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Phonology Acquisition in Nepal: A Preliminary Study

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Abstract

The process of speech and language development in children is an effortless and basic human skill. As the child acquires language, they acquire a sign system that bears an important relationship to both cognitive and social aspects of their life. Every language has its own phonological system so it is necessary to develop language-specific articulatory skill acquisition norms. The aim of the study was to delineate the phonology acquisition in typically developing Nepali-speaking children between the ages 3 and 7.

Forty children in 5 discrete groups as: 3.0-3.12 (mean= 3.4), 4.0-4.12 (mean= 4.4), 5.0-5.12 (mean= 5.5), 6.0-6.12 (mean= 6.4) years, each group consisting of 10 children was considered for the study. All the forty children were administered a picture articulation test in Nepali (PAT-N). The test consists of 79 colorful pictures, and analyses 6 vowels, 3 diphthongs, and 28 consonants in different positions: initial, medial, and final position. After the completion of recording, the recorded samples were transcribed in IPA after a few hours of recording on the same day and were analyzed

All the vowels and diphthongs included in the study were acquired before the age of 3 years old. Around 60% of consonants including in all the positions are developed by age 3.12. The result demonstrated that children acquire more speech and become more accurate as they get older. Speech-language pathologists/ therapists can use this study to assess the speech sound errors, link with intelligibility, and know about the actual breakdown in speech sound development.

Keywords: speech sounds, phonology, articulation, misarticulation, acquisition, phoneme

1. Introduction

Language refers to using sound (signs and symbols) systematically and conventionally for communication and expression (Crystal, 1955). There are five basic components of language (phonology, morphology, syntax, semantics and pragmatics) which are found across all the languages. All these component work together to create meaning for communication.

The process of learning a language in children is usually through interaction with others which slowly they refine and improve the communication (Brancalioni et al., 2018). It is an effortless and basic human skill. As the child acquires language, they acquire a sign system that bears important relationship to both cognitive and social aspects of their

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life (Fletcher & Garman, 1986). This process follows certain pattern and rate in every language which is very complex to explain without any research. Some of the most commonly quoted milestone for language development is the child must acquire the first word by 12 months, two-word phrase/ word combination by 24 months and sentences by 36 months which are used by parents and professional to monitor the normal pattern of language acquisition and to rule out whether the child is showing any delay or need intervention (Lyons, 2013).

One of the basic components of language is phonology which refers to the sound system of the language (Edwards, 1997). Acquisition of an individual sound/phoneme can be described as speech sound development and the organization of these speech sounds into patterns. The development of children's speech sound can be analyzed in two ways: phonetic vs. phonemic acquisition. The term 'Phonetic' refers to motoric skill of speech sound production. The term phonemic refers to the use of speech sounds and their organization. The child acquires speech when he/she masters in perception and production of consonants, vowels, clusters, and prosodic features of the language they speak. Children learn an entire range of phoneme of their language gradually from simple to complex sound. For e.g. clusters are developed later in childhood. The acquisition of various speech sounds is closely related to a child's overall language development (Bauman-Waengler, 2004)

Since the 1930s, there are many studies/researches that have been documented in the acquisition of speech sounds in different languages. Till now it has been documented in more than 27 languages. In most of the languages of the world, the consonant is almost acquired by the age of 5 years, by this age almost 93% of consonants are produced correctly. Sounds from the group of plosives, nasals, and non-pulmonic consonants are acquired earlier than trills, flap, fricatives, and affricates (McLeod & Crowe, 2018).

Nepali language is a member of the Indo-Aryan branch of the Indo-European language which is spoken by 12,300,300 in Nepal (2011 census), 2,870,000 in India (2001 census) and 156,000 in Bhutan. It is the national language of Nepal. According to the 2011 national census, 44.6% of the population of Nepal speaks Nepali as the first language and 32.8 % speak as a second language. There are altogether 12 vowels, 33 consonants, and 3 clusters in the Nepali language(assets, n.d.)

Every year more than 142 children with speech and language delay visit tertiary care hospital in Nepal (Shrestha & Adhikary, 2020). Due to less documentation on the acquisition of speech and language in typically developing children in Nepal as a result many speech-language pathologists in the country are not able to set proper goals for the delayed speech and language. Studying a whole set of language at a stretch is a very complex task and need lots of dedication. There has been a minimal study done in the acquisition of speech and language in typically developing Nepali speaking. The first case study on language development was documented by Pathak where he mentioned that the different component of language is developed at the different stage however there is no clear-cut phase for anything. In the same study he had discovered that around 7 vowels, 3

diphthongs and 11 consonants are acquired at 6 months of age (Pathak 2015). However there no document on phonology acquisition in typically developing Nepali speaking children according to age so this study can be a preliminary study to document the acquisition of one of the components of language. The aim of the study was to delineate the phonology acquisition in typically developing Nepali-speaking children between the ages 3 and 7.

2. Methodology

2.1. Participants and data collection

A cross-sectional study for which forty children from middle-class families that speak Nepali at home and had English as the medium of instruction at school were considered for the study. They were further divided into 5 discrete groups: 3.0-3.12 (mean= 3.4), 4.0-4.12 (mean= 4.4), 5.0-5.12 (mean= 5.5), 6.0-6.12 (mean= 6.4) years, each group comprising of 10 children. The children with normal speech-language and motor histories were included in the study. However, children with hearing loss and slow learners were excluded from the study.

Table 1
Age group and mean age

Group	Mean Age
3-3.12	3.4
4-4.12	4.4
5-5.12	5.5
6-6.12	6.4

All the forty children were administered Picture Articulation Test in Nepali (PAT-N) (Dawadee et al., 2016). The test consists of 79 colorful pictures and analyses 6 vowels, 3 diphthongs, and 28 consonants in different positions, initial, medial and final positions. Out of 28 consonants, 27 consonants were able to assess in the initial position, 24 consonants were able to assess in the final position however only 19 consonants were able to assess in the middle position.

Table 2
Total number of vowels and consonants in different position

	Initial	Medial	Final
Vowels	|a|, |a:|, |i|, |o|, |u|, |e|		
Diphthongs	|ai|, |au|, |ang|		
Consonants	|k|, |kʰ|, |g|,| gʰ|, |ʧ|, |ʧʰ|, |ʤ|, |ʤʰ|, |t|,tʰ|, |d|, |dʰ|, |ʈ|,|ʈʰ|, |ɖ|, |ɖʰ|, |n|, |p|, |pʰ|, |b|, |bʰ|, |m|, |j|, |r|, |l|, |s|, |h|	|k|, |kʰ|,|g|, |ʧ|, |ʧʰ|, |ʤ|, |t|, |d|, ||ʈ|, |n|, |p|, |pʰ|, |b|, |m|, |j|, |r|, |l|, |s|, |h|	|k|, |kʰ|, |g|, |gʰ|, |ʧ|, |ʧʰ|, |ʤ|, |t|, |tʰ|, |d|, ||ʈ|, |ʈʰ|, |ɖʰ|, |n|, |p|, |pʰ|, |b|, |m|, |j|, |r|, |l|, |s|, |h|, |w|
	6 vowels, 3 diphthongs 27 consonants	19 consonants	24 consonants
	Total =79		

During response elicitation, the children were asked to sit on chairs comfortably and the pictures were presented. The responses were recorded and saved in Hewlett-Packard model HP envy 4 notebooks. In the case of a child not able to name the picture, an initial phoneme was provided as cues. If a phonemic cue was not enough syllabic cue followed by a question and the modeling of the word was done. Appropriate reinforcements were provided.

2.2. Data processing and analysis

After the completion of recording, the recorded samples were transcribed in IPA after few hours of recording on the same day and were analyzed. In case of articulation errors, the words were analyzed for phoneme substitution, omission, distortion, or addition. The criterion of 80% for the entire phoneme in all positions was considered for them to be acquired?

3. Findings

3.1. Vowels and Diphthongs

All the vowels and diphthongs that were included in this study were achieved by the age 3-3.11 years of age. Diphthongs |au| had the least percentage of acquisition i.e. 80% and the rest had 100% acquisition. All the vowels and diphthongs were assessed in only the initial position and were independent vowels.

Table 3
Vowel and Diphthongs Development percentage

Vowels	3-3.12 yrs	4-4.12 yrs	5-5.12 yrs	6-6.12 yrs
|a|	100%	100%	100%	100%
|a:|	100%	100%	100%	100%
|i|	100%	100%	100%	100%
|o|	100%	100%	100%	100%
|u|	100%	100%	100%	100%
|e|	100%	100%	100%	100%
|ang|	100%	100%	100%	100%
|au|	80%	90%	100%	100%
|ai|	100%	100%	100%	100%

3.2. Consonants

3.2.1. 3-3.12 years old group

The velar plosive unaspirated voiceless sound like |k|, alveolar plosive unaspirated voiceless sound like |t|, bilabial plosive unaspirated voiceless sound like |p|, bilabial plosive unaspirated voiced sound like |b|, bilabial nasal unaspirated voiced sound like |m|, alveolar nasal unaspirated voiced sound like |n| and alveolar affricates unaspirated voiceless sound like |ʧ| are acquired in all the positions, initial, medial, and final positions with 80% acquisition criterion.

Whereas, other sounds, velar plosive aspirated voiced to sound like |kʰ|, dental plosive unaspirated voiceless sound like |t̪|, palatal approximant unaspirated voiced sound like |j| and bilabial plosive aspirated voiced to

sound like |pʰ| are acquired only in the initial and final position with an 80% acquisition criterion.
Alveolar lateral approximants unaspirated voiced sound like |l| is acquired at middle and final positions and alveolar plosive unaspirated voiced |g| is developed in initial and middle positions only with an 80% pass criterion.

Table 4
Consonant Development in Percentage

Consonant	Position	3-3.11	4-4.11	5-5.11	6-6.11	Consonants	Position	3-3.11	4-4.11	5-5.11	6-6.11
|k|	I*	100%	100%	100%	100%	| ɖ|	I	60%	100%	100%	100%
	M	90%	90%	100%	100%		M	100%	100%	100%	100%
	F	100%	100%	100%	100%	| ɖʰ|	I	100%	100%	100%	100%
|kʰ|	I	80%	100%	100%	100%		F	40%	60%	60%	70%
	M	60%	80%	100%	100%	|n|	I	100%	100%	100%	100%
	F	90%	90%	100%	100%		M	100%	100%	100%	100%
|g|	I	100%	100%	100%	100%		F	80%	90%	100%	100%
	M	100%	100%	100%	100%	|p|	I	100%	100%	100%	100%
	F	40%	40%	60%	80%		M	100%	100%	100%	100%
|gʰ|	I	80%	90%	100%	100%		F	100%	100%	100%	100%
|ʧ|	I	100%	100%	100%	100%	|pʰ|	I	100%	100%	100%	100%
	M	80%	90%	100%	100%		M	70%	80%	90%	100%
	F	80%	100%	100%	100%		F	80%	90%	90%	100%
|ʧʰ|	I	50%	60%	70%	70%	|b|	I	100%	100%	100%	100%
	M	60%	60%	60%	70%		M	100%	100%	100%	100%
	F	30%	50%	70%	80%		F	100%	100%	100%	100%
|ʤ|	I	70%	90%	90%	100%	|bʰ|	I	100%	100%	100%	100%
	M	60%	90%	90%	100%	|m|	I	100%	100%	100%	100%
	F	70%	80%	80%	100%		M	100%	100%	100%	100%
|ʤʰ|	I	100%	100%	100%	100%		F	70%	90%	100%	100%
|t|	I	80%	90%	100%	100%	|j|	I	100%	100%	100%	100%
	M	70%	80%	90%	90%		F	100%	100%	100%	100%
	F	100%	100%	100%	100%	|r|	I	40%	60%	80%	90%
|tʰ|	I	100%	100%	100%	100%		M	60%	80%	90%	100%
	F	30%	90%	100%	100%		F	50%	80%	90%	100%

|d|	I	70%	100%	100%	100%	|w|	F	70%	80%	90%	100%
	M	60%	80%	100%	100%	|s|	I	70%	80%	90%	100%
	F	50%	50%	80%	100%		M	70%	90%	90%	100%
|t̪|	I	100%	100%	100%	100%		F	60%	90%	90%	100%
	M	100%	100%	100%	100%	|h|	I	100%	100%	100%	100%
	F	70%	100%	100%	100%		M	60%	70%	80%	80%
|l|	I	60%	90%	90%	100%		F	70%	100%	100%	100%
	M	80%	90%	90%	100%	|dʰ|	I	100%	100%	100%	100%
	F	100%	100%	100%	100%						

*[I=Initial, M=Medial, F=Final]

Similarly, velar plosive aspirated voiced to sound like |gʰ|, palatal affricates aspirated voiced to sound like |ʤʰ|, alveolar plosive aspirated voiceless sound like |tʰ|, alveolar plosive aspirated voiced sound like |dʰ|, dental plosive aspirated voiceless sound like | t̪ʰ|,| dental plosive aspirated voiced sound like| d̪ʰ|, bilabial plosive aspirated voiced to sound like |bʰ| and glottal fricative aspirated voiced to sound like |h| are acquired only in initial the position whereas dental plosive unaspirated voiced sound like |d̪| is acquired in middle position only. All are considered to be acquired with an 80% acquisition criterion.

3.2.2. 4-4.12 years old group

The new sounds which are developed in this group are alveolar affricate unaspirated voiced sound like| ʤ| and alveolar fricatives aspirated voiceless sound like |s| which are acquired in all initial, middle and final positions
Sound like alveolar plosive unaspirated voiced sound like |d| is acquired in initial and middle position.
Other sounds like dental plosive unaspirated voiced sound like | d̪| and alveolar lateral approximants unaspirated voiced sounds like |l| are acquired in initial position only, velar plosive aspirated voiceless sound like |kʰ|, alveolar plosive unaspirated voiceless sound like |t| and bilabial plosive aspirated voiceless sound like |pʰ| are acquired in middle position only, and alveolar plosive aspirated voiceless sound like |tʰ|, dental plosive aspirated voiceless sound like |tʰ|, bilabial nasal unaspirated voiced sound like |m|, glottal fricative aspirated voiced sound like |h| and bilabial approximant unaspirated voice sound |w| are acquired in final position only.

3.2.3. 5-5.12 years old group

Alveolar tap unaspirated voiced sound like |r| is acquired in initial position only, glottal fricative aspirated voiced sound like |h| is acquired in the middle position only and alveolar plosive unaspirated voiced sound |d| is acquired in the final position only.

3.3. 6-6.12 years old group

Velar plosive unaspirated voiced sound like |g| and alveolar affricatives aspirated voiced sound like |ʄʰ| are developed in final position only.

3.4. 6.12 years old group

Alveolar affricates aspirated voiceless sound like |ʄʰ| is developed in initial and middle position only and Velar plosive aspirated voiced sound like |gʰ| is developed in final position only.

4. Discussion and conclusions

The responses elicited from 40 typically developing Nepali speaking children were analyzed to obtain normative data. It was considered that the children master acquisition as the age increases which is supported by this study indicating some sounds are acquired earlier in life than other sounds.

It was noted from the result that children's speech becomes more accurate as they get older. Almost all the vowels are acquired by the age of 3.12. Around 60% of consonants including in all the positions are developed by the age 3.12 which increases to 89%, 93%, and 96% by the age 5, 6 and 7 respectively and rest are acquired after 7. This finding correlates with Dodd et.al 2003 and K. Ramandeep et.al 2015 which states the majority of error pattern resolve within 4 years. The most difficult sound to acquire are palatal affricatives |ʃ|, |ʄʰ| and tap |r| according to the percentage table. As the speech sound continue to develop even after 6.5 this study also indicates few sounds are not acquired even after 6.12 which is supported by the studies Banik (1998), Maya (1990), Rao (2015), P. Ravali (2016).

Table 5
Summary of development of consonants in different position with age and their percentage of acquisition

Age	Initial	Medial	Final	Total acquisition
3-3.12	|k|, |kʰ|, |g|, |gʰ|, |ʧ|, |ʤʰ|, |t|, |tʰ|, |dʰ|, |ʈ|, |ʈʰ|, |ɖʰ|, |n|, |p|, |pʰ|, |b|, |bʰ|, |m|, |j|, |h|	|k|, |g|, |ʧ|, |ʈ|, |ɖ|, |n|, |p|, |b|, |m|, |l|	|k|, |kʰ|, |ʧ|, |t|, ||ʈ|, |n|, |p|, |b|, |m|, |j|, |l|, |pʰ|	60%
4-4.12	|ʤ|, |d|, |ɖ|, |s|, |l|	|kʰ|, |ʤ|, |t|, |d|, |pʰ|, |r|, |s|	|ʤ|, |tʰ|, |ʈʰ|, |m|, |r|, |s|, |h|, |w|	89%
5-5.12	|r|	|h|	|d|	93%
6-6.12			|g|, |ʄʰ|	96%
>6.12	|ʄʰ|	|ʄʰ|	|gʰ|	100%

The result which is obtained from the study has a great clinical implication. As the results were obtained using most of the phoneme in

different positions this data can be used to differentiate between phonological disorders and normal children in a clearer way. Speech-language pathologists/therapists can use this study to assess the speech sound errors, link with intelligibility, and know about the actual breakdown in speech sound development. This is one of the preliminary studies so this might be a small yet important milestone in knowing the phonological aspect of language development. The study was carried out with a limited sample size and there the lack of inter-rater reliability.

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