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Syllable Deletion, Syllable Addition, Syllable Substitution and Syllable Restoration Tasks in Odia-speaking Typically Developing Children, Children with Learning Disability and Children with Phonological Misarticulation

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Abstract

Speech is the audible manifestation and spoken medium of language. The study of speech sound systems in a language is called Phonology and falls under the category form of the three sub-fields of Linguistics. Phonological skills development is one of the basic foundations before language mastery of a child. Language-specific phonological and morpho-phonemic rules make it essential to test various aspects designed to assess different phonological abilities in that specific language.

Odia, an alphasyllabic language of the Indic group of the Indo-European family, has unique features of few phonemes, morphophonemic and morphosyntactic rules, dissimilar to its sister languages. This study includes an analysis of data obtained for many tasks like phoneme deletion, addition, substitution, and restoration tasks as a part of Ph.D. research to construct a screening test in Odia language. After construction of stimuli by pilot studies, the main stimuli (words, non-words, word pairs, sentences etc.) were presented to a total of 480 typically developing children (12 subgroups) in the age range of 3-12 years and 20 children with Learning Disability, 20 children with Phonological misarticulation and 40 Adults. The results were analyzed gender-wise, age and group-wise for each task. Comparison of skills developing for typically developing children to that of children with Learning Disability and phonological misarticulation gives an insight into possible processing of information at various stages and abnormalities in those stages.

Keywords: Odia language, Developmental changes, Syllable deletion, Addition of syllable, Substitution of a syllable, Phoneme restoration, Learning Disability, Phonological misarticulation

Introduction

The scientific study of human language, linguistics, is broadly broken into three categories or subfields of structurally motivated domains: form, content, and use. Phonology, the study of speech sound system, falls under the first sub-filed- form. Psycholinguistics, the study of the underlying cognitive processes, deals with the psychological and neurobiological factors, enabling individuals to acquire, use, comprehend and produce language as a reflection of inherent mental processes.

The development of various psycholinguistic abilities correlates with mental abilities sophisticated for language functions; therefore, any abnormality in the pattern can explain underlying problems and help intervention. The skills start potentially with observable, measurable behaviors like the deletion of syllables to form words, the addition of syllable or substitution of a syllable to make a meaningful word or even restoration of a syllable when missed or replaced by noise.

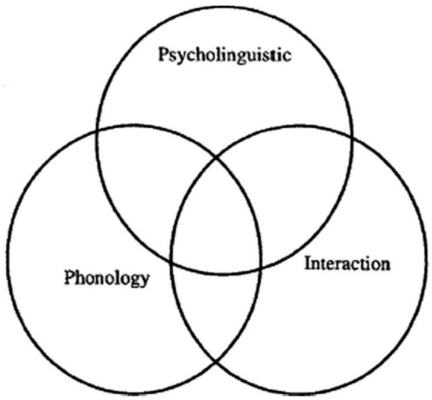

Figure-1. A. An integrated three-way approach to intervention for children with speech difficulties (from Pascoe, Stackhouse, & Wells, 2006).

Following or understanding a psycholinguistic perspective is knowing that children's acquisition of speech and literacy skills is the product of an intact speech processing-production-feedback system. This loop comprises speech input processing like auditory discrimination; lexical representations like storage for semantic, phonological, motor, grammar and orthographic; speech output processing like programming and production, and feedback and correction system like monitoring own speech.

Different psycholinguistic approaches to the management of a child with speech difficulties aim at-

- Within a psycholinguistic model, where speech errors arise.
- Analyzing the possible root cause like medical conditions like hearing loss, neurological condition or structural abnormality.
- Examine the effect of such conditions on different aspects of development other than speech perception and production, like reading and spelling.
- Make a profile for baseline, strengths, and weaknesses to plan for intervention.
- Select intervention targets based on linguistic analysis of speech output.
- Use the model at each step to monitor progress, utilize strength, and evaluate intervention efficacy.

Odia Language

Odia is widely spoken in the state of Odisha and some regions of West Bengal, Andhra Pradesh, and Chhattisgarh. At the same time, Odia is bounded and influenced by those neighboring languages. There are different regional dialects of Odia like the dialect of Ganjam and Koraput in the south, the dialect of Sambalpur in the west, the dialect of Balasore in the north, dialect of the districts, Cuttack and Puri. Regardless of the regional, social, and tribal dialects, there is an inter-group communication method using standard Odia, which is the closest form of written Odia, using more or less derived words.

Odisha has a slightly lower percentage (18.79) compared to national bilingualism (19.44%); however, it has a slightly higher trilingual percentage of 9.22.

The Phonology of Odia

The Odia phonemes occurring in all varieties, regional and social, amount to thirty-eight segmental phonemes, including six vowels and thirty-two consonants, two suprasegmental phonemes and two juncture phonemes. The vowel length is not phonemic, though it has orthographic symbols of two long vowels used in written form.

Tab 1. A. Vowels of Odia Language

	Unrounded (Front)	Neutral (Central)	Rounded (Back)
Close (High)	ଈ /i/		ଊ /u/
Half Close (High-Mid)	ଏ /e/		ଓ /o/
Half Open (Low-Mid)			ଅ /ɔ/
Open (Low)		ଆ /ɑ/	

Tab 1. B. Consonants of Odia Language.

	Bilabial	Dental	Alveolar	Retroflex	Palatal	Velar	Glottal
Stops Unaspirated Voiceless Voiced Aspirated Voiceless Voiced	 ପ /p/ ବ /b/ ଫ /pʰ/ ଭ /bʰ/	 ତ /t̪/ ଦ /d̪/ ଥ /t̪ʰ/ ଧ /d̪ʰ/		 ଟ /ʈ/ ଡ /ɖ/ ଠ /ʈʰ/ ଢ /ɖʰ/		 କ /k/ ଗ /g/ ଖ /kʰ/ ଘ /gʰ/	
Affricates Unaspirated Voiceless Voiced Aspirated Voiceless Voiced					 ଚ /t͡ʃ/ ଜ /d͡ʒ/ ଛ /t͡ʃʰ/ ଝ /d͡ʒʰ/		
Nasals	ମ /m/	ନ /n̪/		ଣ /ɳ/	ଞ /ɲ/	ଙ /ŋ/	
Laterals			ଲ /l/	ଳ /ɭ/			
Tapped			ର /ɾ/				
Flapped Unaspirated Aspirated				 ଡ଼ /ɽ/ ଢ଼ /ɽʰ/			
Fricatives		ସ /s/					ହ /ɦ/
Semivowels	ୱ /(w)/				ୟ /(y)/		

Specific features of Odia Language:

- A gap in the vowel system makes it unique from any other language in the world.
- Special consonantal allophones
- 2nd person familiar singular imperative person number suffix /phai/.

- The penultimate stress pattern of language.
- Nasalization is the only suprasegmental phoneme found in Oriya.
  Eg. ବଇଁଶୀ /bɔĩʂi/ - flute ପେଁକାଳୀ /pẽkɑɭi/- small trumpet
  ପୁଇଁବା /puĩbɑ/ - to get warm from fire ମୁଆଁ /muã/- fried rice cake
  ଆଁ /ã/- opening mouth

  Non-phonemic vowel length, although there are a number of instances where the vowels are phonetically long and may also contrast with their short counterparts. (ପିଲା /pilɑ/- child, ପିଇଲା /pi:lɑ/- he drank as in morpheme boundaries), imperative words ending takes a longer vowel form (ଧୁଅ /d̪ʰo:/-wash).
- Geminate vowel construction in word pairs due to the vowel ending system in languages like Oriya. (ଗୋଟେ-ଏକା /goʈe:kɑ/- Only one).
- There are two graphemes for long forms of vowels /i/ & /u/- ଇ, ଈ and ଉ, ଊ; with only one phonemic form with shortness while speaking.
- Syllable structure: Except for the loan words, Odia words are vowel ending, including most of the syllables to be open. Even closed syllables have a vowel peak. Monosyllabic words can be in the form of V (ଆ -/ɑ/- come), CV (ଯା-/d͡ʒɑ/- go), CCCV (ସ୍ତ୍ରୀ-/sʈ̺ri/ - wife), and ending with consonants in some dialectical variations VC (ଆସ- /ɑs/- come), CVC (ବସ /-/bɔs/ - sit). Bi-syllabic words can be in the form of CVCV, CVCCV, CCVCV, CCVCCV.
- Consonant clusters with two, three, and four consonants are found in Odia, including geminations.
- The flapped retroflex ଡ଼ [ɽ], on the other hand, is treated as an allophone of ଡ /ɖ/ and is a very frequent phone in the language. ଡ଼ [ɽ] occurs intervocally, whereas ଡ /ɖ/ occurs elsewhere. It also has an aspirated form ଢ଼ [ɽʰ] to be used intervocally for the aspirated ଢ /ɖʰ/.
- There are two Diphthongs ଐ /ai/ and ଔ /au/ available in Odia.

Besides these above specific features, there are many Morpho-phonemic rules, unique to this language, play a major role, like phonologically conditioned alternations- ଏ~ଇ - /e/~/i/, before ଅ (/ɔ/), /e/ is replaced by /i/, example- ଦେ (/d̪e/)+ ଅ (/ɔ/)→ ଦିଅ (/d̪iɔ/) – (you), meaning ‘give’.

Need for the Study

There are very limited studies in Odia or languages with similar features on the development pattern of acquisition of linguistic skills, specifically phonology skills in Odia language.

The baseline age-wise performance is essential to note or mark any disordered form or abnormality processing for intervention strategies.

Hypotheses

- There is no difference in performing the tasks for phoneme selection (blending to form words), addition, substitution and restoration tasks in different age groups of children, which can show a developmental trend.
- There is no difference in performance between the typically developing children and children with Learning Disability and children with Phonological misarticulation when age matched.

Review of Literature

Phonological awareness is defined as the sensitivity to the sounds of spoken language and the ability to work with those sounds (Goswami, 2000). Though there are differences like grapheme-phoneme relationships and orthographic representations across language, phonological awareness serves to be an essential skill in - the acquisition of language (Ziegler et al., 2010) and word decoding along with correspondence between grapheme and phoneme (Lambrecht Smith, Scott, Roberts, & Locke, 2008).

Phonological awareness skills mean a person can detect similarities between two words, manipulate words through blending and segmentation, and detect the parts of words like phonemes and syllables (Alcock, Ngorosho, Deus, & Jukes, 2010).

Phonological awareness is a multilevel skill of breaking down words into smaller units. The difficulty of various Phonological awareness tasks varies with linguistic level (Trieman & Zukowski, 1991).

Anthony and Francis (2005) suggested that Phonological development is universal across languages.

In many western studies, it is reported that Phonological awareness plays an important role in the early stages of reading in alphabetic languages such as English (Ehri, Nunes, Willows, Schuster Yaghoub Zadeh & Shanahan, 2001). However, in case of non-alphabetic languages, the role of phonological awareness towards reading acquisition has been questioned (Nag, 2007).

There are both contradictory studies in Indian languages like Akila (2000), Dinesh (2002), and also there are many studies that support the involvement of phonological awareness in learning to read the alphasyllabic scripts like Iyyer (2000), Kumar et al. (2010), and Nag, Caravolas and Snowling (2011).

Phonemic awareness is a subset of the broader concept - Phonological awareness (Snow, Burns & Griffin, 1998). Hampenstall (2003) stated that prior to phonemic awareness, there are 11 stages of phonological development-

a. Recognition that sentences are made up of words.
b. Recognition that words can rhyme-then production thereof.
c. Recognition that words can be broken down into syllables - then production thereof.
d. Recognition that words can be broken down into onsets and rimes - then production thereof.
e. Recognition that words can begin with the same sound – then production of such words.
f. Recognition that words can end with the same sound - then production of such words
g. Recognition that words can have the same medial(s) – then production of such words.
h. Recognition that words can be broken down into individual phonemes – then production thereof. i. Recognition that sounds can be deleted from words to make new words – the production thereof. j. Ability to blend sounds to make words.
k. Ability to segment words into constituent sounds.

Authors like Griffith and Olsen (1992) suggested that the last four levels (from h to k) belong to phonemic awareness.

Several authors suggested that phonemic awareness requires individuals to be able to manipulate sounds (phonemic analysis), blend sounds to form words (phonemic synthesis) and change, delete, add, and substitute individual phonemes. (Trehearne, 2003; Chard & Dickson,1999).

Perception of smaller units of a word also includes the task of filling the gaps or creating a missing portion or part. Kashino et al. (2006) stated that under certain conditions, missing sounds from a speech signal could be synthesized by the brain to be heard, which is known as phonemic restoration. Restoration of phonemes when replaced by noise is one major aspect of it; however, it also can occur when temporally distorted (Ishida, Arai & Kashino, 2018) or in the presence of allophonic variation (Meunier, 2022).

Methodology

The present study has a survey research design, where scores were collected from a defined population, the selected sample was systematically questioned, and results were analyzed and generalized. The selected sampling process was purposive because a series of factors like language exposure, educational exposure at school and home, parental socioeconomic status, and teaching methods were to be kept uniform for all the groups of children.

Participants: This study included four groups for all tasks-

Group A: A total of 480 typically developing, Odia-speaking children with no problem or deficits in hearing, psychological, visual or neurological functioning. This group is abbreviated or written as Children with typical development- CWTD.

Table 3. A. Subgroups of children of Group A with their age range and number.

Subgroup	Age	No. of subjects Male/	Subgroup	Age	No. of subjects Male/ Female
I	3 yrs to 3 yrs 6 months	20/20	VII	6 yrs to 7 yrs	20/20
II	3 yrs 6 months to 4 yrs	20/20	VIII	7 yrs to 8 yrs	20/20
III	4 yrs to 4 yrs 6 months	20/20	IX	8 yrs to 9 yrs	20/20
IV	4 yrs 6 months to 5 yrs	20/20	X	9 yrs to 10 yrs	20/20
V	5 yrs to 5 yrs 6 months	20/20	XI	10 yrs to 11 yrs	20/20
VI	5 yrs 6 months to 6 yrs	20/20	XII	11 yrs to 12 yrs	20/20

*Age differences of 6 months at a younger age were taken for a better and more precise analysis of developmental changes).

Group B: This group comprised 20 Odia-speaking children with Learning Disability aged 7 to 12 years. This group is abbreviated or written as Children with Learning Disability- CWLD.

Group C: This group included 20 Odia-speaking children with Misarticulations in the age range of 7 to 12 years (classified into phonological errors/misarticulations with no anatomical abnormalities and no motor impairment of Oral Peripheral mechanism). This group is abbreviated or written as Children with Phonological Misarticulation- CWPM.

Group D: This group included 40 Odia-speaking adults aged 25-35 years with no history of hearing loss, neurological impairments, and cognitive deficits.

Inclusionary and exclusionary criteria: All participants use Odia as their primary language, Odia (only) for their daily communication needs; exposure to Odia is limited to learning as part of the curriculum.

Group B- Children with Learning Disability without any mental illness or mental retardation. The subtype of learning disability was not considered as a factor, as the different difficulties overlap in many cases.

Group C- Children with misarticulations without any mental illness or mental retardation and any structural abnormalities, neurological, neuromuscular abnormalities.

Screening: All children and adults were screened for the inclusion criteria of the research design.

Task Descriptions of tasks with examples of stimuli

A. ***Syllable deletion:*** It is the person's ability be able to delete a specific syllable from a given word. In this task, the participants had to listen carefully and delete the first syllable of the words in the first list and the last syllable of the words from the second list.

For example- for the Word ଦୋକାନ /d̪okɑn̪ɔ/- 'shop', when the first syllable is deleted, it becomes କାନ /kɑn̪ɔ/- 'Ear.'

B. ***Addition of syllable (to form a word):*** This task aims at checking the individual's ability to add a syllable to make a word; in this task, participants were needed to add one syllable to a two-syllable utterance to make a meaningful word.

For example- For the non-meaningful utterance ବୁଜ /bud͡ʒɔ/, if someone adds the syllable ସ /s̪ɔ/ and produces it, it becomes ସବୁଜ /s̪ɔbud͡ʒɔ/- 'Green'.

C. ***Substitution of syllable (to form a word):*** This task aims at checking the individual's ability to substitute a syllable of a true word to make a new word.

For example- For the word ଆଧାର /ɑd̪ʰɑrɔ/- base, substitute ଚ /t͡ʃɑ/ for ଧା /d̪ʰɑ/, and make the new word- ଆଚାର /ɑt͡ʃɑrɔ/ - 'Pickle'.

D. ***Phoneme restoration:*** It is the ability of the participant to guess the full word when one syllable of the word is added with noise in the middle syllable (synthesized).

For example- For a word produced with noise ସ**ଦ୍ର /s̪ɔ**d̪rɔ/ for ସମୁଦ୍ର /s̪ɔmud̪rɔ/- 'Occean', ସ**ରି /s̪ɔ**ri/ for ସପୁରି /s̪ɔpuri/- 'Pinapple'.

Presentation of the Stimuli: The stimuli were constructed (based on the frequency of use, the structure of the words, the position of a syllable, arrangement of a syllable, rhyming), checked for familiarity and subjected to repeated pilot studies.

The stimuli had many words that could not be represented by pictures. For example, ଯିବା /d͡ʒibɑ/- (will go) can not be shown with a simple action of going as the base go verb takes a lot of forms in Odia language and easily will elicit the response as 'he is going' instead of 'will go'. Further, many stimuli were non-words, segments of words, sentences etc.

Also, the basis of this study was to see the breakdown in the system from auditory processing to conceptualization to production. Therefore, excluding visual memory or visual perception was necessary by avoiding pictures for words. The pictures also might elicit synonyms or related words. Lastly, tasks like phoneme restoration would become an easy task with a given picture,

Written forms of the stimuli in Odia script were also avoided as few children from younger age groups might not have attained literacy skills, especially for clusters or longer words.

Considering all the above factors, based on previous similar research, the presentation of the stimuli was done in either recorded speech or live speech for the participants to listen and respond, based on each task.

Results

The means of the scores for each task were put through the Shapiro Wilk Normality test to see if the data falls under normal distribution, which showed that the significance value was less than 0.05 for all mean values, indicating that the data did not fall under normal distribution, with skewness ranging from -2.765 to 1.8 for different comparisons.

Therefore, different non-parametric tests were performed as described below for detailed statistical analysis, besides descriptive statistics.

Common Observation from Analysis of all tasks revealed that there was no difference in scores for gender for any of the groups, subgroups, tasks, or other complexity of stimuli.

Syllable Deletion Task: The mean scores obtained from participants were analyzed to see age-wise and group-wise differences.

Table 4.A. Friedman Chi-Square Analysis of responses for Initial Syllable Deletion (ISD) and Final syllable deletion (FSD), for Group A (CWTD), for the task of syllable deletion.

Parameters	N	Minimum	Maximum	Mean	SD	Median	X^2 (11)	p-value
ISD	480	2	5	4.15	1.06	5.00	440.104	0.000**
FSD	480	2	5	4.32	0.91	5.00	416.300	0.000**

*** Indicates significant at P< 0.05 ** Indicates significant at P<0.01**

This table indicates a significant difference between scores obtained from the section of initial syllable deletion and final syllable deletion task, indicating children with typical development performed differently for initial syllable deletion and final syllable deletion.

Table 4.B. Mann Whitney Analysis of responses between groups for Initial Syllable Deletion, for Group A (CWTD), for the task of syllable deletion.

Groups	n	Mean	SD	Median	Mean Rank	|Z|	p
1 vs. 2	40	2.40	0.50	2.00	34.50	2.680	0.007**
	40	2.70	0.46	3.00	46.50		
2 vs. 3	40	2.70	0.46	3.00	33.70	3.251	0.001**
	40	3.10	0.55	3.00	47.30		
3 vs. 4	40	3.10	0.55	3.00	36.90	1.594	0.111
	40	3.30	0.65	3.00	44.10		
4 vs. 5	40	3.30	0.65	3.00	33.90	2.896	0.004**
	40	3.70	0.46	4.00	47.10		
5 vs. 6	40	3.70	0.46	4.00	26.10	6.184	0.000**
	40	4.60	0.50	5.00	54.90		
6 vs. 7	40	4.60	0.50	5.00	32.50	4.444	0.000**
	40	5.00	0.00	5.00	48.50		
7 vs. 8	40	5.00	0.00	5.00	40.50	0.000	1.000
	40	5.00	0.00	5.00	40.50		
8 vs. 9	40	5.00	0.00	5.00	40.50	0.000	1.000
	40	5.00	0.00	5.00	40.50		
9 vs.10	40	5.00	0.00	5.00	40.50	0.000	1.000
	40	5.00	0.00	5.00	40.50		
10 vs. 11	40	5.00	0.00	5.00	40.50	0.000	1.000
	40	5.00	0.00	5.00	40.50		
11 vs. 12	40	5.00	0.00	5.00	40.50	0.000	1.000
	40	5.00	0.00	5.00	40.50		
12 vs. D	40	5.00	0.00	5.00	40.50	0.000	1.000
	40	5.00	0.00	5.00	40.50		

*** Indicates significant at P< 0.05 ** Indicates significant at P<0.01**

*Subgroups 1-12 stand for Group A(CWTD)-Subgroups A-I till A-XII, D represents Group D-Adults

This can be observed that Group A (CWTD)-Subgroup A-III and A-IV scored similar for the initial syllable deletion. And subgroup A-VII onwards, there was no difference in scores

till the adult group, indicating the children achieved adult-like production from the A-VI subgroup onwards.

Table 4.C. Mann Whitney Analysis of responses between groups for Final syllable deletion, for all typically developing children, for the task of syllable deletion.

Groups	n	Mean	SD	Median	Mean Rank	|Z|	p
1 vs. 2	40	2.90	0.84	3.00	36.70	1.561	0.118
	40	3.20	0.88	3.50	44.30		
2 vs. 3	40	3.20	0.88	3.50	37.50	1.268	0.205
	40	3.50	0.51	3.50	43.50		
3 vs. 4	40	3.50	0.51	3.50	38.50	0.893	0.372
	40	3.60	0.50	4.00	42.50		
4 vs. 5	40	3.60	0.50	4.00	35.30	2.395	0.017*
	40	3.90	0.55	4.00	45.70		
5 vs. 6	40	3.90	0.55	4.00	27.30	5.645	0.000**
	40	4.70	0.46	5.00	53.70		
6 vs. 7	40	4.70	0.46	5.00	34.50	3.734	0.000**
	40	5.00	0.00	5.00	46.50		
7 vs. 8	40	5.00	0.00	5.00	40.50	0.000	1.000
	40	5.00	0.00	5.00	40.50		
8 vs. 9	40	5.00	0.00	5.00	40.50	0.000	1.000
	40	5.00	0.00	5.00	40.50		
9 vs.10	40	5.00	0.00	5.00	40.50	0.000	1.000
	40	5.00	0.00	5.00	40.50		
10 vs. 11	40	5.00	0.00	5.00	40.50	0.000	1.000
	40	5.00	0.00	5.00	40.50		
11 vs. 12	40	5.00	0.00	5.00	40.50	0.000	1.000
	40	5.00	0.00	5.00	40.50		
12 vs. D	40	5.00	0.00	5.00	40.50	0.000	1.000
	40	5.00	0.00	5.00	40.50		

*** Indicates significant at P< 0.05 ** Indicates significant at P<0.01**

*Subgroups 1-12 stand for Group A(CWTD)-Subgroups A-I till A-XII, D represents Group D-Adults

From the above table, it can be noticed that for final syllable deletion, the scores obtained from Group A(CWTD)-subgroup A-III and A-IV were not different, and from age group A-VII, till adult group, scores were similar to initial syllable deletion.

The following table was constructed from the statistical analysis to show at which age Group B (children with LD) and Group C (children with PM) matched with the typically developing children.

Table 4.D. Age Matched Group B (CWLD), Group C(CWPM) with Group A(CWTD) for the task of Syllable deletion.

		Group B					Group C			
	Age-matched groups	Mean	SD	Z	P	Age-matched groups	Mean	SD	Z	P
	A-III	3.1	0.55	1.006	0.315	A-VI	4.6	0.5	0.293	0.77
ISD		3.25	0.64				4.5	0.69		
	A-IV	3.3	0.65	0.315	0.753					
		3.25	0.64							
	A-I	2.9	0.84	1.167	0.243	A-VI	4.7	0.46	1.356	0.175
		3.15	0.67				4.45	0.69		
FSD										
	A-II	3.2	0.88	0.437	0.662					
		3.15	0.67							
	A-III	3.5	0.51	1.952	0.051					
		3.15	0.67							

From the above table, it can be observed that the Group B (children with LD) scored similar to lower age groups (A-I,A-II, A-III) and Group C (Children with PM) scored similar to higher age groups (A-VI) for Final Syllable deletion, whereas, Group B (children with LD) scored equivalent to age group A-III,IV for initial syllable deletion, indicating that it was easier for them to score for initial syllable deletion.

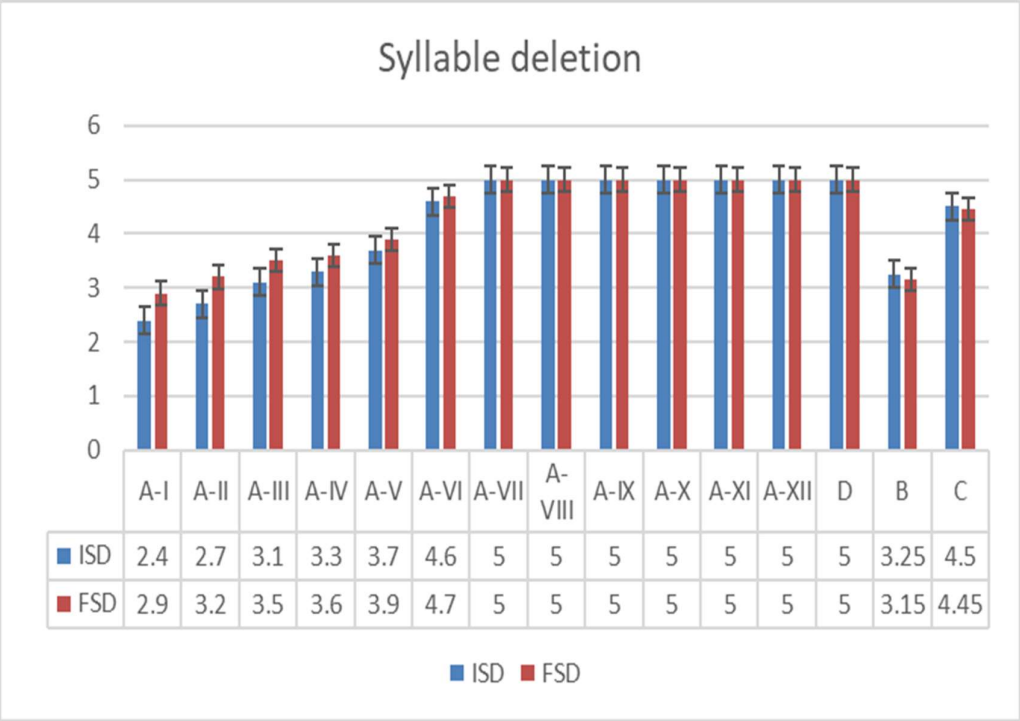

Fig. 4. A. Mean Scores of participants in each subgroup for Initial and Final Syllable Deletion for the task of syllable deletion.

From the above table, it can be observed that for children with typical development, Initial syllable deletion scored less than final syllable deletion until they achieved adult-like production. However, initial consonant deletion was easier in the case of children with LD and children with PM, though there was a difference in scores between the groups.

Similar analysis was conducted for all the tasks using mean scores and summarized in the following table to show the age-wise changes and similarities with the children with Learning Disability, Children with Phonological misarticulation and Adults.

In below table- The first Column represents the Groups and Subgroups.

Group B (CWLD)- Yellow color, wherever in Group A (CWTD), age-matched with Group B has been colored as Yellow.

Group C (CWPM)- Blue color, wherever in the Group A (CWTD), age-matched with Group B has been colored as Blue.

Group D (Adults)- Orange Color, wherever in Group A (CWTD), age-matched with Group D has been colored as Orange. This means Orange colored cells of a column show from that age; children achieved adult-like production.

Table 4.E. Developmental changes and Adult-like production on different tasks, only mean scores.

Groups & Subgroups	Syllable deletion		Add of Syl.	Sub of Syl.	Phoneme Restoration
	Ini. syl. Del.	Fi. Syl. Del.			
A-I	2.4	2.9	1.3	0	0.5
A-II	2.7	3.2	1.8	0.2	1.8
A-III	3.1	3.5	2.2	0.2	2.8
A-IV	3.3	3.6	2.6	0.6	3.5
A-V	3.7	3.9	3.5	2.3	3.6
A-VI	4.6	4.7	4.6	3.3	4.2
A-VII	5	5	5	3.4	4.4
A-VIII	5	5	5	4.2	6.1
A-IX	5	5	5	4.9	9
A-X	5	5	5	5	10
A-XI	5	5	5	5	10
A-XII	5	5	5	5	10
B	3.25	3.15	2.75	2.1	2.25
C	4.5	4.45	4.5	4.15	4.9
D	5	5	5	5	10

Discussion

The aim of the present study is to provide a baseline performance score for a few phonological awareness tasks and to find out if these tasks helped distinguish typical development from any abnormality like phonological misarticulation and learning disability. The mean scores of each subgroup of Group A were put into a graph to understand the pattern of development based on age in the following graph.

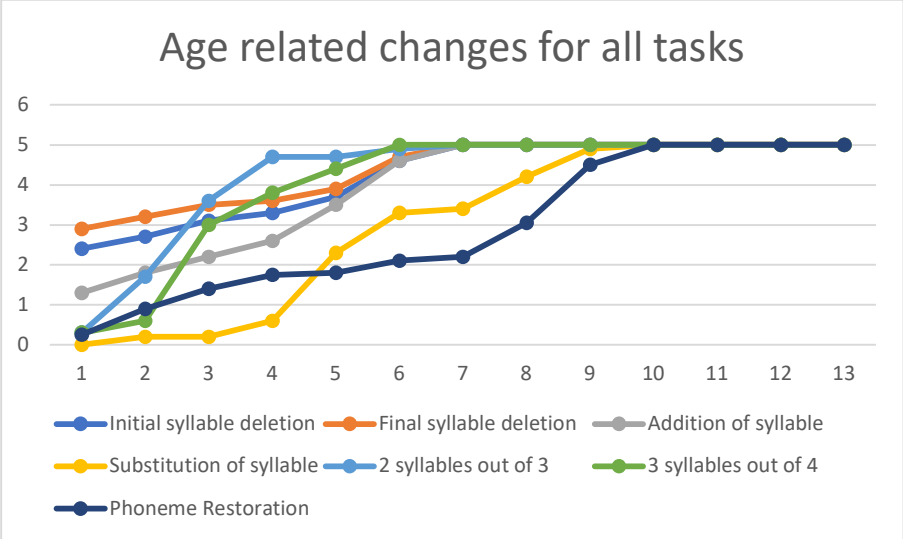

Fig.4. B. Mean Scores of participants in each subgroup for all the tasks showing developmental changes.

From both descriptive statistics and statistical methods to determine significant differences, it is evident that there is a pattern of development in typically developing children, where children not only develop different abilities differently but also reach the ceiling or adult-like productions differently.

When compared with age-matched typical development, both the group of children with phonological misarticulation and children with Learning Disability showed a lower score, and there was also a significant difference between the groups of Learning Disability and Phonological misarticulations, which also can serve as a basis for understanding the underlying malfunctioning of the processes in both conditions.

The performance of typically developing children (95% confidence interval) will be provided with the total screening test pack to compare with other tasks of phonological and morphological abilities.

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