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A Deductive Theorem Examination of Speech Perception and Production Theories in the Context of Impaired Speech

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ABSTRACT

The paper explores the relationship between hearing (perception) and production of the English speech sounds to account for the phonological problems faced by children with hearing loss. The methodology used is oral test. It was used to elicit responses from the subjects in which their speeches were recorded. The subjects comprise of SS1, 2 and 3 hard-of-hearing students of School for Special Education, Tudun Maliki, Kano. The phonographic recordings of the speeches were transcribed based on impressionistic transcription. Thus, the study reveals numerous phonological errors due to hearing loss. Hence, cases such as deletion and insertion of consonants and vowels, breaking of consonant clusters via vowel insertion, vowel substitutions etc. dominate the speeches of hearing-impaired students. Consequently, the findings show that expressive and communicative ability of these students are affected for production is affected.

INTRODUCTION

Speech is a product of the various articulations of the vocal apparatus. It is produced with pulmonic air drawn from the lungs which is modified by the so-called organs of speech to produce the desired sound. This field of study is known as phonetics (Cruttenden 2008, Roach 2000, Ekundare 1993 etc.). All things being equal, every normal human being who speaks can

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produce sounds correctly. However, there are some categories of people with some biological lesions which hinder correct production of speech sound. These are children with hearing impairment. According to Virgil and Newby (1973) the probability of a child producing any sound properly in his normal speech patterns is contingent upon his ability to hear that sound well, hearing loss therefore affects speech production. Correct production of speech sounds by human beings requires good functional ears. It is along this trend of thought that this paper argues and demonstrates that speech production is contingent upon hearing. So, hearing loss can affect speech production in particular and language in general which can further affect the child's performance in school. It is, therefore, the intention of this paper to find out the definite interaction between hearing (perception) and production of English Speech Sounds with a view to, through deductive theorem, showing how speech production is facilitated and/or constrained by the auditory pathway revealing how hearing loss impact on the production of English consonants and vowels.

Speech Sounds Production by Hard-of-hearing: Scholarly Views

Crystal, (1976) states that the first striking finding in the speech production of hard-of-hearing students is the large number of errors in the production of vowels. He states that (Bang,1942), for example, finds a few vocalic errors in his study, and that normal children acquire vowels early. Secondly, the devoicing of stops is not like the normal processes of assimilation. Normally, stops tend to be voiced before vowels. A third unusual process is the deletion of initial consonants. Normally children usually overcome this quite early. Creation of CV syllable is another feature of children with hearing impairment. Crystal (1976) points out that widespread characteristic of several of the processes are the creation of CV syllables. This happens when the two consonants come together, either in cluster or across a syllable boundary. There is also a tendency to insert a /ə/ vowel and creates a new syllable. This occurs with vowels where two syllables would be created from one (e.g. boy [bawi]). This can be explained as resulting from earlier noted tendency towards slow, drawn-out speech. This is generally described as inability to produce correct timing in the production of speech (cf. John and Howarth 1962).

Observing hard-of- hearing individuals may likely depict variation in data as opposed to what will be obtained in grouped data, Crystal (1976) therefore states that since these processes were observed in grouped data, it is probable that deaf children do not individually show all of them.

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In fact, linguistic analyses of young hard-of-hearing children have shown this. For example, West and Weber (1973) in Crystal (1976) analyzed the speech of a girl of 4:4 and found that she had more or less correct use of vowels.

Oller and Eiller (1974) carried out a research on individual young hard-of-hearing children who varied in terms of their age in the research. They found out that a 6-year-old hard-of hearing girl would avoid final voiced stops by adding a /∂/ to the word, Crystal (1976).

In another study of a three year hard-of-hearing children ranging from 5:3 to 6:3 age, Oller and Eillers have also confirmed more of Hudgings and Numbers findings. In their analysis one child, Randy would break up clusters by insertion of a (∂}, e.g block (b∂lok). Two of them Marjie and Melanie, showed a tendency to delete initial consonants. Oller and Eilers (1974) compare these deletions and found that the hard-of-hearing children were deleting them much more frequently. The same two children also showed the addition of syllables e.g baby (bebe?e). This is similar to Hudgins and Number's findings on the creation of two vowels from one. Moreover, Markides (1970) has also found cases on this. The same two girls also showed errors in nasalization. Sometimes nasals would replace stops and vice-versa. Hudgins had earlier noted the dimension of nasalization as a particular striking aspect of hard-of-hearing speech (Crystal, 1976).

Ibrahim (2008) also points that children with hearing loss often cannot hear quite speech sounds such a /s/, /ʃ/, /f/, /t/, /k/, and therefore do not include them in their speech. Thus, speech may be difficult to understand. Due to their poor perception, children with hearing loss often find it difficult to hear word endings. Ibrahim says that they often cannot hear word endings such as-s-or—ed. This leads to misunderstanding and misuse of verb tense, plurizations, non-agreement of subject and verb and possessive. Similarly¸ some scholars hold that hearing loss can cause delay in the development of receptive and expressive communication skills. For example, Batshaw, (2005) in Ibrahim (2008), holds the view that hearing loss causes delay in the development of receptive and expressive communication skills, (speech and language). Receptive here means the ability for the person to comprehend what is being said, while the expressive is the ability for the person to express himself through speech and language. The language deficit causes learning problems that result in reduced academic achievement. Furthermore, communication difficulty often leads to social isolation and poor self-concept.

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Another area of language that hearing loss tampered with among children with hearing loss, is the area of vocabulary development. Children with hearing loss are found to have serious problems compared with normal children. According to Ibrahim (2008), vocabulary develops more slowly in children who have hearing loss. He adds that children with hearing loss learn concrete words like *goat, sheep*, *five* and *blue*, more easily than abstract words like *before*, *after*, *equal* to, and *jealous*. They have problems with function words like *the, an*, and *a*. This problem is both in understanding and production.

Theoretical Framework

The theoretical framework adopted for this research is the best-known theory of speech perception and speech production postulated by Kess (1993). These theories are the motor theory of speech perception, the analysis by synthesis approach and the auditory-motor theory of speech production. The classical motor theory claims that auditory-motor theory of speech derived from the psycholinguistic approach to the study of speech production. The basic assumption for this theory is that speech errors may be revealing some levels of processing. According to Garman (1994:40) the form of the utterance may fail to represent the intended message-level e.g. rode {wout]. The abstract form of the utterance may not be appropriately represented in its expression e.g. black [pack] or the approach establishes the direct relationship between biological systems and the auditory and visual signals conveying language and the articulatory and manual generation of such signal, and impairment of hearing may lead to poor generation of the signal. The choice of this approach was informed by the need to account for phonological errors caused by physiological impairment as well as the need to account for the naturally occurring speech errors as opposed to errors informed by mother tongue interference.

Methodology

The method used in collecting data for this research is oral test. In this approach the researcher conducted an oral test where the subjects who were hard-of-hearing were given some words to pronounce and form some simple sentences. Forty students were selected based on the degree of their hearing impairment and therefore non probabilistic sampling technique was used. During the test, the speeches of these subjects were recorded by the researcher, which were later transcribed using International Phonetic Alphabets. And the researcher uses impressionistic transcription to account for the various phonological problems associated with the speech of

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these subjects. The subjects are non- native speakers of the English language hence they speak it as a second language.

Analysis of the Data

The data collected from the subjects demonstrate significant impacts of hearing /perception on the production of English speech sounds. They justify the claim that hard-of-hearing persons are stultified in the correct acquisition of consonants and vowels leading to poor production of English speech sounds. This is because the responses reveal numerous phonological errors. Though both consonants and vowels are affected by the impairment of hearing organs, it can be argued that each is affected in different ways. Consonants are sounds produced with obstruction or constriction of the flow of air or with its passage through a narrow opening. In this process, phonological errors such as mixed substitutions, consonantal insertion and deletion, breaking of consonant clusters etc. become pervasive.

One of the striking findings in the research is mixed substitutions of consonant sounds. Mixed substitution is a phonological error which results in changing of one phoneme with another in a particular environment. It is also a process where the hard-of-hearing persons alternate one phoneme with another hence producing different phonological word and morphological word when transcribed. In their speeches, for examples, four respondents substituted /s/ for /tʃ/ in "is" and "school" where they are realized as /tʃ/-/itʃ/ and (tʃukl) respectively. However, error such as this was not found in Crystal findings. Similarly, one out of the respondents substitutes /k/ for /g/ as in "come" (gom), /l/ for /r/ as in pencil (pensir). In the two examples, the initial /k/ for the word come and final /l/ for the word *pencil* are substituted with velar /g/ and alveolar /r/ sounds. The possibility of these substitutions could be related to their place of articulation. /k/ and /g/ are phonemes that have the same place of articulations that means they are velar sounds. Likewise, /l/ and /r/ are alveolar sounds, so it can be posited that the possibility of hard-of-hearing persons to substitute one sound for another depends on their place and manner of articulation.

However, the substitution of /s/ for /tʃ/ by some subjects is slightly different. In these cases, the place of articulation is not the same /s/ is alveolar while /tʃ/ is palato alveolar. But substitution is equally possible, for the phonemes substituted for the others /s/ for (tʃ), are neighbors in terms of place of articulation. In other words, while /s/ is produced with the tip of the tongue nearly touching the alveolar ridges (or it is a voiceless consonant that is weak in phonetic power,

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relatively invisible for person dependant on visual cues, characterized by the concentration of energy in the articulator placement for correct production Virgil and Newby 1973) /tʃ/ is produced with the front of the tongue pressed against the hard palate. As for the manner of articulation, the /s/ is produced with hissing and /tʃ/ with almost sudden release of air. So it can also be argued according this case that substitution is possible between neighboring sounds; this is referred to as regressive substitution.

On the other hand, breaking of clusters was observed in the speeches of hard- of- hearing. The hard-of-hearing persons simplify as well as break clusters via insertion of vowels between the clusters. For example in "block" the "CC" of the initial cluster was broken through the insertion of vowel /i/ and deletion of the final /k/ sound (bilo). In the word "English" vowel /i/ was inserted in the second syllable producing (cvc) and nasal sound /n/ was also inserted between /l/ and /s/. The short vowel /i/ was substituted with short /a/ sound. These cases are found in the speech of one hard-of- hearing. Elsewhere in (Crystal) findings, a similar case was found where "wh" of who was broken via insertion of /u/ sound to produce /wuhi). This indicates the possibility of such errors to both native and non-native hard-of-hearing speakers of English Besides, the hard-of-hearing persons are also found with problem of an inappropriate deletion of consonants. From the data, the final /n/ of the word "been" was deleted, final /l/ of "fool" and /k/ of chalk were all deleted. Initial /h/ of "how" and final /m/ in "name" etc were also deleted. One significant observation from the data is that deletion of consonant mostly occurs at the final position with rare case in initial and mid positions.

In addition, insertion of consonant sounds in a word has been a phonological errors found in the speech of hard-of-hearing person. This error happens due to impairment as well as orthographic influence of English words. For example most English Language learners realize the /b/ in "plumber" which is deleted by the native speakers. They are influenced by the presence of the sound in the mid position of the word. Similarly the hard-of-hearing persons are not only influenced by the presence of sounds due to be deleted but sounds that are not in the word are added. For example /tʃ/ is added in the initial position of the word "you" (tʃu). Most of the sounds inserted are normally at the final and mid position.

Nonetheless, the speeches by three subjects demonstrate another phonological error. This is the substitution of vowels with consonants. Though this is rare, it is worth acknowledging. The data

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reveal substitution of vowels occurring at the initial positions of the word with consonants as in the following:

/i/ ⟶ /t/ is (tʃt)

/a:/ ⟶ /h/ are (ha)

/a/ ⟶ /w/ am (wm)

This phonological problem seems to be unique among the hard-of-hearing for it is very difficult to find such cases among L2 learners as shown by Ubahakwe (1993) data on varieties and functions of English in Nigeria. From the data there were no cases of vowel substitutions with consonant as found in the above data. What appeared most in his data is the presence of errors within vowel or consonant categories but cases of overlap do not or hardly occur. On the other hand, the production of vowels has been associated with great deal of phonological errors. Errors such as mixed substitution, shortening of long vowels, creation of syllables via vowel insertions, diphthong reduction dominate the speeches of hearing impaired persons. In her speech, for example, a female hard- of -hearing substitutes front vowel /i/ with mid vowel /e/ as in "sorry" final /i/ changed to /e/ (sore). Similarly, another substitutes (^) in "but" for (u) realizing it as (but). One of the subjects also mixes vowels, example /e/ for /a/ as in "well" (wal), /i:/ for /e/ feel (fel). Another subject demonstrates the extent of mother tongue influence on the production of vowels. The following words were read via the use of Hausa orthography; "are" was realized as (a:re) and "were" as (wErE). The impact of orthography on this error should not be taken for granted for Jowitt (2006) says that RP's lack of consistency in the sound values it attributes to orthography /e/ and /ea/ caused PNE confusion of Rp /i/ and /e/. So, if normal hearing persons can confuse the sounds because of the claim, then such confusion could be severe from impaired persons.

Similarly, many long vowels are shortened by the subjects. Many tested on this, show this error of long vowel shortening, for example "pea" shortened to (pi), fool to (ful), heard to (hed) etc. In the first example, a new word (pi) was produced instead of the independent variable "pea". In the second, derivative morpheme (ful) was the result instead of full lexical morpheme "fool". In the last example, the sound produced has no equivalent in English (hed). Many short vowels, unlike long vowels are realized correctly by the subjects though most of them are substituted through the phenomenon of mixed substitution.

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More so, incorrect realization of diphthongs has been one of the phonological errors found in the speeches of hard-of-hearing persons. Through the diphthong test, many subjects find it difficult to realize the diphthongs with glide. Hard-of-hearing persons, unlike English language learners, show more pervasive cases in their speeches. Again responses of some subjects demonstrate diphthongs monothongization phenomenon, for example the followings are monothongized "go" (g), inside (insed), file(fil), pair (pire), poor (pure) etc.

Likewise, morphophonemic alternation test has served a great deal of function in observing how the hearing impaired persons behave in the production of vowel sounds. Morphophonemic alternation is a kind of length relationship that exists between the vowels in the root morphemes of the cognate words for example, the root morpheme "divin" in "divine" and "divinity" displays a relationship between long vowel /a/ and short vowel /i/ (Crutteden 2008). Thus, alternations in the speeches of hearing impaired persons were not there. For instance, one hard- of- hearing does not alternate the diphthong /au/ in the word "type" with the correct vowel /i/ to correctly pronounce the word "typical" instead he uses the same /ai/ to produce (taipital). Another alternates /ai/ for /e/ in the word "bible" (bebl) and in "biblical" the second /b/ occurring at the coda position of the first syllable got an addition of /i/ to produce (bibilikl). "Type" and "typical" posed a problem to him. In all the words, /ai/ was used hence producing (taip) and taipikl). In normal circumstances /ai/ is alternated in the second variable with /i/ to produce (tipikl), but that was not the case here. Triphthongs production by the hearing impaired persons is also full of phonological errors. In his speech for example, a male hard – of hearing pronounces the word "player" and "lawyer" correctly but with a pause separating the two syllables. While "power" and "how" were realized correctly, they were also accompanied with some force during production. The /p/ sound occurring at the initial position was aspirated.

Moreover, vowels have aided in the breaking of clusters. In all cases of consonant cluster breaking, vowels are the powerful tools for such processes; example (bilik, bilak, kilas, tʃukl etc). Hearing loss can also lead to a case such as one found in two congenitally anartharic children. The children have full language capabilities but with no production of speech. According to their teacher, the two students have full language capabilities but have never uttered a word. This is a similar case found by Lennerberg (1962). This justified the claim that perception and

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understanding of speech are possible without productive capabilities but the reverse is never possible.

Conclusion

From the above discussion, it is obvious that the findings of this research agree with auditory-motor theory of speech production which claims that production of speech is guided by acoustic images. That is to say the acoustic cues heard by hard-of-hearing L2 speakers of English guide production of their speech. Thus, the findings of this study such as deletion, insertion, cluster breaking and alveolization serve as inferences that become the antecedents of a conclusion that is to say phonological errors committed in speech production are guided by the acoustic cues heard. However, other than the impairment, one contributing factor that leads to these phonological errors is the interference of mother tongue. Also poor knowledge of the English pronunciation is among the factors that worsen the good production of English speech sounds. Thus, to overcome these problems, the following measures and recommendations could be helpful: auditory training with and without amplification, speech reading (lip reading), speech correction through effective speech game, tongue gymnastic, auditory bombardment and language instruction where needed, psychological counseling and vocational guidance, (Virgil and Hayes, 1973).

Appendices

Read the following words

Containing short and long vowels

SHORT VOWELS TEST

Hid, Fill, Bid, Except, Had, Bad, Hood, Bode, Bud, Bed, Is etc

LONG VOWELS TEST

Heed, Feel, Bead, Pea, See, , Fool, Heard etc.

DIPHTHONG TEST

Go, Inside, File, How, Fail, So, , Foil, , Poor, Hired, Pair etc.

LONG AND SHORT VOWELS TEST

Bid and Bead, Good and Food, Cod and Card

MORPHOPHONEMIC ALTERNATION TEST

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Divine, Divinity, Bible, Biblical, Wise, wisely, Type and Typical

TRIPHTHONGS TEST

Player, Lawyer, Prayer, Mayer, Royal, Power and How

CONSONANT TEST

Big, Ball, Bag, But, Buy Cap, Cat, Coup, Cow, Black, Block, Bleak, Scissors, Plumber, Football, Scent, Provide, Know, Class, School etc.

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