DISTINCTIVE FEATURE TRAINING IN BANGLA CONSONANTS: DISTINGUISHING LEARNING AND WORKING MEMORY

Tanzila Pias, Fariea Bakul*, Mst Sonia Islam Nisha[1] and Shahin Ahmed

Department of Psychology, University of Dhaka, Dhaka-1000, Bangladesh

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Abstract

Like other languages, Bangla has some phonetically distinct letters that make it difficult for young children to learn and pronounce. As a result, they make mistakes in the articulation of those letters. Results from earlier studies suggest that phonemes that are similar in sound become confusing for each other in short-term memory, which can create a barrier for learning and retention in long-term memory. However, any comprehensive study of the distinctive features of the Bangla alphabet has yet to be carried out. The goal of the current study was to determine whether there are any differences between the two independent groups' levels of learning and working memory (the training/experimental group, which received training in phonetic distinctive features, and the non-training/control group, which received no training). Children between seven and eight years of age were selected as participants in the study. The result of this experiment shows a clear connection between distinctive feature training and articulation. Specific training in some alphabet letters in Bangla helps the children in their letter learning and working memory. For children with articulation problems, distinctive feature training can bring about significant developments in terms of the number of errors and sound precision.

Introduction

For developing early word decoding skills, children must identify and manipulate several phonological skills, for example, syllable structure, phoneme segments, and letter knowledge (also known as phonological awareness)[1]. These phonological skills are highly needed for understanding written words. A meta-analysis of studies investigating phonological awareness and its relationship to early reading suggested that children's phonological ability is essential for early word learning[2]. However, it is also empirically evident that, in the early stages of learning, the children may have difficulty distinguishing the visually similar letter forms, for example, /b/, /d/, /d/, /p/ or /v/, /u/[3]. In phonological theory, the idea of 'distinctive features' is arguably considered the foundation of speech sounds. In spoken languages, speech sounds often display a

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*Author for correspondence: E-mail: <fariea.bakul@du.ac.bd>. [1]Department of Communication Disorders, University of Dhaka, Dhaka-1000, Bangladesh.

number of similar characteristics; it is usually the case that these sounds share phonetically similar properties, which is termed "natural class"[4]. Distinctive features define the contrasts between speech sounds, refer to the ways in which the speech sounds may alternate or change, and determine the natural classes. It is a process by which one can identify the differences between things and objects.

The early learners do not focus on the individual letter form; rather, the focus is concentrated on the overall context, and the development of letter recognition starts when they focus on the individual letters for a particular word[5]. For them, therefore, letter identification is a challenge. Several empirical studies suggested that training in distinctive features might be an effective way to develop phonological skills for young people[5-6]. When children acquire a new phoneme, they do so by differentiating it from other phonemes that are already present in their repertoires, and gradually they add new features and extend their phoneme repertoire[7]. The phonological acquisition in relation to distinctive feature theory has also been emphasized and suggested that the acquisition of phonological rules and phonological classes is mainly based on the capacity of differentiating sounds by analyzing distinctive features of speech sounds[8]. Therefore, for developing articulation, distinctive feature training can be a useful tool. In an experiment to study the distinctive features of five consonants paired with the vowel 'a', researchers focused on the letters having almost similar articulation and found that distinctive features are important in encoding and memory maintenance in addition to facing difficulty articulating similar letters[9].

The mechanism that holds a limited amount of information for a short period of time is called working memory, an active system analogous to RAM in a computer. It helps in executing cognitive tasks such as learning and memory. For example, when we are asked to say our phone number, we might say the first 3 or 4 digits, pause, and then say the next 3 or 4 digits, and so on. The 3 or 4 digits are first held in our working memory temporarily until we accomplish the task of saving the phone number in our contact list.
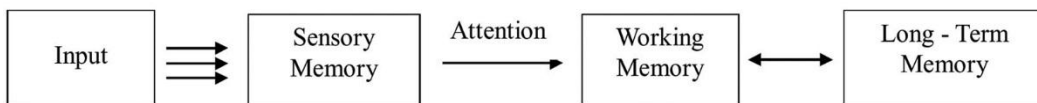

Fig. 1. Working Memory Model.

The idea of chunking helps us to bind or gather the information together into a meaningful whole, usually called "the magic number seven, plus or minus two" [10]. According to this chunking theory, we have a memory span of five to nine items/ units in terms of short-term memory and working memory. In our everyday lives, it helps us learn, memorize, and communicate immediately with various information. In every language, there are vowels and consonants. A vowel is a sound that can be produced by exhaling freely through the mouth without the lips or throat being closed. However, a

consonant is produced by partially or entirely restricting the airway in the mouth. To make a consonant sound, no one can fairly pass the air. There are 50 letters in the Bangla language. Among them, 11 are vowels and 39 are consonants. Each letter has a particular way to be pronounced. Some letters are overlapped, some sound almost similar e.g. চ /ছ, ড/ঢ, গ/ঘ etc.

It won't come as a huge surprise if the early readers who speak Bangla frequently mix the two up. Therefore, the pronunciation of these related letters was the experiment's primary focus. The current study sought to determine whether there were any differences in the levels of learning and working memory between two distinct groups of participants (the training/experimental group that received training in phonetic distinctive features and the non-training/control group that had not). Highlighting the distinctive feature training may generate two benefits. First, it will help Bangla-speaking pupils become familiar with the particular aspects of the Bangla sound system so they can distinguish between phonetically identical letters with ease. Second, it would have made it possible for them to learn the features during the training sessions without making lots of mistakes. This is particularly crucial because early learning setbacks and obstacles may make youngsters less interested in learning later on.

Materials and Methods

Participants and design of the study: For this experiment, 60 youngsters aged seven to eight were chosen from a government primary school at Savar, Dhaka. A group design was used to conduct the experiment. Among them, 30 students were given phonetic distinctive feature training in the experimental group, and 30 were not given any training in the control group. Their socio-economic condition was middle-class.

Before the experiment could begin, the class teachers were asked to help in the recruitment process of pupils who would be interested in taking part. The parents of the children were then asked face to face or called to gain permission for their children to take part in the experiment after finishing the regular school day's work. The parents were also made aware that the children would get snacks and drinks as refreshment. The experiment was carried out after obtaining the parents' consent to conduct the experiment and stay for a predetermined amount of time after school on a specific day.

Measuring Instruments: Ten lists were utilized to carry out this experiment with children between the ages of seven and eight who participated in it (with their parents' permission). Each list contained five Bangla consonants, however in order to prevent the repetition effect, no consonant was repeated inside a list.

Example of a list: গ (ga)   ঠ (tha)   দ (do)   ঘ (gha)   ত (ta)

They were instructed to memorize the letters for a later recall phase after being presented a placard with the letters (from a list) and hearing a recording of that letter being clearly pronounced at once. For example, let's take the letters "ta" (ত) and "ta" (ট). Both share the same place for articulation (alveolar ridge, the area right behind the upper

front teeth on the roof of the mouth), a similar stop style, and voicelessness at the same stage of pronunciation. Retroflexion (curling of the tongue to make a sound), however, distinguishes "ta" (ত) from "ta" (ট) because it's not present in the former one. The participants saw the placard written "ত" (ta) and "ট" (ta) one after another and heard clear recordings of both (ত) and (ট) simultaneously, and were asked to memorize these two with three more letters {গ (ga), ঝ (tha), দ (do)} of a five letter list. They were asked to repeat the five-letter list immediately after seeing and hearing it.

Procedure: At first, all the interested participants were welcomed into a quiet room. To select the participants for the experiment, a screening process was necessary since the focus was to recruit children who could not differentiate the phonetically similar letters (e.g. গ and ঘ, চ and ছ etc.). For this, they were asked to recite the Bangla consonants to identify the children who have pronunciation problems in phonetically distinctive features. For this experiment, a total of sixty children who showed pronunciation problems with phonetically similar letters were selected. Following this primary selection, all of the children were given a number between one and sixty. In order to make the time and task exciting and for random assignment purposes, they were asked to write down their name and the given number on a small piece of paper (chits), fold it, and put it in a jar. The experimenter then randomly picked 30 paper papers chits from the jar, and these 30 children were assigned to the training/ experimental group and the rest to the non-training or control group.

The participants of the experimental group were given distinctive feature training- they listened and pronounced the similar sounding but distinct letters until they could fully learn to differentiate between them and utter them correctly. After this, the experiment began. At first, they were given five seconds to see each letter written on a placard and hear each list of five Bangla consonants simultaneously. Immediately, they were asked to recall the letters serially and correctly. They were praised for their accurate recall. Additionally, corrections were also made so they wouldn't repeat the errors the next time. Then they moved on to the next list until the total of ten lists was completed.

Before the actual trial began, there was no such training for the control group as there was for the experimental group. Just like in the experimental group, participants in this group were instructed to remember the letters for correct recall after seeing the placard and hearing the audio recordings. After the recall phase of each list, however, they were not corrected for mispronunciations. They were simply thanked, moved on to the next list and finished the same ten lists as the prior group did.

Data analysis: The independent sample *t* test was used for data analysis in the present study because the observations within each group are independent of each other, the data within each group are normally distributed, and this test assumes that the data is continuous and measured on a numeric scale where the interval between values is consistent.

Results and Discussion

Results from Table 1 show the learning of the participant (mean of the total number of correct responses) between the training/experimental and non-training/control groups.

Table 1. Learning of the participant (N-60).

Condition	N	Mean	t	P
Training/ Experimental Group	30	46.20		
Non-Training/ Control Group	30	33.30	13.23	0.001

There were significant differences (t = 13.23, d = 3.41, p < .001) in the scores, with the mean score for learning of the participant training group (M = 46.20, SD = 2.56) being higher than the non-training group (M = 33.33, SD = 4.68). With Cohen's d value of 3.41, the magnitude of the differences in the means (mean difference = 12.87, 95% CI = 10.94 to 14.85) was significant.

As a measure of the participant's working memory, Table 2 compares the mean retention of the number of letters from the ten lists, each consisting of five letters, meaning it is a total of fifty words. There were significant differences (t = 17.02, d = 4.40, p = <.001) in terms of the mean score for the total memorizing capacity of the participants.

Working memory helps us process and retain information through coordination and rehearsal. Due to the training of the experimental group and the nature of working memory, this group (M = 44.30, SD = 3.87) was able to memorize better than the non-training group (M = 23.73, SD = 5.36) in the recall phase. The magnitude of the differences in the means (mean difference = 20.57, 95% CI = 18.14 to 22.98) was significant with Cohen's d value of 4.40.

Table 2. Working memory of the participants (N-60).

Condition	N	Mean	t	P
Training/ Experimental Group	30	44.30		
Non-Training/ Control Group	30	23.73	17.02	0.001

When children acquire a new phoneme, they do so by differentiating it from other phonemes that are already present in their repertoires, and gradually they add new features and extend their phoneme repertoire. Previous research with articulation errors in children was analyzed for distinctive feature errors and resulted in findings similar to the present research findings, where results revealed the efficiency of articulation training and specifically distinctive feature training[7]. The current study's findings also imply that a consonant or vowel is encoded in short-term memory as a collection of

distinctive features rather than as a single unit. Similar to the current study's findings, a previous study found that substitution errors during the ordered recall of a series of phonemes were controlled by similarities in their distinctive features[11-12].

The result of this experiment also showed a clear connection between distinctive feature training and articulation. Specific training in some alphabets and letters in Bangla language helps the children in their learning and working memory function for those letters. For children with articulation problems, distinctive feature training can bring about significant developments in terms of the number of errors and sound precision. Incorrect pronunciations can be corrected with distinctive feature training, and these results are consistent with earlier research[7, 13].

Furthermore, distinctive feature training can facilitate the encoding of the consonants in working memory[11]. Even though the task for this experiment was quite simple, it can be argued that working memory and distinguishing feature training and learning go hand in hand. Distinctive feature training can help Bangla-speaking children learn the different features of the Bangla sound system for learning and using phonetically similar letters in different contexts. Children's memories of the differences between the Bangla letters can be strengthened through this or similar types of training.

Since IQ was not determined prior to the experiment's start, and since IQ affects our ability to learn quickly and accurately, there may be an effect of student IQ level on this experiment. Any in-depth research on the topic has yet to be done on the basis of the Bangla sound system. Thus, referring to the results of Bangla's linguistic influence was scare. From this experiment, it is clear that distinctive feature training has to be considered a fruitful way to deal with letter learning and working memory so they can transfer the learning to long-term memory and face fewer errors and failures in terms of similar pronunciations of Bangla words.

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