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Typical Consonant Acquisition by Children across Dialects in Vietnam

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ABSTRACT

Information about typical consonant acquisition holds a key position in the practice of speech-language therapy. The purpose of this review article was to describe the typical age of acquisition of consonants produced by children across dialects in Vietnam. A review was undertaken of seven studies reporting consonant acquisition by 1,631 children living in Vietnam. Data were extracted to describe methodological aspects and the age of acquisition of individual Vietnamese consonants. Combining data from the seven studies reveals that most Vietnamese consonants are acquired by age 5. Ordered by the mean age of acquisition at the 90% criterion, Vietnamese children acquired three initial consonants (/m-, b-, ʔ-/), one final consonant (/-m/), and two final semivowels (/-w, -j/) by 2;0–2;11 (years; months); six initial consonants (/c-, k-, n-, ɲ-, f-, h-/) and seven final consonants (/-p, -t, -k, -kᵖ, -n, -ŋ, -ŋ-) by 3;0–3;11; six initial consonants (/d-, t-, ŋ-, s-, ɣ-, l-/) by 4;0–4;11; four initial consonants (/x-, ʈʰ-, v-, ʈ-/) by 5;0–5;11; and four initial consonants (/ʂ-, p-, ʐ-, z-/) and two final consonants (/-c, -ɲ/) by 6;0–6;11. Vietnamese final consonants were acquired earlier than initial consonants. Plosives and nasals were acquired earlier than fricatives. Most labials were acquired earlier than velars and retroflexes. These findings

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on Vietnamese consonant acquisition are similar to those in English and other global cross-linguistic studies, which show that children acquire most consonants by age 5. This information is essential for speech and language therapists and other related professionals working with Vietnamese-speaking children to apply in their clinical decision-making.
Keywords: Acquisition; Consonants; Vietnamese; Children; Dialects

1. Introduction

Speech acquisition is one of the important areas of development for children. It is considered as a "journey from unintelligible to intelligible speech"[1], children's speech develops over time from birth to childhood. Some studies also suggest that a child's speech comprehension begins before birth, demonstrated by the fact that the fetus while still in the mother's womb is able to receive speech sounds from the outside environment. They can distinguish their mother's voice from other people's voices, even distinguishing when the mother speaks her native language from when she speaks a foreign language. The process of children's speech development takes place in different stages and ages and becomes increasingly complex. By the age of 5, children acquire most of consonants[2] or can "speak clearly"[3] and by the first years of elementary school, children can speak like adults[1].

Understanding the typical speech acquisition is important and it has been welled explained in many studies across languages. Knowledge of typical speech acquisition has been applied in the practice of speech-language therapy for a long time. It has been considered as a "powerful clinical tool"[4] to support professionals to make clinical decisions from referral, assessment, diagnosis to selecting intervention goals and providing interventions or dismissal[1]. Among data of children's speech acquisition, consonant mastery has been used the most widely as a benchmark during speech assessment in order to support diagnosis of children who have typically developing speech and those who are at risk of speech sound disorder[5] and to determine the type and severity of the disorder and to direct intervention services[6, 7].

The acquisition of consonants was documented in many studies across languages. A number of cross-language reviews were undertaken to describe its general principles and language specific characteristics[2, 8]. Consonant acquisition was conclusively characterized by three constructs including: (1) age of acquisition; (2) percentage of consonants corrects (PCC); and (3) early-middle-late consonants[2]. Regarding the first construct, the age of acquisition of consonants was initially described in studies of Templin[9], Wellman et al[10] and then Sander[11] by customary versus mastery production of consonants and this summary has been used widely by speech and language therapists. For the second construct of PCC, it was calculated by dividing the number of correct consonants by the total number of consonants produced in a connected speech sample[12]. PCC has been used widely to document typical and atypical consonant acquisition since since Shriberg and Kwiatkowski introduced it[13]. The early-, middle- and late-metrics was third feature of consonant acquisition since Shriberg[14] introduced the early-middle-late consonants of 24 English consonants and this summary has been used to describe consonant acquisition of typically developing children and children with speech sound disorders in assessment and intervention[13].

In 2018, McLeod and Crowe published a cross-linguistic review of 64 studies from 60 articles reporting consonant acquisition by 26,007 children speaking 27 languages from 30 countries[2]. This comprehensive review concluded that children across the world produced at least 93% of the world's consonants correctly and acquired most consonants by five years old, and variability in the rate of consonant acquisition was associated with the manner and place of articulation. The review results have rapidly and widely cited and used as an update of the world's consonant acquisition. However, among data from 27 languages gathered and comprehensively analyzed, by this time, there was no study about Vietnamese consonant acquisition available to be included in this cross-linguistic systematic review.

Vietnamese, a tonal and syllabic language, is one of the top 20 common languages spoken in the world[15] by over 100 million people living in the country and the Vietnamese diaspora worldwide. The Vietnamese syllable structure maximally consists of five components: initial consonant, medial semivowel, main vowel/diphthong, final semivowel/consonant and tone, of which main vowel/diphthong and tone are compulsory[16]. Vietnamese has 25 initial consonants (/p-,

b-, ʈʰ-, t-, d-, ʈ-, c-, k-, ʔ-, m-, n-, ɲ-, ŋ-, f-, v-, s-, z-, ʂ-, ʐ-, x-, ɣ-, h-, j-, l-, w-/), one medial semivowel (/-w-/), 11 single vowels (/i, e, ɛ, ɯ, u, o, ɔ, ɤ, ɑ, ă, ɤ̆/), three diphthongs (/ie, uo, ɯɤ/), two final semivowels (/-w, -j/), 10 final consonants (/-p, -t, -c, -k, -kᵖ, -m, -n, -ɲ, -ŋ, -ŋᵐ/) and six tones (level, falling, creaky, dipping-rising, rising and constricted) across three main dialects[16, 17]. The number of the Vietnamese consonants, vowels and tones vary across northern, central and southern dialects[16, 17]. For the case of consonants, shared consonants across three dialects include 16 initials /b-, ʈʰ-, t-, d-, c-, k-, m-, n-, ɲ-, ŋ-, f-, s-, x-, ɣ-, h-, l-/) and six finals /-p, -k, -kᵖ, -m, -ŋ, -ŋᵐ/) and dialectal variants include /p-, ʈ-, ʔ-, v-, z-, ʂ-, ʐ-, w-, j-/ for the initials and /-t, -c, -n, -ɲ/ for the finals[16, 18].

Studies on Vietnamese speech acquisition have been conducted since the 1990s in the country but have been published in Vietnamese in print formats and only available in the country's libraries. Therefore, except for some recent studies on Vietnamese speech acquisition published in international journals written in English, there were a number of studies that were not easily accessed through digital databases for broader audience particularly for those who were international and non-Vietnamese-speaking professionals. Currently, there is no study describing similarities and differences in consonant acquisition by children speaking the northern, central and southern Vietnamese dialects. Also, there is no comparative study reporting similarities and differences in consonant acquisition between Vietnamese and other languages. For the first attempt, a review synthesizes data from publications published in Vietnamese and English on Vietnamese children's consonant acquisition is essential. Given well documented evidence that consonant acquisition is one of "the most widely used metrics of typical phonological acquisition and of phonological disorder"[5], information about Vietnamese consonant acquisition summaries from previous studies will play important role on decision-making process of professionals in identifying individuals with speech sound disorders. The summary of mastery production of consonants from Vietnamese studies will also serve as quality research-based evidence for recent revision of the Developmental Standards for Children aged 5 that the Vietnam Ministry of Education and Training has been undergoing[3].

The aim of this review was to inform professionals working with Vietnamese-speaking children about mastery of consonant across three main Vietnamese dialects. Specific aims include descriptions and summaries of the age of acquisition for individual Vietnamese consonants at the 50%, 75% and 90% criteria in initial- and final-syllable positions; early-, middle- and late Vietnamese consonants; and manner and place characteristics across Vietnam.

The overarching and specific aims of this review were obtained by answering following research questions:

(1) What are methodological characteristics of studies of Vietnamese consonant acquisition?

(2) What is the age of acquisition for individual initial- and final-syllabic Vietnamese consonants at the 50%, 75% and 90% criteria?

(3) What are the early, middle and late consonants acquired by Vietnamese-speaking children?

2. Materials and Methods

2.1. Ethical Considerations

This study was undertaken by reviewing previous publications about Vietnamese consonant acquisition that were available either at libraries in Vietnam or in digital databases. Since no collection for primary data at field trips was involved, the study was not requested for consideration of ethical approval.

2.2. Methods

Search strategy of literature. Since Vietnamese literature is not systematically available in databases, a systematic literature search was not possible to undertake for this review. The review drew on publications available from three sources including English literature, Vietnamese literature and expert knowledge. Source 1 was English literature that was searched through advanced search in Google Scholar using the following search terms: "children", "consonant", "Vietnamese", "acquisition" or "development". The first 100 results were examined and eight publications met the searching criteria. Source 2 was Vietnamese literature that was searched through the databases available at the Vietnam national library and the Hanoi National University of Education library. Seven publications were found, including a doctoral thesis and six journal articles. Source 3 was expert

knowledge as consultancy was requested from researchers and clinicians with Vietnamese speech acquisition expertise for any additional publications. By this source, three master theses were added into the searched publication list. Through these three sources, there were 18 publications identified.

Inclusion and exclusion criteria. Inclusion criteria applied to include publications for this review were: (1) results presenting typical acquisition of the individual Vietnamese consonant; (2) primary data from different research designs including cross-sectional study, longitudinal study or case study; (3) participants are children with typical development, living in Vietnam, and speaking Vietnamese as the first language; and (4) publications published in any year, in any formats of journal articles, book chapter, or thesis and written in either English or Vietnamese. Studies were excluded when data reported could not interpreted using the 50%, 75% or 90% criterion for individual consonants.

After applying inclusion and exclusion criteria, three out of eight studies identified from English literature were eligible, five were excluded, including: a journal article that does not describe the age of individual Vietnamese consonants; three journal articles describing the age of the Vietnamese consonants by children living in the United States (one article) and Australia (two articles), and a journal article describing the phonological characteristics including consonant acquisition by children with speech sound disorder. In addition, a master thesis written in English was included in this review but only the data reporting consonant acquisition of a child living in Vietnam was extracted, excluding the data of the one living in Canada. From Vietnamese literature, three out of seven publications were eligible and four publications were excluded, including: three articles describing consonant acquisition of Vietnamese children suspected with speech sound disorders and a journal that presented secondary data from previous studies. From expert knowledge source, there was a master thesis included as the two others described Vietnamese children suspected with speech sound disorders. In total, there were seven publications describing Vietnamese children's consonant acquisition were eligible to include in this review (**Table 1**).

Table 1. Studies describing typical acquisition of Vietnamese consonants in Vietnam, grouped by dialects.

Author (Year)	Publication	Location	Sample Size	Age	Age Group	Sex
Vietnamese Northern dialect						
1. Luu [19]	Doctoral thesis in Vietnamese	Hanoi	62	2;0–6;0	12 mths/group	-
2. Phạm & McLeod [20]	Article in English	Hanoi, Haiphong	195	2;0–5;11	6 mths/group	94/101
3. Vu [21]	Master thesis in English	Haiphong	1*	1;5–3;4	-	1/0
Vietnamese Central dialect						
4. Lee et al. [22]	article in English	Hue city	80	3;0–7;0	12 mths/group	43/37
Vietnamese Southern dialect						
5. Nguyen [23]	article in Vietnamese	Hochiminh city	298*	2;6–6;3	6 &12 mths/group	-
6. Nguyen & Pham [24]	article in Vietnamese	Hochiminh city	635	2;0–4;0	6 mths/group	-
7. Le [25]	Master thesis in Vietnamese	Hochiminh city	360	3;0–5;11	6 mths/group	180/180
Total			1,631	1;5–7;0		

*Vu [21] sampled 2 participants but excluding 1 participant as living outside Vietnam. Nguyen [23] sampled 303 participants but excluded 5 participants who were suspected to speech sound disorders.

Procedure. Seven publications identified were reviewed and data were extracted to describe methodological aspects and results of the age of individual Vietnamese consonant acquisition for each study. Methodological aspects were reported into four themes: 1) general information including publication type, year of publication, study location; 2) demographic information of participants including sample size, sex, age range, development status; 3) speech elicitation methods including research design, technique for elicitation of speech samples, number of stimulations, scoring, transcription, reliability, examiners; and 4) speech analysis including criteria and measures.

Data described the results of consonant acquisition were extracted for the age each consonant acquired by using the 50%, 70% or 90% criteria used in the study. When studies presented the percentage of children who acquired each consonant, the data were re-calculated into the age each consonant that was acquired by 50%, 75% and 90% of children. Data were analyzed by using frequency, mean, standard deviation and range. The data of the age of acquisition of

consonants were classified by syllabic positions (initial and final syllabic positions) and by place and manner of articulation. Interrater reliability was undertaken for all studies by point-to-point agreement between the first author and other co-authors.

3. Results

3.1. Description of Methodological Aspects of the Studies on Vietnamese Consonant Acquisition

Table 1 presents description of the seven studies including in the review that consists general information, consonant sample elicitation and analysis. Firstly, general information of the seven studies on Vietnamese children's consonant acquisition included author, year of publication, type of publication, location, dialect spoken. There were three studies [19–21] reporting consonant acquisition of the northern dialect, one study [22] for the central dialect and three studies [23–25] for the southern dialect. Five studies were conducted solely by native Vietnamese authors and two studies were conducted in collaborations with the two foreigners from Australia [20] and the United States [21]. All authors have backgrounds either in speech and language pathology, special education, early childhood education, primary education or linguistics, or they have transdisciplinary backgrounds of these fields.

Luu [19] and Le [25]'s studies were doctoral and master theses written in Vietnamese, and submitted and stored in printed versions at two universities in Vietnam. Studies of Nguyen [23] and Nguyen and Pham [24] were journal articles written in Vietnamese published in professional journal in the country, the former one was only accessed in printed version and the latter one was able to find from digital searching. Studies of Phạm and McLeod [20] and Lee et al. [22] were journal articles and Vu [21] was a master thesis written in English and can be searched digitally.

The earliest study was conducted in 1996 [19] and the latest one was conducted in 2023 [22]. In total, these seven studies reported data from 1,631 participants. The average sample size of participants was 233 (*SD* = 219.80), ranging from 1 participant [21] to 635 participants [24]. Participants' age range was from 1 year old to 7 years old. Participants' ages were divided into age groups by either 12-month or 6-month intervals. Sex distribution of participants was presented in three studies conducted in recent years and there were an equal number of boy and girl children participating in each study [20, 21, 25]. These three studies also reported on participants' social-economic status that was based on parental education and occupations since these are considered as factors influencing speech accuracy of children [1]. Inclusion and exclusion criteria for recruitment participants were applied in all studies but more details were described in three recent studies compared to three studies published over 10 years ago. Inclusion criteria included children who: spoken Vietnamese as the first language, had both parents who were native Vietnamese speakers, and went to preschools because speech samples were collected in preschool settings. All studies recruited children who were typically developing, had no history of hearing or oral motor difficulties, except for some of this information was missed in some studies. Screening for development, hearing and oral motor status were either done by teachers, parents or by research teams. However, all studies have not reported in details that children were monolingual, bilingual or multilingual Vietnamese speakers because foreign languages, particularly English have increasingly been teaching in preschools.

Regarding research design, five studies were used cross-sectional design, except for studies of Luu [19] and Vu [21]. Luu was combined cross-sectional and longitudinal designs when collecting speech samples of two participants longitudinally over three years at home setting and 62 participants at preschool settings [19]. Vu's study was collected speech samples from a participant in over two years at the participant's home setting [21].

Regarding speech sample collection technique, Luu's study collected speech samples from natural conversations in preschool and home settings. The author observed a child or a group of children at one time, heard what children talked then recorded all what they heard in a diary. The author observed children in different activities in five conservative days, six hours per day at preschools. Speech samples were written in orthography then for speech analysis [19]. Similarly, Vu collected speech samples from natural conversations in the participant's home setting by audio recordings then transcribed for speech analysis [21]. Five studies used single picture naming task ranging from 50 to 284 words to elicit speech samples from participants collected in preschool settings [20, 22–25] (see **Table 2**).

Table 2. Speech elicitation and analysis across studies on Vietnamese consonant acquisition (N = 1,631).

Author (Year)	Research Design	Speech Elicitation	No of Words	Examiner	Reliability	Analysis	Criteria
Vietnamese Northern dialect							
1. Luu [19]	Cross-sectional, longitudinal	Natural conversation	-	author (linguist)	-	Percentage of consonants correct: initial	"appeared"
2. Phạm & McLeod [20]	Cross-sectional	Single word	77	speech therapists, SE teacher	Intra-rater (95.1%), inter-rater (96.1%)	Percentage of consonants correct: initial, final	75%, 90%
3. Vu [21]	Longitudinal	natural conversation	-	grandfather recorded	-	Percentage of consonants correct: initial, final	"acquired" (50%)
Vietnamese Central dialect							
4. Lee et al [22]	cross-sectional	single word	55	Speech therapists	inter-rater (91.6%)	Percentage of consonants correct: initial, final	50%, 75%, 90%
Vietnamese Southern dialect							
5. Nguyen [23]	Cross-sectional	single word	284	teachers	-	Percentage of consonants correct: initial, final	"percentage of consonant correct"
6. Nguyen & Pham [24]	Cross-sectional	single word	50	teachers	-	Percentage of consonants error: initial, final	"percentage of consonant error"
7. Le [25]	Cross-sectional	single word	77	speech therapists	-	Percentage of consonants correct: initial, final	75%, 90%

When using the single picture naming task in five studies [20, 22–25], procedure to elicit speech samples was described. Speech samples were collected in preschool settings, in a quiet room or place. Nguyen [23] and Nguyen and Pham [24] described procedure of speech samples were collected by testers who gave questions for each individual child for each picture then the child's responses were written in orthography in score forms. Three studies from Phạm and McLeod [20], Lee et al [22] and Le [25] collected individual child of each word in the wordlist by both online transcribing by using the International Phonetic Alphabets (IPA) [26] in the score form and audio and/or video recording the speech samples for offline checking with online transcription before rating. Studies of Phạm and McLeod [19] and Le [25] used four-step prompts to elicit each word in the wordlist, as follow: 1) Asking what is this? 2) Providing lexical clues for the word; 3) Providing binary choices and the target word was said first; and 4) Modelling by saying the target word for the child to imitate. Lee et al. [22] used three-step prompts by omitting the binary choices.

Regarding reliability, three studies used audio and/or video recordings while collecting speech samples of participants. Audio/video recordings were used to re-listen to check with online scoring for each word. Intra-rater reliability is calculated by an agreement of an examiner between scores rated online and scores rated from re-listening to audio/video recordings. Inter-rater reliability is calculated by an agreement of scores that rated independently from at least two examiners for a speech sample. Inter-reliability was calculated for 10% of all speech samples in the three studies. This measure achieved a high score (over 90%) between two examiners for speech sample scoring in Phạm and McLeod [20] and Lee et al. [22]. Only Phạm and McLeod's study reported intra-rater reliability and also at high agreement of over 90% [20].

Examiners who collected speech samples in studies of speech acquisition were considered as a factor associated with the quality of speech samples [1]; therefore, in speech acquisition studies, there is description about who were examiners. In Luu's study [19], although it was stated clearly in the thesis, by using the pronounce used in the report it can be assumed that the author was only examiner for the speech samples of children. Studies of Nguyen [23] and Nguyen and Pham [24], examiners were described very briefly when indicating that teachers provided prompts when elicit speech samples from the word list. Studies from Phạm and McLeod [20], Lee et al [22] and Le [25] described examiners eliciting speech samples from children were speech and language pathologists or special educators who spoke the same dialect with the participants. Examiners received speech sampling trainings prior to data collection and monitored by research team leaders at preschools while collecting speech samples from children. Examiners practiced to use consistently the speech sample collection protocol among participants and among other testers. Furthermore, examiners involved in speech sample collection in the three studies were described as a professional who had high experience of transcription skills in IPA to transcribe online and offline from audio recordings.

Regarding speech analysis, consonants were calculated

by percentage of initial consonant correct (PICC) and percentage of final consonant correct (PFCC). A study conducted by Nguyen and Pham [24] reported children's speech sample by measures of percentages of consonants errors (PCE), it was reverted into percentages of consonants correct to be consistent with measures calculated in the other four studies.

Criteria to determine the age of acquisition for each consonant in the Vietnamese children's speech acquisition studies was applied by the criteria established in international studies [2]. Criteria for age of acquisition were introduced by many researchers and particularly by pioneer Smit [27] and Templin [9]. The most common criteria were applied included: 50%, 75% and 90%. The meaning of the criteria 50% or 75% or 09% was percentages of the participants in the whole sample produced correctly a phoneme. The criteria 50% was scaled as a level of *emerging*, 75% was *acquired* and 90% was *mastered.* Studies of Phạm and McLeod [20], Lee et al. [22], and Le [25] described and applied these three criteria for all Vietnamese phonemes being assessed; whereas, studies of Luu [19], Vu [21], Nguyen [23], and Nguyen and Pham [24] neither applied these three acquisition criteria nor sampled full potential range of the Vietnamese repertoire. For example, Luu's study [19] did not apply acquisition of 50%, 75% and 90% but applied the criterion of "appeared" to record any phoneme that being heard by the author that children in the sample produced correctly during the data collection at preschools for the children from 2 years old to 6 years old. The "appeared" criterion is equivalent to the criterion of 50%. Similarly, Vu's study [21] reported consonants that were considered as "acquired" by over 50% occurrences producing correctly and this is equivalent to the 50% criterion. Results of age acquisition from Nguyen [23] and Nguyen and Pham [24] were recalculated into the three criteria to be consistent with other studies.

For example, Nguyen [23] reported results of age acquisition for the /f-/ at the age 2;6–2;11 (years; months) was 59.1%; at the age 3;0–3;11was 88.1%; at the age 4;0–4;11 was 93.9%; and at the age 5;0–6;3 was 77.1%. By using criteria of 50%, the initial phoneme /f-/ was acquired at the age of 2;6-2;11 (years; months); 75% at the age of 3;0–3;11 and 90% at the age of 4;0–4;11 and there was a notice that this initial phoneme had a revert at the age of 5;0–6;3. Percentage of error for each consonant was reported in Nguyen and Pham's study [24] was converted into percentage of phonemes correct for each consonant. For example, at the age of 2;0–2;5, the initial consonant /b-/ had percentage of consonant error was 2.8%, this result was re-calculated by converting into percentage of correct at 97.2% (100%–2.8% error = 97.2% correct).

3.2. Age of Acquisition of Consonant Phonemes across Vietnamese Dialects

By using the acquisition criteria in all seven studies, data on the number of consonants was reported differently. Because speech samples were collected naturally by conversations, Luu [19] reported information for 10 phonemes /p, b, t, d, c, m, f, s, z, x/ appeared in the sample out of 22 consonants in the Vietnamese Northern dialect and following consonants were omitted from the data: /ʈʰ, ʈ, k, ʔ, ɲ, ŋ, v, z, ʂ, ʐ, ɣ, h, l, -w-, -j, -w/. In the study of Nguyen [23], age acquisition was presented results for 8 consonants /b-, m-, f-, th-, c-, l-, ŋ-, x/; four final consonants/ /-p, -k, -m, -ŋ/; a medial semivowel /-w-/; a final semivowel /-w/.

Consonants are listed according to the place, manner and voicing order of the IPA [26]. The age of acquisition of each consonant is reported by descriptive statistics including mean, standard deviation and range at the 50%, 75% and 90% criteria.

Mean age of acquisition of consonant phonemes across Vietnamese dialects at the 50% criterion

Table 3 and **Figures 1** and **2** presented the mean age of acquisition of each consonant at the 50% criterion.

Regarding initial consonants, seven consonants were acquired at a mean age between 2;0 and 2;5 (24–29 months): /b-, m-, k-, t-, n-, d-, h-/; nine consonants between 2;6 and 2;11 (30–35 months): /ʔ-, ŋ-, ɣ-, f-, s-, ɲ-, l-, c-, x-/; three consonants between 3;0 and 3;5 (36–42 months): /v-, z-, ʈʰ-/; one consonant between 3;6 and 3;11 (42–47 months): /p-/; and three consonants between 4;0 and 5;5 (48–66 months): /ʐ-, ʂ-, ʈ-/ (see **Figure 1**). The initial approximant consonants /w-, j-/ were produced by children speaking the southern Vietnamese dialect and were acquired at a mean age of 3;0 (36 months).

Table 3. Mean age of acquisition of Vietnamese consonants across dialects (N = 1,631).

Consonant:	Luu [19]	Phạm & McLeod [20]	Vu [21]	Lee et al. [22]	Nguyen [23]	Nguyen & Pham [24]	Le [25]	*Mean*	*SD*	*Range*
Plosives										
/p/	24	73*	22	36	-	-	73*	45.60	25.58	22–73
/b/	24	24	17	36	30	24	36	27.29	7.04	17–36
/t̪ʰ/	-	36	40	48	30	36	60	41.67	10.76	30–60
/t/	24	30	17	36	-	24	42	28.83	9.09	17–42
/d/	24	36	19	36	-	24	36	29.17	7.70	19–36
/ʈ/	-	73*	-	84	-	24	73*	63.50	26.84	24–84
/c/	24	30	40	48	30	24	36	33.14	8.78	24–48
/k/	-	30	17	36	-	24	36	28.60	8.17	17–36
/ʔ/	-	24	-	-	-	-	36	30.00	8.49	24–36
Nasals										
/m/	24	24	17	36	30	24	36	27.29	7.04	17–36
/n/	-	30	19	36	-	24	36	29.00	7.48	19–36
/ɲ/	-	42	19	36	-	24	36	31.40	9.53	19–42
/ŋ/	-	36	19	36	30	24	36	30.17	7.28	19–36
Fricatives										
/f/	24	36	31	36	30	24	36	31.00	5.39	24–36
/v/	-	30	22	36	-	24	73*	37.00	20.86	22–73
/s/	24	36	30	36	-	24	36	31.00	5.90	24–36
/z/	-	36	26	85*	-	24	36	41.40	25.00	24–85
/ʂ/	-	-	-	85*	-	24	73	60.67	32.32	24–85
/ʐ/	24	54	-	85*	-	24	73	52.00	27.85	24–85
/x/	24	54	26	36	30	24	48	34.57	12.09	24–54
/ɣ/	-	36	20	36	-	24	36	30.40	7.80	20–36
/h/	-	30	21	36	-	24	36	29.40	6.84	21–36
Lateral										
/l/	-	36	29	36	30	24	42	32.83	6.40	24–42
Approximants										
/j/	-	-		36	-	-	36	36.00		36–36
/w/	-	-	-	-	-	-	36	36.00		36–36
Medial										
/-w-/	48	30	-	-	-	24		36.00	8.49	30–48
Final										
/-p/	24	24	19	36	30	24	36	27.57	6.58	19–36
/-t/	24	24	19	-	-	24	36	25.40	6.31	19–36
/-k/	24	36	19	36	30	24	36	29.29	7.04	19–36
/-kᵖ/	24	24	-	36	-	-	36	30.00	6.93	24–36
/-c/	24	36	21	48	-	-	-	32.25	12.34	21–48
/-m/	24	24	19	36	30	24	36	27.57	6.58	19–36
/-n/	24	24	21	36		24	36	27.50	6.69	21–36
/-ɲ/	24	48	21	36	-	-	-	32.25	12.34	21–48
/-ŋ/	24	36	19	36	30	24	36	29.29	7.04	19–36
/-ŋᵐ/	24	24	-	36	-	-	36	30.00	6.93	24–36
/-j/	-	24	19	-	-	24	36	25.75	7.23	19–36
/-w/	-	24	19	-	-	24	36	25.75	7.23	19–36

Hyphens indicate not assessed or no variability, *consonants were not achieved by the upper age limit of the study.

Regarding final consonants, two final semi-vowel /-w, -j/ and six final consonants were acquired at a mean age between 2;0 and 2;5 (24–29 months): /-t, -n, -p, -m, -k, -ŋ/ and four final consonants between 2;6 and 2;11 (30–35 months): /-kᵖ, -ŋᵐ, -c, -ɲ/ (see **Figure 2**).

Mean age of acquisition of consonant phonemes across Vietnamese dialects at the 75% criterion.

Table 4 and **Figures 3** and **4** presented the mean age of acquisition of each consonant at the 75% criterion.

At the 75% criterion, seven initial consonants were acquired at a mean age between 2;6 and 2;11 (30–35 months): /b-, m-, ʔ-, n-, f-, h-, c-/; five consonants between 3;0 and 3;5

(36–42 months): /k-, ɲ-, l-, d-, ŋ-/; three consonants between 3;6 and 3;11 (42–47 months): /t-, v-, s-/; three consonants between 4;0 and 4;11 (48–59 months): /ɣ-, x-, t̪ʰ-/; and five consonants between 5;6 and 7;0 (66–85 months): /ʈ-, ʂ-, ʐ-, p-, z-/. The initial consonant /j-/ was produced by children speaking the central and southern Vietnamese dialects and the initial consonant /w-/ was produced by southern Vietnamese children and both /j-/ and /w-/ were acquired at the age of 3;0 (36 months) (see **Figure 3**).

Table 4. Mean age of acquisition of Vietnamese consonants across dialects at the 75% criterion (*n = 1,568*).

Consonant:	Luu [19]	Phạm & McLeod [20]	Vu [21]	Lee et al. [22]	Nguyen [23]	Nguyen & Pham [24]	Le [25]	*Mean*	*SD*	*Range*
Plosives										
/p/	-	73*	-	85*	-	-	73	77.00	6.93	73–85
/b/	-	24	-	36	30	24	36	30.00	6.00	24–36
/t̪ʰ/	-	54	-	60	30	60	73	55.40	15.81	30–73
/t/	-	48	-	36	-	42	48	43.50	5.74	36–48
/d/	-	36	-	36	-	30	48	37.50	7.55	30–48
/ʈ/	-	72*	-	85*	-	48	73*	69.50	15.50	48–85
/c/	-	36	-	36	30	36	36	34.80	2.68	30–36
/k/	-	36	-	36	-	36	36	36.00	0.00	36–36
/ʔ/	-	30	-	-	-	-	36	33.00	4.24	30–36
Nasals										
/m/	-	30	-	36	24	24	36	30.00	6.00	24–36
/n/	-	36	-	36	-	24	36	33.00	6.00	24–36
/ɲ/	-	48	-	36	-	24	36	36.00	9.80	24–48
/ŋ/	-	36	-	36	30	54	36	38.40	9.10	30–54
Fricatives										
/f/	-	42	-	36	30	24	36	33.60	6.84	24–42
/v/	-	30	-	48	-	24	73	43.75	22.01	24–73
/s/	-	66	-	48	-	24	42	45.00	17.32	24–66
/z/	-	72	-	85*	-	-	-	78.50	9.19	72–85
/ʂ/	-	72	-	85*	-	54	73	71.00	12.78	54–85
/ʐ/	-	72	-	85*	-	-	73	76.67	7.23	72–85
/x/	-	60	-	72	36	36	60	52.80	16.10	36–72
/ɣ/	-	42	-	60	-	42	48	48.00	8.49	42–60
/h/	-	42	-	36	-	24	36	34.50	7.55	24–42
Lateral										
/l/	-	36	-	48	30	24	48	37.20	10.73	24–48
Approximants										
/j/	-	-	-	36	-	-	36	36.00	0.00	36–36
/w/	-	-	-	-	-	-	36	36.00		36–36
Medial										
/-w-/	-	36	-	-	60	60	36	48.00	13.86	36–60
Final										
/-p/	-	36	-	48	30	24	36	34.80	8.90	24–48
/-t/	-	24	-	-	-	24	42	30.00	10.39	24–42
/-k/	-	48	-	36	30	24	36	34.80	8.90	24–48
/-kᵖ/	-	24	-	36	-	-	36	32.00	6.93	24–36
/-c/	-	48	-	36	-	-	-	42.00	8.49	36–48
/-m/	-	24	-	60	30	24	36	34.80	14.94	24–60
/-n/	-	24	-	-	-	24	42	30.00	10.39	24–42
/-ɲ/	-	60	-	60	-	-	-	60.00	0.00	60–60
/-ŋ/	-	42	-	36	30	24	36	33.60	6.84	24–42
/-ŋᵐ/	-	36	-	36	-	-	36	36.00	0.00	36–36
/-j/	-	24	-	-	-	24	36	28.00	6.93	24–36
/-w/	-	24	-	-	30	24	36	28.50	5.74	24–36

Hyphens indicate not assessed or no variability, *consonants were not achieved by the upper age limit of the study.

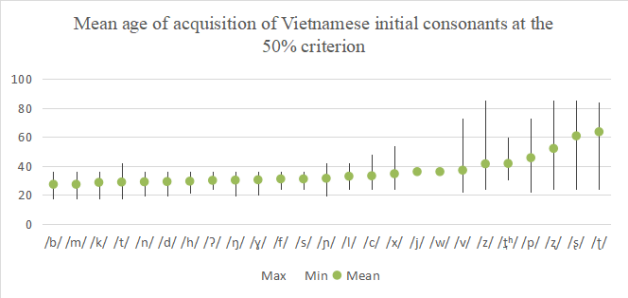

Figure 1. Mean age of acquisition of Vietnamese initial consonants at the 50% criterion.

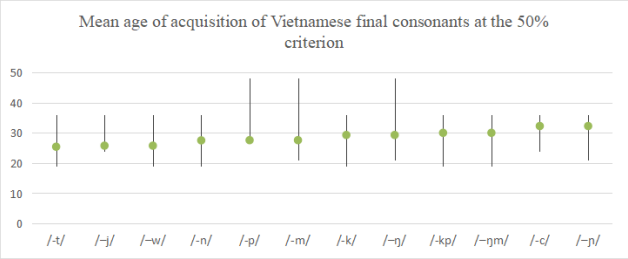

Figure 2. Mean age of acquisition of Vietnamese final consonants at the 50% criterion.

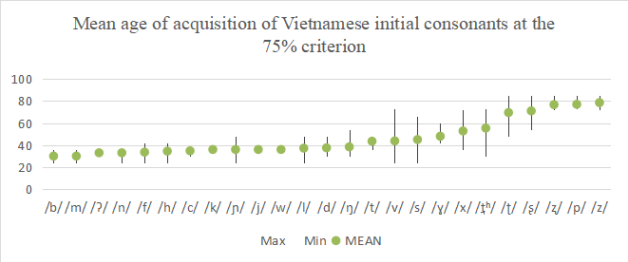

Figure 3. Mean age of acquisition of Vietnamese initial consonants at the 75% criterion.

At the 75% criterion, two final semi-vowel /-w, -j/ were acquired at a mean age of between 2;0 and 2;5 (24–29 months). Seven final consonants were acquired at a mean age of between 2;6–2;11 (30–35 months): /-t, -n, -kᵖ, -ŋ, -p, -k, -m/, two final consonants between 3;0 and 3;11 (36–47 months): /-ŋᵐ, -c/ and the final consonant /-ɲ/ was acquired at the age of 5;0 (60 months) (see **Figure 4**).

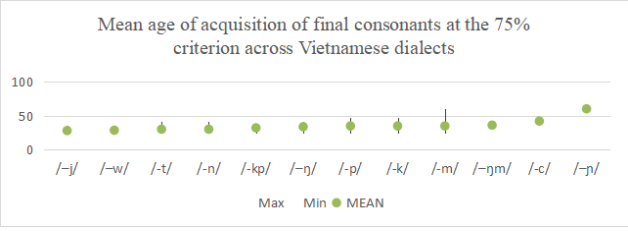

Figure 4. Mean age of acquisition of Vietnamese final consonants at the 75% criterion.

Mean age of acquisition of consonant phonemes across Vietnamese dialects at the 90% criterion.

Table 5 and **Figures 5** and **6** presented the mean age of acquisition of each consonant at the 90% criterion.

At the 90% criterion, three initial consonants were acquired at a mean age between 2;6 and 2;11 (30–35 months): /b-, m-, ʔ-/; six consonants between 3;6 and 3;11 (42–47 months): /k-, n-, h-, ɲ-, c-, f-/; six consonants between 4;0 and 4;11 (48–59 months): /d-, l-, s-, ŋ-, t-, ɣ-/; three consonants between 5;0 and 5;11 (60–71 months) /x-, ʈʰ-, v-/; and five consonants between 6;0–7;0 (72–85 months): /ʈ-, ʂ-, p-, ʐ-, z-/. The initial approximant consonant /j-/ was produced by children speaking the central and southern Vietnamese dialects and the initial consonant /w-/ was produced by southern Vietnamese children and both these approximants /j-/ and /w-/ were acquired at the age of 3;0 (36 months) (see **Figure 5**).

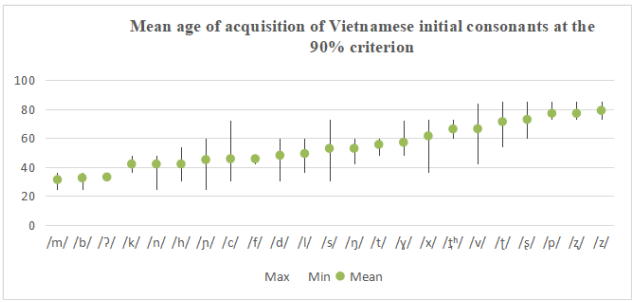

Figure 5. Mean age of acquisition of Vietnamese initial consonants at the 90% criterion.

At the 90% criterion, two final semi-vowel /-w, -j/ were acquired at a mean age of between 2;6 and 2;11 (30–35 months) similarly to the final consonant /-m/. Six final consonants were acquired at a mean age of 3;0 (36–47 months): /-kᵖ, -ŋᵐ, -p, -k, -n, -ŋ, -t/, and the two latest final consonant /-c, -ɲ/ were acquired at the age of 6;0 (72 months–83 months) (see **Figure 6**).

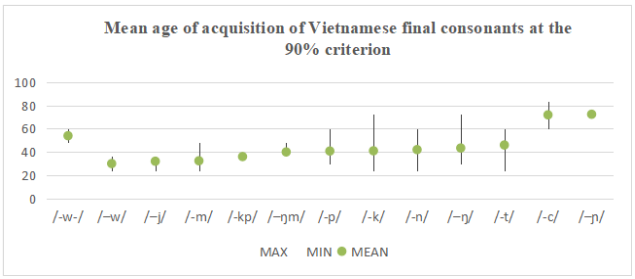

Figure 6. Mean age of acquisition of Vietnamese final consonants at the 90% criterion.

Table 5. Mean age of acquisition of Vietnamese consonants across dialects at the 90% criterion (n = 1,568).

Consonant	Luu [19]	Phạm & McLeod [20]	Vu [21]	Lee et al. [22]	Nguyen [23]	Nguyen & Pham [24]	Le [25]	*Mean*	*SD*	*Range*
Plosives										
/p/	-	73*	-	85*			73*	77.00	6.93	73–85
/b/	-	36	-	36	30	24	36	32.40	5.37	24–36
/ʈʰ/	-	66	-	72	60	60	73	66.20	6.26	60–73
/t/	-	54	-	48	-	60	60	55.50	5.74	48–60
/d/	-	54	-	48	-	30	60	48.00	12.96	30–60
/ʈ/	-	73*	-	85*	-	54	73*	71.25	12.82	54–85
/c/	-	48	-	72	30	42	36	45.60	16.21	30–72
/k/	-	42	-	36		48	42	42.00	4.90	36–48
/ʔ/	-	30	-	-	-	-	36	33.00	4.24	30–36
Nasals										
/m/	-	30	-	36	24	30	36	31.20	5.02	24–36
/n/	-	48	-	48	-	24	48	42.00	12.00	24–48
/ɲ/	-	60	-	60	-	24	36	45.00	18.00	24–60
/ŋ/	-	42	-	60	48	60	54	52.80	7.82	42–60
Fricatives										
/f/	-	42	-	48	48	42	48	45.60	3.29	42–48
/v/	-	42	-	84	-	-	73	66.33	21.78	42–84
/s/	-	73	-	60	-	30	48	52.75	18.28	30–73
/z/	-	73	-	85*	-	-		79.00	8.49	73–85
/ʂ/	-	73	-	85*	-	60	73	72.75	10.21	60–85
/ʐ/	-	73	-	85*	-	-	73	77.00	6.93	73–85
/x/	-	73	-	72	36	60	66	61.40	15.13	36–73
/ɣ/	-	48	-	72	-	48	60	57.00	11.49	48–72
/h/	-	54	-	48	-	30	36	42.00	10.95	30–54
Lateral										
/l/	-	42	-	60	48	36	60	49.20	10.73	36–60
Approximants										
/j/	-	-	-	60	-	36	36	44.00	13.86	36–60
/w/	-	-	-	-	-	-	36	36.00		36–36
Medial										
/-w-/	-	48	-			60	60	56.00	6.93	48–60
Final										
/-p/	-	60	-	48	30	30	36	40.80	13.01	30–60
/-t/	-	54	-	-	-	24	60	46.00	19.29	24–60
/-k/	-	73	-	36	36	24	36	41.00	18.63	24–73
/-kᵖ/	-	36	-	36	-	-	36	36.00	0.00	36–36
/-c/	-	60	-	84	-	-		72.00	16.97	60–84
/-m/	-	24	-	48	30	24	36	32.40	10.04	24–48
/-n/	-	42	-		-	24	60	42.00	18.00	24–60
/-ɲ/	-	73	-	72	-	-	-	72.50	0.71	72–73
/-ŋ/	-	73	-	36	36	30	42	43.40	17.08	30–73
/-ŋᵐ/	-	36	-	48	-	-	36	40.00	6.93	36–48
/-j/	-	24	-	-	-	36	36	32.00	6.93	24–36
/-w/	-	24	-	-	30	30	36	30.00	4.90	24–36

Hyphens indicate not assessed or no variability, *consonants were not achieved by the upper age limit of the study.

The early-, middle- and late Vietnamese consonants across studies

Adopting the early-, middle-, and late-consonant metrics created by Shriberg [12] using the 90% criterion across Vietnamese studies of typical consonant acquisition, Vietnamese initial consonants were classified as early (2;0–3;11), including: /b-, c-, k-, ʔ-, m-, n-, ɲ-, f-, h-/; middle (4;0–4;11), including: /t-, d-, ŋ-, s-, ɣ-, l-/; and late (5;0–6;11), including: /p-, ʈʰ-, ʈ-, v-, z-, ʂ-, ʐ-, x-/. Vietnamese final consonants were classified as early (2;0–3;1), including: /-p, -t, -k, -kᵖ, -m, -n, -ŋ, -ŋᵐ/; and late (5;0–6;11), including /-c, -ɲ/.

4. Discussion

By combining data from seven studies on Vietnamese consonant acquisition, all three research questions of the studies were answered. The first research question aimed to describe methodological features across Vietnamese consonant acquisition studies. The second question was addressed by providing results on age means of individual Vietnamese consonants acquired according to the 50%, 75% and 90% criteria. A list of early-, middle- and late-consonants for the Vietnamese language was provided to answer for the third research question.

Description of methodological features included demographic information, age range, stimuli, consonant acquisition data, consonant acquisition analysis and presentation. Under these methodological features, there were differences between studies conducted over 10 years and those conducted more recently. The methodological features described in recent Vietnamese studies [20–22, 25] aligned with the recommendations for studies reporting age of acquisition of consonants, as suggested in McLeod and Crowe's study [2].

By synthesizing the results of the age of acquisition of individual consonant phonemes from seven studies, similarities and differences were observed. Although the studies were conducted in different years, with varying speech sample sizes and dialects, there was a consistent pattern in the early and late acquisition of consonants across the studies. Consonants reported as early acquired included the initial consonants /b-, m-, v-/; final consonants /-p, -t, -m, -n/; and the two final semi-vowels /-j, -w/. The retroflex phonemes /ʈ-, ʂ-, ʐ-/, the aspirated phoneme /ʈʰ-/, and the velar /x-/ in the initial syllabic positions were acquired at the latest.

Basal and ceiling effects were observed in Vietnamese studies of consonant acquisition. The basal effect occurred when participants acquired consonants at the 90% criterion by the youngest age group sampled in the study. For example, Le reported that 11 initial consonants were acquired at the 90% criterion by the youngest group (3;0) [25]. The ceiling effect was observed in all studies when participants in the oldest age group had not yet acquired consonants at the set criterion [2]. For example, Le reported that the consonants /p-, ʈʰ-, ʈ-, v-, ʂ-, ʐ-/ were not acquired by children aged 5;11 in her study [25]. Since both basal and ceiling effects were observed, "mean ages of acquisition are conservative" [2].

Across Vietnamese studies on consonant acquisition, final consonants were acquired earlier than initial consonants. All 10 final consonants were acquired at the 50% criterion by ages 2;0–2;11, and 8 final consonants were acquired at the 90% criterion by ages 3;0–3;11, except for the palatals /-c, -ɲ/. This finding is similar to the findings in a Cantonese study by To et al. [28]. Since differences were observed in acquisition rate between consonants in the initial syllable positions and the finals, it was necessary to provide Vietnamese consonant acquisition information for the initial and final positions.

When comparing the mean ages of Vietnamese consonants with the mean ages of consonant acquisition for children in a global sample [2], similarities were found in the age of acquisition for a number of consonants (see **Table 6**).

By age 5, children from the global sample [2] and children living in Vietnam had acquired most consonants. Most nasals and plosives were acquired earlier than fricatives. Labials were acquired earlier than other consonants, while retroflex consonants were the most difficult for Vietnamese-speaking children to acquire. Similarities were also found when comparing the ages of consonant acquisition between Vietnamese and other languages, such as Japanese, Korean, Spanish [2], and American English [8].

Vietnamese data on consonant acquisition across studies supported the consensus that most consonants are acquired by age 5. Based on the IPA classification of manners of articulation, the data on Vietnamese consonant acquisition also supported the consensus that nasals, plosives, approximants, and laterals are acquired earlier than fricatives. Based on the IPA classification of places of articulation, the data from Vietnamese consonant acquisition supported the conclusion that consonants produced with the lips (e.g., bilabial and labiodental), posterior tongue (e.g., palatal and velar), and pharynx (e.g., glottal) were acquired earlier than those produced with the anterior tongue (e.g., dental, alveolar, and retroflex). Additionally, it is important to consider the interaction between manner and place of articulation in Vietnamese consonant acquisition, as anterior plosives and nasals (e.g., /n/, /t/) were typically acquired earlier than anterior fricatives (e.g., /s/, /z/).

Information on the early-, middle-, and late-consonant metrics between Vietnamese and other languages extracted from McLeod and Crowe's study [2] was summarized in **Table 7**. It was obvious that most consonants across languages

Table 6. Mean age of consonant acquisition for Vietnamese-speaking children in Vietnam and children across the world.

Age		50%	75%	90%
2;0–2;11 (24–35 months)	Vietnamese	Initial: /b, d, t, c, k, ʔ, m, n, ɲ, ŋ, f, s, x, ɣ, l, h/ Final: /-w, -j, -p, -t, -c, -k, -k^{p}, -m, -n, -ɲ, -ŋ, -ŋ^{m}/	Initial: /b, c, ʔ, m, n, f, h/ Final: /-w, -j, -p, -t, -k, -k^{p}, -m, -n, -ŋ/	initial: /m-, b-, ʔ-/ Final: /-m, -w, -j/
	Global[2]	/p, b, d, t, k, g, m, n, f, s, ʃ, h, j, w/	/p, b, d, k, g, m, n, ŋ, f, h, w/	/p/
3;0–3;11 (36–47 months)	Vietnamese	Initial: /p, t̪^{h}, v, z/ Final:	Initial: /d, **t**, k, ɲ, ŋ, v, **s**, l/ Final: /-c, -ŋ^{m}/	Initial: /c-, k-, n-, ɲ-, f-, h-/ Final: /-p, -t, -k, -k^{p}, -n, -ŋ, -ŋ^{m}/
	Global[2]	/ŋ, v, z, ð ʒ ʍ ɹ, l, tʃ, dʒ/	/**t**, **s**, ʃ, j, l/	/b, t, d, k, g, m, n, ŋ, f, h, j, w/
4;0–4;11 (48–59 months)	Vietnamese	Initial: /ʐ/ Final:	Initial: / t̪^{h}, x, ɣ/ Final:	Initial: /d-, t-, ŋ-, s-, ɣ-, l-/ Final:
	Global[2]	/θ/	/v, z, ʒ, ɹ, tʃ, dʒ/	/v, s, z, ʃ, l, tʃ, dʒ/
5;0–5;11 (60–71 months)	Vietnamese	Initial: f/ʂ, ʈ/ Final:	Initial: /ʂ, ʈ/ Final: /-ɲ/	Initial: /x, t̪^{h}, v, ʈ/ Final:
	Global[2]		/ð/	/ð, ʒ, ɹ/
6;0–6;11 (72–83 months)	Vietnamese		Initial: /p, z/ Final:	Initial: /ʂ, p, ʐ, z/ Final: /-c, -ɲ/
	Global[2]		/θ/	/θ/

were acquired by early and middle ages (i.e., under 5 years old). There were a few consonants that were acquired later than 5 years old. This information provided an update for the traditional early-, middle-, and late-consonant metrics that was first introduced by Shriberg in 1993 [14].

There were some limitations in this review. Since there were varying degrees of methodological differences, inconsistencies occurred in the speech sampling technique, analysis, and data presentation. Information on the age of acquisition for several consonants was omitted; therefore, a full range of the Vietnamese consonant repertoire was not represented. In addition, basal and ceiling effects were observed across the studies in this review, which led to the reported data being conservative. These limitations also suggest the need for further investigation into Vietnamese consonant acquisition at younger ages (under two years old) and older age groups (after six years old).

5. Conclusions

This paper describes a comprehensive review of seven studies that reported Vietnamese consonant acquisition by 1,631 children from 1 year and a half to seven years old (19 months to 84 months) living in Vietnam. Data were extracted to describe methodological aspects and the age of acquisition of individual Vietnamese consonants. Combining data from seven studies reveals that most Vietnamese consonants were acquired by 5 years old. Ordered by mean of age of acquisition at the 90% criterion, Vietnamese children acquired three initial consonants /m-, b-, ʔ-/, a final consonant /-m/ and two final semivowels /-w, -j/ by 2;0–2;11 (years; months); six initial consonants /c-, k-, n-, ɲ-, f-, h-/ and seven final consonants /-p, -t, -k, -k^{p}, -n, -ŋ, -ŋ^{m}/ by 3;0–3;11; six initial consonants /d-, t-, ŋ-, s-, ɣ-, l-/ by 4;0–4;11; four initial consonants /x-, t̪^{h}-, v-, ʈ-/ by 5;0–5;11 and four initial consonants /ʂ-, p-, ʐ-, z-/ and two final consonants /-c, -ɲ/ by 6;0–6;11. Vietnamese final consonants were acquired earlier than the initials. Plosives, nasals were acquired earlier than fricatives. Most labials were acquired earlier than velars and retroflexes. These findings on Vietnamese consonant acquisition were similar to the findings in English and global across-linguistic studies that children acquired most consonants by 5 years old. These data provided research-based evidence for the

Table 7. Early-, middle- and late-consonants across languages.

	Vietnamese	**Global English** [2]	**American English** [8]	**Japanese** [2]	**Korean** [2]	**Spanish** [2]
Early (2;0–3;11)	/m-, b-, ʔ-/ /c-, k-, n-, ɲ-, f-, h-/	/p, b, m, d, n, h, k, g, w, ŋ, f, j/	/b, n, m, p, h, w, d, g, k, f, t, ŋ, j/	/m, t, j, cɕ, p, g, k, ʑ, d, n, w, ɸ, h/	/t, k, p^h, h, t^h, k^h/	/p, t, m, j, ɲ, l, tʃ/
Middle (4;0–4;11)	/d-, t-, ŋ-, s-, ɣ-, l-/	/l, dʒ, tʃ, s, v, ʃ, z/	/v, dʒ, s, tʃ, l, ʃ, z/	/ç, ɾ, ɕ, s, ts/	/p, t, m, s, tɕ, $tɕ^h$, n, k, ŋ/	/ŋ, ʒ, dʒ, g, n, b, d, f, x, ð, w, ɾ/
Late (5;0–6;11)	/p-, $t̪^h$-, ʈ-, v-, z-, ʂ-, ʐ-, x-/	/ɹ, ʒ, ð, θ /	/ɹ, ð, ʒ, θ/	/z/	/s, l/	/r, s, β/

speech development standard index in the Vietnamese Development Standards for Children Aged Five that has been currently revised and updated by the Vietnam Ministry of Education and Training [2]. These data support teachers, special educators, speech and language therapists and other related professionals working with Vietnamese-speaking children in identifying, screening, diagnosing the presence and determining severity of children with speech sound disorders. The information also will be used as a bench mark for intervention goal setting, intervention method selecting and progress monitoring.

Author Contributions

All authors have contributed to the paper. Conceptualisation of the paper: all authors; methodology including searching, reviewing and interpreting, visualising the secondary data: H.P., V.P., T.T.M.T., N.H., L.B., L.T.C., Y.H.T.P., T.D., and L.T.P.; writing—original draft preparation: B.P.; writing—reviewing and editing: H.P., V.P., T.T.M.T., N.H., L.B., L.T.C., Y.H.T.P., T.D., and L.T.P. All authors have read and agreed to the published version of the manuscript.

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Conflict of Interest

The authors have declared that no competing interests existed at the time of publication.

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