	9	11	20
TOTAL	64	68	132

Table 3.

Percentage of Consonants Correct (PCC) [a]*, Vowels/Diphthongs Correct (PVC), and Tones Correct (PTC) for Typically Developing Southern Vietnamese-Speaking Children (n = 132)*

Age	*n*	Consonants [a,b]			Vowels/Diphthongs [b]			Tones [b]		
		Mean	*SD*	Range	*Mean*	*SD*	Range	*Mean*	*SD*	Range
3;0-3;5	33	89.19	7.83	74.5-100.0	99.15	1.34	94.9-100.0	99.19	2.89	83.5-100.0
3;6-3;11	17	91.90	6.69	74.5-99.3	99.02	1.37	94.9-100.0	99.85	0.43	98.7-100.0
4;0-4;5	22	94.87	5.36	81.8-100.0	99.07	1.19	96.2-100.0	99.89	0.53	97.5-100.0
4;6-4;11	19	96.08	3.54	89.8-100.0	99.60	0.74	97.5-100.0	99.89	0.57	97.5-100.0
5;0-5;5	21	97.99	2.73	89.8-100.0	99.57	0.63	98.7-100.0	100.0	0.00	100.0-100.0
5;6-5;11	20	99.31	1.33	95.6-100.0	99.87	0.40	98.7-100.0	100.0	0.00	100.0-100.0
TOTAL	132	94.41	6.48	74.5-100.0	99.36	1.07	94.9-100.0	99.74	1.50	83.5-100.0

[a] PCC includes percentage of initial consonants, final consonants and semivowels correct (see Table 4 for more information).

[b] Dialectal variants are included as correct productions.

Table 4.

Percentage of Initial Consonants Correct, Final Consonants Correct, and Semivowels Correct for Typically Developing Southern Vietnamese-Speaking Children (n = 132)

Age	*n*	Initial consonants [a]			Final consonants [a]			Semivowels [a]		
		Mean	*SD*	Range	*Mean*	*SD*	Range	*Mean*	*SD*	Range
3;0-3;5	33	84.24	12.66	57.0-100.0	95.45	4.66	83.3-100.0	97.17	4.70	81.3-100.0
3;6-3;11	17	88.98	10.51	57.0-100.0	94.82	5.39	81.0-100.0	98.54	2.71	93.8-100.0
4;0-4;5	22	94.41	5.33	79.7-100.0	94.36	9.10	66.7-100.0	98.31	3.43	87.5-100.0
4;6-4;11	19	95.46	4.31	87.3-100.0	96.48	3.67	85.7-100.0	98.03	4.19	87.5-100.0
5;0-5;5	21	97.58	3.57	87.3-100.0	98.19	3.09	90.5-100.0	99.41	1.86	93.8-100.0
5;6-5;11	20	98.93	2.15	92.4-100.0	99.88	0.54	97.6-100.0	99.69	1.39	93.8-100.0
TOTAL	132	92.51	9.67	57.0-100.0	96.44	5.39	66.7-100.0	98.40	3.49	81.3-100.0

[a] Dialectal variants are included as correct productions. Semivowels are not included in the percentage of initial and final consonants correct scores.

Table 5.

Intelligibility in Context Scale (ICS-VN) Mean Scores and Comparisons Between Studies

Partners	**Southern Vietnamese (*N* = 132)**	**Northern Vietnamese (*N* = 181)** (Phạm, McLeod & Harrison, 2017)	**English (*N* = 803)** (McLeod et al., 2015)
Age range	3;0 – 5;11 years	2;0 – 5;11 years	4;0 – 5;5 years
Parents	4.77 (0.47)	4.66 (0.63)	4.7 (0.5)
Immediate family members	4.64 (0.54)	4.53 (0.70)	4.5 (0.6)
Extended family members	4.45 (0.68)	4.30 (0.82)	4.3 (0.8)
Friends	4.58 (0.59)	4.38 (0.72)	4.4 (0.8)
Acquaintances	4.47 (0.69)	4.53 (0.59)	4.2 (0.8)
Teachers	4.64 (0.48)	4.43 (0.77)	4.4 (0.7)
Strangers	4.29 (0.81)	4.21 (0.87)	4.0 (1.0)
ICS TOTAL	**4.55 (0.54)**	**4.43 (0.62)**	**4.4 (0.7)**
Criterion validity	**PCC (r = .29, p < .001)**	**PCC (r = .42, p < .01)**	**PCC (r = .24, p < .001)**

Note. Mean scores were generated from responses on a 5-point scale where 1 = *never*, 2 = *rarely*, 3 = *sometimes*, 4 = *usually*, 5 = *always* (McLeod et al., 2012a). PCC, percentage of consonants correct.

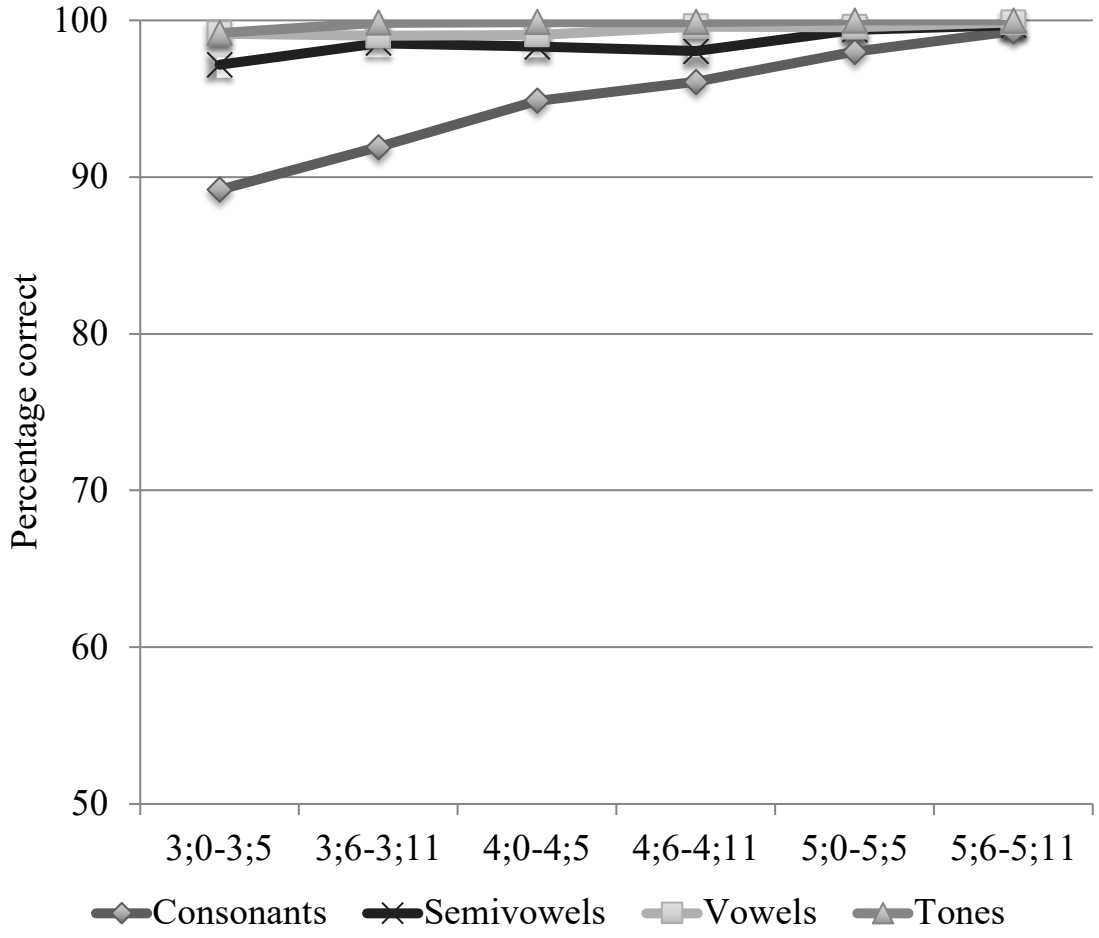

Figure 1. Percentage of Consonants, Semivowels, Vowels/Diphthongs and Tones Correct for Southern Vietnamese-Speaking Children by Age Group (n = 132). (Semivowels are not included in the percentage of consonants correct).