



Prerequisites for Learning Cued Speech in Tamil Language among Individuals with Hearing Impairment

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ABSTRACT

A study was conducted to assess the prerequisite skills for learning Cued Speech in Tamil language among 45 individuals with hearing impairment in the Coimbatore district of Tamil Nadu, India. Purposive sampling method was followed to select the participants. A questionnaire was developed by the authors which included three domains: a) Awareness on Tamil speech sounds, b) Skill to identify the mouth shape for Tamil speech sounds, and c) Skill to form compound letters. Data was gathered and collected through administering the questionnaire and analysed qualitatively and quantitatively. The findings of the study suggested that the individuals were poor achievers in identifying the speech sounds vital for linguistic performance and effective communication. The study recommends exposure to Tamil speech sounds, their formations, and following Mouth shape, which will help to learn the cued speech effectively to enhance the verbal communication skills of individuals with hearing impairment.

Keywords: Language; Communication; Speech; Hearing Impairment; Cued Speech

Introduction

Language makes a person to do purposeful activities in communication. The development of personality depends on the language proficiency of an individual. An individual's personality benefits his existence and gives rise to society, in turn, reshapes and remodels the language according to its needs and desires. Both language and society are interconnected to each other. The individual speaks and expresses his emotions, feelings, desires, and concepts that he has formulated while living in the community. When every individual express, social action and interaction takes place; that is why we say that language is a social phenomenon. People use various languages worldwide that have a complex phenomenon, and one has to devote many years to learning a language.

Language plays a vital role in the academic achievement of a student. Language learning begins at home, following the mother tongue. Children can practice listening and speaking skills while responding to elders

and develop the skill of language. However, individuals with hearing impairment (IwHI) feel difficulties in learning a language. Hearing impairment causes limitations in hearing, resulting in delayed language development. Moreover, hearing loss varies from individual to individual, so each of them needs a different type of assistance based on an existing sense of hearing.

Theoretical Framework

In their study, Liu et al. presented a Hybrid Temporal Segmentation Detection Algorithm (HTSDA) for hand movement in Cued Speech (CS). They found out that HTSDA significantly improves the recognition performance compared with the baseline (i.e., audio-based segmentation) [1]. Language development is vital for an individual in developing literacy skills, and interpreting services for deaf and hard-of-hearing students, regardless of the communication option used,

are often inadequate and could seriously hinder access to the classroom environment [2]. Previous researches revealed that most schooled deaf people did not reach the minimum or functional level for written communication during the last five decades [3].

Liu et al. proposed a novel re-synchronization procedure for multi-modal fusion that aligns the hand and lip features [4]. The re-synchronization approach was incorporated into a practical continuous CS recognition system that combines a Convolutional Neural Network (CNN) with a Multi-Stream Hidden Markov Model (MSHMM). A significant improvement was observed; 4.6% has been achieved, retaining 76.6% CS phoneme recognition correctness compared with the state-of-the-art architecture (72.04%), which did not take into account the asynchrony issue of multi-modal fusion in CS.

Difficulties Faced in Discriminating Tamil Speech Sounds

Among all the languages of the world, 'Tamil' is one of the few privileged languages to have stood strong and tall for a very long period. In the Tamil language, *vallinam* (hard consonants) have more than one speech sound. For example, the hard consonant 'k' has [k], [g], [x], [ɣ], [ɦ] speech sounds. It is difficult for IwHI to understand the different sounds used for the same consonant letter, which leads to spelling and speech errors. Also, it is difficult to discriminate the speech sounds, since the articulation of certain speech sounds are similar. For example, the bilabial consonants [m], [p], [b]; the dental consonants [n], [ɲ], [ɳ], [ɽ]; the alveolar consonants [l], [t], [d]; the retroflex consonants [ɻ], [ʈ], [ɡ] look similar.

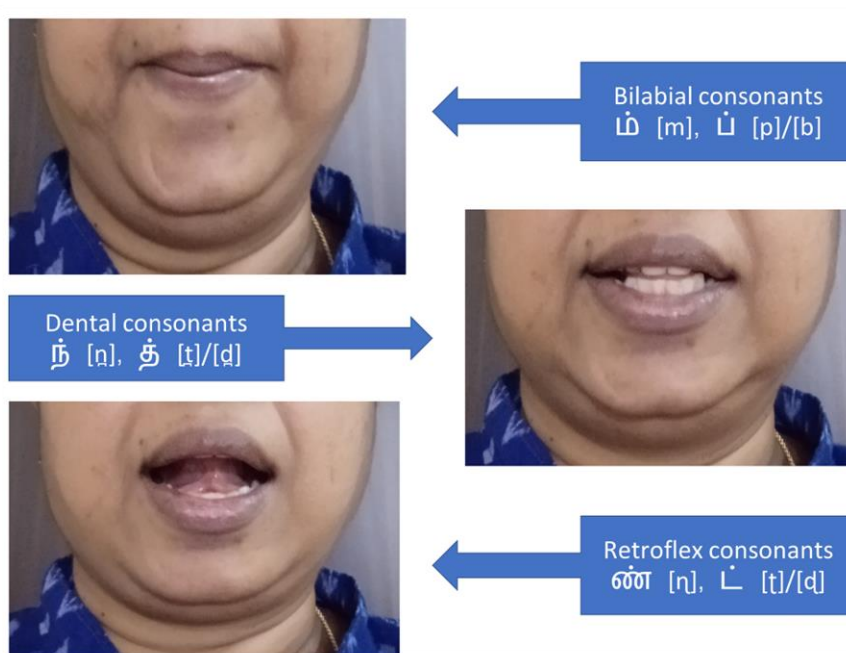


Figure 1: Consonant sounds in Tamil language with similar mouth shape.

In Tamil consonants, there are 3 'n', 3 'l' and 2 'r'. People tend to misarticulate one sound with the other. Certain consonant sounds like [ɲ], [k], [g], [x], [ɣ], [ɦ] are invisible on mouth. Hence IwHI may not get clear discrimination between the sounds. There are 216 compound letters in the Tamil language. They are the combinations of 18 consonants and 12 vowels.

Understanding these combinations is challenging for IwHI.

In Tamil language, 6 Grantha consonants are also used. In these, certain speech sounds are similar to sounds of certain consonants used in Tamil. Similarly, there is a hermaphrodite letter which sounds similar to a consonant sound.

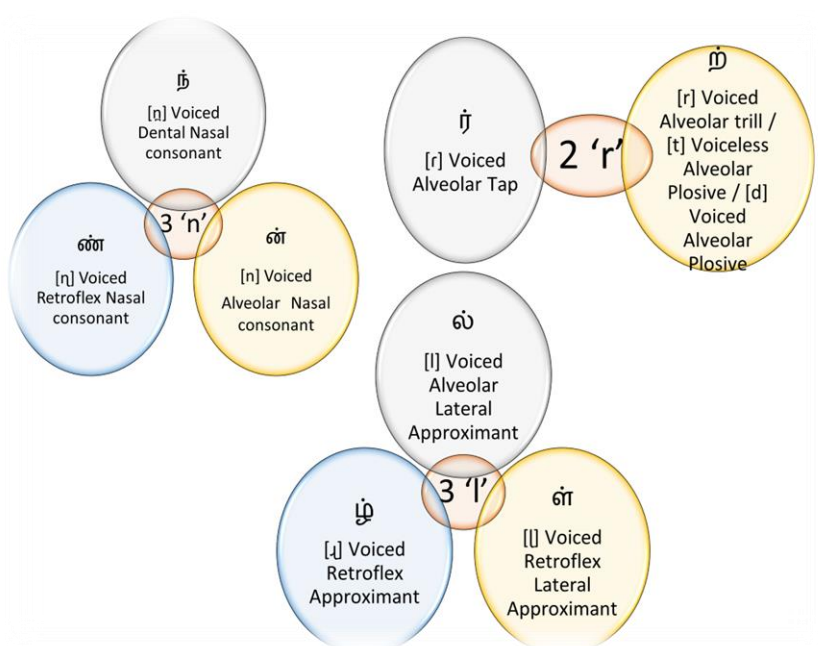


Figure 2: Three 'n' Three 'l' and Two 'r' in Tamil language.

Grantha Consonant	IPA Symbol	Tamil Consonant
ஹ்	[h]	க்
ஸ்	[s]	ச்
ய்	[c]	ச்
ஜ்	[dʒ]	ஞ்
Hermaphrodite Letter	IPA Symbol	Tamil Consonant
ஃ	[x]	க்

Figure 3: Similar sounds for different letters/consonants used in Tamil language.

All these factors cause challenges for IwHI in perceiving the speech sounds, that in turn affect their receptive and expressive language, reading, and writing.

Cued Speech and the Prerequisites

Cued speech is a visual illustration of spoken language that helps to access the spoken language by IwHI. Spoken language is a composition of phonemic building blocks. Cued Speech is a system developed by Dr.

Cornett in 1966, to address an issue where the average reading level of persons with hearing impairment is at the third-grade level since they do not have access to phonological awareness. It comprises eight handshapes representing consonant sounds and four positions around the mouth representing vowel sounds [5].

If we put the hand shapes and hand positions together, they represent compound letters, and it is specifically useful for IwHI. Cued speech is an excellent medium of

instruction for individuals with hearing impairment to understand what is being said to them without hearing.

Three types of prerequisite skills can be considered in general for learning Cued Speech (CS). The prime requirement is the awareness of the speech sounds of the language used. In Tamil language, there are 38 characters: (i) Vowels – 12 characters; (ii) Consonants – 18 characters; (iii) Hermaphrodite (Aidham) – 1 character; (iv) Grantha (Sanskrit) – 6 characters + 1 special character, which are used in the functional language. However, there are 52 speech sounds involved while pronouncing these characters.

One should be aware of all speech sounds. CS represents these sounds with different handshapes, positions and movements. CS is a supplementary to Oralism, which emphasizes speech development.

The second prerequisite is the awareness of different mouth shapes while producing speech sounds. Along with handshape and position, one has to observe the mouth shape to understand what the sound is and which character it belongs to. The third prerequisite is that an individual learning CS should be familiar with the compound letters in the Tamil language. They are formed by combining consonants with vowels.

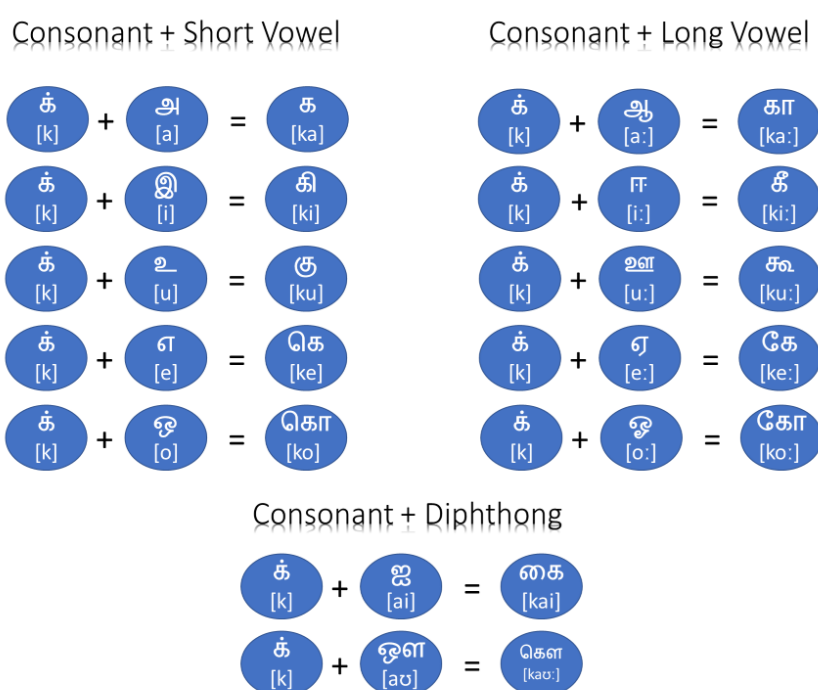


Figure 4: Example of formation of compound letters in Tamil language.

The CS for a compound letter is done by placing the consonant's handshape in the vowel position. Unless one can break down compound letters into consonants and vowels, s/he will not understand how to do CS for them. It is better to assess whether the individuals have all these three prerequisites before learning CS. If insufficient, giving awareness on these aspects can be planned prior to training CS. Hence, this study assesses the prerequisite skills required for learning Cued Speech among Individuals with Hearing Impairment.

Materials and Methods

Forty-five participants aged between 5 to 20 years were selected for the study by following purposive sampling technique. The participants were individuals with

hearing impairment and having Sensori-Neural Hearing Loss or Mixed Hearing Loss. They were grouped age-wise as: i) 5-10 years, ii) 11-15 years, and iii) 16-20 years. Qualitative analysis was done to measure the awareness, and quantitative analysis using t-test was performed to assess the level of prerequisite skills for learning Cued Speech among Individuals with Hearing Impairment.

A tool was developed and standardized to assess the prerequisite skills required to learn CS comprising of three domains, namely a) Awareness on Tamil speech sounds, b) Skills to identify the mouth shape for Speech Sounds and c) Skills to form compound letters.

(i) Awareness on Tamil Speech Sounds

A list of words covering Tamil speech sounds was carefully analysed and selected. Depending upon the receptive and expressive skills of the IwHI, they were asked to pronounce those words and/or listen to words pronounced. This part was assessed by following oral and aural methods. The participants were asked to pronounce the words for oral assessment, and their responses were recorded. Each speech sound was assessed separately from the words pronounced. For aural assessment, the investigators pronounced the words with three different options for each word: one correct option and two incorrect options. The participants attempted to identify the correctly pronounced option.

(ii) Skill to Identify the Mouth Shape for Speech Sounds.

The second part of the tool was prepared to elicit information regarding whether the IwHI could identify the Tamil speech sounds by observing the mouth shape. The mouth shape includes whether the lips are together

or protruded or squared or rounded or flat, whether the tip of the tongue is between teeth or touched behind the lower teeth or behind upper teeth, and whether the place and manner of articulation are invisible in the mouth. Ten pictures showing different mouth shapes and three speech sounds for each picture were given as options to identify the correct one.

(iii) Skill to Form Compound Letters.

The third part of the tool was prepared to elicit information regarding the current level of skill in forming compound letters. A compound letter consists of a consonant and a vowel. The IwHI needs to be aware of this combination of sounds. A total of 10 items were used, consisting of three options (one correctly and the other two incorrectly) and asked to identify the correct one.

Result

Background details

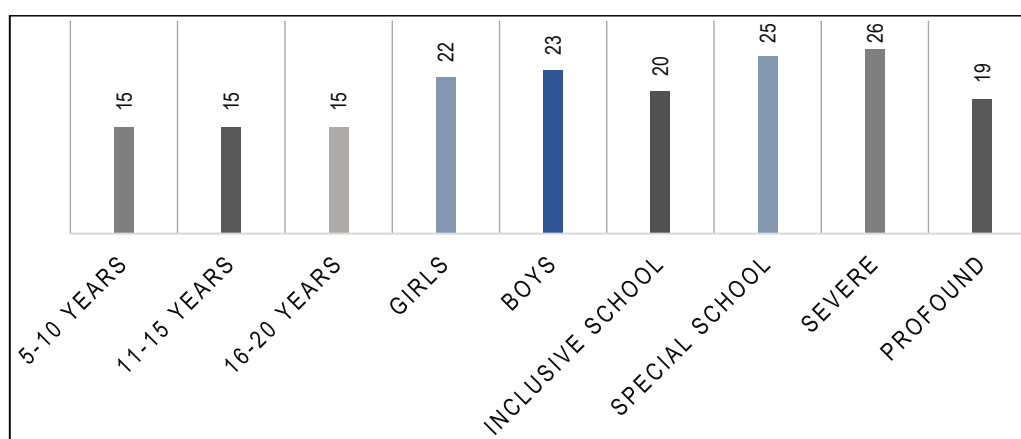


Figure 5. Background details of the selected participants

A total of 45 (22 Girls and 23 Boys) individuals with hearing impairment were participated in the study. Among them 15 participants were in each age group, i.e., 5-10 years, 11-15 years, and 16-20 years. Twenty

participants were enrolled in Inclusive Schools and 25 were in special schools. Twenty-six individuals had severe and 19 had profound hearing loss.

Table 1. Achievement Test Scores of the participants on awareness on Tamil speech sounds with respect to age group.

Age Group	Number	Performance					
		Below 40%		41-60%		61 and above	
		N	P	N	P	N	P
5 – 10 years	15	8	53	7	47	0	0
11 – 15 years	15	4	27	6	40	5	33
16 – 20 years	15	5	33	6	40	4	27

*N =Number, P= Percentage

Table 1. revealed the awareness of IwHI on the speech sounds in Tamil language. Fifty-three percentage of the individuals aged 5-10 years scored below 40%, and 47% of them scored 41-60% while 40% of them from

11-15 years and 16-20 years were scored the same. Thus, it may be said that the majority of the participants were less aware of all the speech sounds in the Tamil language and need exposure.

Table 2. Achievement Test Scores of the participants on skill to identify the mouth shape for speech sounds with respect to age group.

Age Group	Number	Performance							
		Below 20%		21-40%		41-60%		61 and above	
		N	P	N	P	N	P	N	P
5 – 10 years	15	12	80	3	20	0	0	0	0
11 – 15 years	15	8	53	7	47	0	0	0	0
16 – 20 years	15	11	73	4	27	0	0	0	0

*N =Number, P= Percentage

Table 2. depicts the scores of skills to identify the letters by observing the Mouthshape of others while communicating. Eighty percent of the individuals from the age group of 5-10 years, 53% from 11-15 years, and 73 % from 16-20 years were scored below 20%. Only

47% of them from the age group 11-15 years scored 21-40%. Thus, it may be said that, it is difficult for IwHI to identify the Tamil speech sounds by observing the mouthshape. Hence, they need exposure to the Tamil speech sounds that have similar mouthshape.

Table 3. Achievement Test Scores of the participants on skill to form compound letters with respect to age group.

Age Group	Number	Performance					
		Below 40%		41-60%		61 and above	
		N	P	N	P	N	P
5 – 10 years	15	15	100	0	0	0	0
11 – 15 years	15	7	47	3	20	5	33
16 – 20 years	15	8	53	2	14	5	33

*N =Number, P= Percentage

The knowledge and awareness about the sounds and letters need to be combined to form compound letter in Tamil language among IwHI are presented in Table 3. It was found that, the majority of the students scored below 40% belonged to the age group 5-10 years. Forty

seven percent of the individuals from 11-15 years and 53% of the individuals from 16-20 years scored below 40%. Hence, it may be said that, the IwHI belonging to the lower age group were not familiar with the formation of compound letters and need assistance.

Table 4. Prerequisite skills in awareness on Tamil speech sounds.

Variables	Levels	N	Mean	SD	t-value
Gender	Girls	22	14.50	5.10	0.06ns
	Boys	23	11.78	7.90	
Type of School	Inclusive School	20	14.85	5.89	0.25ns
	Special School	25	11.72	7.18	
Degree of Hearing Loss	Severe	26	12.50	6.34	0.28ns
	Profound	19	13.95	7.37	

*ns=Not Significant

Awareness on speech sounds is essential for individuals with hearing impairment for effective communication. An independent t-test was performed to determine the

awareness on speech sounds. The t-value with respect to gender (t=0.06), type of school (t=0.25) and degree of hearing loss (t=0.28) of individual with hearing impairment was not significant. It means there is no

significant difference in awareness on Tamil speech sounds with respect to gender, type of school, and degree of hearing loss among the participants

Table 5. Prerequisite Skills to Identify Mouth Shapes for Speech Sounds

Variables	Levels	N	Mean	SD	t-value
Gender	Girls	22	5.86	2.82	0.94ns
	Boys	23	6.04	2.87	
Type of School	Inclusive School	20	6.65	2.48	0.23ns
	Special School	25	5.40	2.99	
Degree of Hearing Loss	Severe	26	5.65	2.73	0.34ns
	Profound	19	6.36	2.95	

*ns=Not Significant

Different mouth shapes are used to pronounce a letter. It helps to identify the letter of a speech sound. Thus, participants were allowed to identify the mouth shapes for certain letters. The t-value depicted that it was not significant with respect to gender (t=0.94), type of

school (t=0.23), and degree of hearing loss (t=0.34) among individuals with hearing impairment. No significant difference was observed with respect to gender, type of school, and degree of hearing loss of individuals with hearing impairment.

Table 6. Prerequisite Skills to Form Compound Letters

Variables	Levels	N	Mean	SD	t-value
Gender	Girls	22	2.86	3.36	0.24ns
	Boys	23	3.61	3.93	
Type of School	Inclusive School	20	3.90	4.02	0.07ns
	Special School	25	2.72	3.29	
Degree of Hearing Loss	Severe	26	2.65	3.16	0.03ns
	Profound	19	4.05	4.16	

*ns=Not Significant

Individuals with hearing impairment feel difficulties to form compound letters that are used in words. Participants were allowed to form compound letters, i.e., necessary to identify speech sounds. The t-value for gender (t=0.24), type of school (t=0.07), and degree of hearing loss (t=0.03) showed no significant difference. It indicated that gender, type of school, and degree of hearing loss have no significant impact on prerequisite skills to form compound letters.

Findings

- Majority of the individuals faced difficulties in Identifying and Pronouncing Tamil Speech Sounds.
- Eighty percent of the individuals belonged to the age group of 5-10 years scored below 20% in identifying the mouth shape for communication.
- Individuals with hearing impairment faced difficulties in identifying Tamil speech sounds, mouth shapes, and form compound letters.
- No significant differences were observed with respect to gender, type of school, and degree of

hearing loss of individuals with hearing impairment.

Discussion

Individuals with hearing impairment often experience delayed language development due to limitations in hearing. The majority of the participants scored below 40% for awareness on Tamil speech sounds, skills to identify mouth shapes, and skills to form compound letters. It indicated that the participants need training in enhancing the linguistic and communication skills. It was also found that the gender, type of school, and degree of hearing loss have no significant impact on the performance of IwHI.

Recommendation

The authors recommend providing systematic training through Cued Speech by means of verbal speech sounds for individuals with hearing impairment to enhance their linguistic and communication skills. An individual's proficiency and skills can be measured

before providing instructions and teachers can begin a program with an accurate picture of the student's strength while teaching linguistic skills [6].

Conclusion

Communication skills are an integrated part of our life, and language plays a pivotal role in effective communication. Children can acquire language around 1 year of age by following elders at home and in the community. Nevertheless, children with hearing impairment face barriers to following others' vocal sounds and lack the opportunity for language development. Prerequisite skills are essential to determine the existing skills and assist the individuals in enhancing the skills to identify, follow and respond meaningfully for effective communication.

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Conflict of Interest

The author declares no conflict of interest.

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