A STUDY OF THE ROLE OF A MIRROR IN SPEECH TRAINING

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Introduction :

" Mirrors have held a traditional role in speech training for hearing-impaired children " (Pflaster, 1979). References to the use of a mirror are found in most major texts that deal with teaching speech to hearing-impaired children. There seems to be a general consensus among educators of hearing-impaired children that mirrors are a valuable adjunct to speech training and development. 'Pictures used to advertise oral schools for the deaf frequently show children seated in front of the mirror during speech training ' (Pflaster, 1979).

The use of mirror can be traced back to a few centuries back, when Amman (1687) stated his belief that ' the muteness accompanying deafness is caused by the deafness '. He extensively used mirror practice for teaching both speech and lip reading. Practice before a mirror as an aid to speech reading developed as a bye-product of teaching articulation to hearing-impaired children. Nemoy and Davis (1954) suggested that ' the mirror might be used as a tool in correction, to study the position of the tongue '. Berry and Eisenson (1956) also emphasized that ' the mirror might be used to create an image of how the sound looks.' Nitchie (1912) recommended mirror practice for eye training. Bell (1916) considered that familiarity with speech through the use of a mirror leads to a perception of muscular feeling of the positions assumed by the vocal organs. O'Neill and Oyer (1961) also emphasized home assignments consisting of mirror practice.

Park (1970) suggested that ' by using the mirror, an additional medium, chilldren will obtain a greater feedback in their attempts at pronouncing and understanding words'. Butt et al (1970) suggested that ' a mirror hung on the baby's crib would encourage babbling and provide visual feedback'. However, they emphasized that this does not mean to diminish the importance of accoustic stimulation and amplification for deaf children.

References to the use of the mirror discuss its relationship to language development (Stark, 1972; Rees, 1975 ; and Tidwell, 1976) ; Auditory training (Dassen, 1966) ; and Speech reading (Nitchie, 1912 ; Bruhn, 1915 ; Deland, 1931 ; and Berger, 1972).

' Although the mirror has been frequently recommended as an aid to correction, not all are in agreement as to the precise role and function of the mirror as a visual feed back', (Pflaster, 1979). Ewing and Ewing (1964) made no mention of mirrors even when discussing the necessity of a multisensory approach to speech training. They considered that ' manner and place of cues could be more effectively signalled usually by blicking techniques in which configuration of the hands and movement of the fingers replicate the actions of the jaw, tongue and lips'. Ling (1976) questioned the value of using a mirror. He reported that he rarely found

it necessary to use a mirror. In accord with Guillaume (1971), he said that children could imitate visible speech organ gestures without seeing themselves to do so.

Pflaster, (1979) attempted to determine the value of using a mirror for speech training in deaf children and found no difference between the number of errors made under the two auditory-visual conditions one employing direct vision and the other using a mirror. Therefore, he concluded that 'the use of a mirror neither enhanced nor detracted from the accuracy of responses'. Further he concluded that 'the usefulness of a mirror as a general aid in speech teaching was doubtful'. The diversity of opinions and recommendations relating to the use of a mirror in the speech training demonstrated the need for the present study. The study mainly based upon Pflaster's (1979) study has some modifications. Instead of using deaf children normal children with simulated hearing loss were included (1) to overcome the effect of mirror practice in deaf children ; and (2) to overcome differential experience under therapy. Further, instead of using CV syllables, fifteen words from an unknown language, Manipuri were selected to overcome the familiarity with known languages. In addition, the task in the present study was not just indentification and repetition of CV syllables (as it was in Pflaster's study), but was identification and repetition of words until there was mastery of all the words. Thus, there was an attempt to study the usefulness of a mirror in providing self-correction in children.

Methodology :

The present study was carried out on 15 normal subjects, under three different conditions, namely,

1 Audition alone,

2 Audition plus direct vision and

3 Audition plus vision using a mirror.

The performance of the subjects in terms of trials required to master the speech stimuli were compared under these three conditions. Thus an attempt was made to study the role of a mirror in speech training.

Subjects :

The study included 15 normal school going children, ranging in age between 5 and 12 years. Both boys and girls were included. The children were selected only when they met the following criteria :

1 Should be free from speech and hearing problems, (tested in conversation and screened at 20 dB at all test frequencies $250H_2$ to $8KH_2$)

2 Should have normal or average intelligence, (tested on Seguin Form Board).

3 Should not be aware of Manipuri language.

The fifteen subjects were divided into three sub-groups, each sub-group consisting of five subjects for the random presentation of the three experimental conditions.

Test Room :

The study was conducted in a distraction free room. One of the therapy room was selected with arrangements similar to those encountered in a typical speech training session. A mirror kept leaning against the wall was used only during the third condition i.e., Audition plus vision using mirror (AVM).

Instruments :

The following instruments were used in the study :

1 A pair of earmuffs (No. 322/G110) to simulate hearing loss. The earmuffs provided an altenuation of 20dB for speech.

2 A mirror measuriug 2 ft. x 1½ ft. (60cms x 45cms), placed approximately 1 ft. (30 cms) away from the subjects, was used in the third condition. The mirror was kept leaning against the wall.

Test Materials :

The speech materials for the study were chosen from an unknown language, Manipuri, in which tonal quality is a characteristic feature. This particular language was selected to overcome the familiarity with known languages.

The speech material consisted of fifteen words including both monosyllabic and disyllabic words. The words selected had either the raising or level types of tones. These words were randomly selected from a Manipuri Phonetic Reader and were randomly grouped into three equivalent lists of five words each. The speech material comprised of four raising, five falling and six level types of tonal words. It included :

1 three blends of initial consonants, dr, kl, and bl.

2 three aspirated words of initial consonants k^h . p^h & g^h .

3 three words formed by the combination of initial, voiceless, unaspirated alveolar stop /t/ with vowel /i/, /a/ and /o/ ; and consonants /n/ and /p/.

4 three words formed by the combination of initial, voiced, lateral /l/ with vowels /a/ and /o/ and consonant /k/.

5 three words formed by the combination of initial vowel /i/ with consonants /p/, /b/ and /m/.

The consonant phonemes differed in two voicing dimensions (voiced and unvoiced) ; two manner dimensions (plosive and lateral) ; and two place dimensions (alveolar and velar). The vowel phonemes differed in the length of the duration (short and long).

The following were the words used in the study :

1	i:ba	(to write, writing)	9	klip	(clip)
2	ima :	(mother)	10	tan	(bread)
3	ipa :	(father)	11	tin	(insect)
4	kha	(south)	12	to : p	(gun)
5	phi	(fee)	13	lak	(mode)
6	ghi	(refined butter)	14	lo : k	(phlegm, cough)
7	dram	(drum)	15	laka	(heart)
8	ble : t	(blade)			

These fifteen words were randomly grouped into three lists of five words each and each list contained all the features mentioned. These three lists of words were used for the three different conditions.

Testers :

A native speaker of Manipuri language (a student of All India Institute of Speech and and Hearing) served as the main tester. Another person a non-Manipuri speaker served as a additional tester. The main tester presented the speech stimuli to the subjects and also noted down their responses, in terms of trials taken to master the stimuli. The other tester was mainly included to give instructions to the subjects and also to note down their responses in terms of trials required. This tester sat behind the main tester and the subject throughout the three conditions.

Procedure :

Before conducting actual study, the attenuation provided by the earmuffs was arrived at on three adult normal subjects under free field condition. The subjects were tested individually. The speech stimuli in the form of words to repeat and questions to answer were presented to each subject and the levels at which they did not respond were noted down. Later with earmuffs on, the levels at which they did not respond the speech stimuli were noted down. The difference in the two levels was taken as the attenuation. For the first and third subjects, the attenuation was arrived at by presenting the speech stimuli first without earmuffs and later with earmuffs. This procedure was reversed for the second subject where the attenuation was found out by presenting the speech stimuli first with earmuffs on and later without them.

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In this way, all the fifteen subjects were tested individually, under the three different conditions. After each condition was over, earmuffs were removed and 5 minutes rest was given to the subjects.

Judgement and Scoring of Responses

The scoring of responses in terms of trials required to master the words under each conditions were done by both the tester separately. The average of the two testers' scores was considered the correct number of trials for a particular subject.

Statistical Analysis :

1. To test for significance of differences between means of three conditions, one way analysis of variance was done.
2. When the above analysis of variance indicated significant differences between means of three conditions, 't' value was computed to test which of the three means differed significantly.
3. The significant differences between means of girls and boys was also computed and later compared.

Results and discussion

The subjects' performances in terms of trials required for mastery of fifteen words under the three conditions provided the raw data for the study.

To the raw data, descriptive statistics in the form of Mean and S. D. were applied. To test for the significance of differences between the means of three different conditions, 'F' ratio was computed. To test which of the three means differed, 't' value was computed, The values obtained for 'F' and 't' were tested for their significance at 0.05 and 0 01 levels.

Results :

I Difference between means of three conditions :

Table (1) shows the total number of trials, mean and S.D. of fifteen subjects under three different conditions.

	Audition alone	Audition + vision	Audition + Vision through mirror
Total	621	398	412
Mean	41.4	26.53	27.47
S.D.	8.82	7.35	6.13

The mean of the group as a whole under Audition alone condition was 41.4 with S.D. of 8.82. The mean under Audition plus Direct Vision was 26.53 with S.D of 7.35. In the third condition i.e., Audition plus Vision using a mirror, mean was 27.47 and S.D. was 6.13.

These scores indicated that there were more number of trials under Audition alone condition. S.D. value was also greater in this condition indicating that the variability among subjects was greater.

The two mean values obtained under the two auditory-visual conditions differed very little, by only 0.94. There was not much of a difference in terms of variability among subjects under these two auditory–visual conditions, the difference being 0.91.

One-way analysis of variance between the three conditions indicated a 'F' value of 4.39, being significant at 0.05 level. Thus there were significant differences between the means of three conditions.

Further, to find out which of the three means differed in conditions, 't' values were computed. These 't' values indicated that there were significant differences between the audition alone condition and audition plus direct vision condition. Between these two conditions, 't' value was found to be 7.59 indicating significance at 0.01 level. Similarly, the difference between audition alone condition and audition plus vision using a mirror condition was found to be significant at the 0.01 level, 't' being 7.53. However, there was no significant difference between means of the two auditory-visual conditions 't' was 0.83 indicating non-significance at 0.05 level.

Table (2) shows the 't' value obtained under the three different conditions.

Conditions	't'	Significance at
A and AV	7.59	0.05 & 0.01
AV and AVM	0.83	not significant
AVM and A	7.53	0.05 & 0.01

II Difference between means of three different conditions with respect to Sex:

There were seven boys and eight girls in the study. The results of the boys under the three different conditions revealed that the mean was greater under the Audition condition (43.14). The variability among the boys under this condition was more (10.30). Under Audition plus direct vision condition, the mean was 28.86 with S.D. of 8.57. There was not much of a difference between the mean and S.D. values and those in the third condition i.e. condition with Audition plus vision using a mirror, mean and S. D. values in the third

The average of the three subjects' attenuation was found to be 20 dB. After knowing this attenuation level, the actual study was conducted under three different conditions :

a) Audition alone (A)
b) Audition plus Direct Vision (AV)
c) Audition plus Vision using a Mirror (AVM)

Testing under three conditions were separated by an interval of 5 minutes. The order of presentation of the conditions was completely randomized. The fifteen subjects were grouped into three sub-groups (a), (b) and (c) of five subjects each. Subjects belonging to sub-group (a) received the three conditions in the order of A, AV and AVM. Subjects of the sub-group (b) received the three conditions in the order of AV, AVM and A. The subjects of sub-group (c) received in the order of AVM, A and AV. The table below shows the order of presentation.

Sub-group (a)	A	AV	AVM
Sub-group (b)	AV	AVM	A
Sub-group (c)	AVM	A	AV

Further, the order in which the fifteen words were presented in the three word lists was also randomized, in such a way that no single word appeared twice in the same order.

Each subject was tested individually under the three conditions. The subject sat beside the main tester and the other tester gave the instructions depending upon the condition used first. The instructions were given before placing the earmuffs on the subjects.

1. Audition alone condition (A)

In this condition, each subject sat by the side of the main tester and the following instructions were given by the second tester.

" Now I will be placing these earmuffs (showing them) on your ears. With these, you will not be able to hear the words clearly. What you have to do is, to close your eyes and repeat the words presented by the tester (by pointing to the main tester). Don't open your eyes until I ask you to open ".

"ನೋಡು, ಈಗ ನಾನು ನಿನಗೆ ಇದನ್ನು (ಕಿವಿಗೆ ಹಾಕುವುದನ್ನು ತೋರಿಸುತ್ತಾ) ಕಿವಿಗೆ ಹಾಕ್ತೀನಿ. ಇದನ್ನು ಹಾಕಿಕೊಂಡಾಗ, ನಿನಗೆ ಪದಗಳು ಸ್ಪಷ್ಟವಾಗಿ, ಜೆನ್ನಾಗಿ ಕೇಳಿಸುವುದಿಲ್ಲ. ನೀನು ಏನು ಮಾಡಬೇಕು ಅಂದ್ರೆ, ಕಣ್ಣು ಮುಚ್ಕೊಂಡು, ಇವರು (ಮೊದಲನೆಯ ಟೆಸ್ಟ್‌ರನ್ನು ತೋರಿಸುತ್ತಾ) ಏನು ಹೇಳುತ್ತಾರೋ ಅದನ್ನು ಮತ್ತೆ ಹೇಳಬೇಕು. ನಾನು ಹೇಳುವ ತನಕ ನೀನು ಕಣ್ಣು ಬಿಡಬಾರದು".

With these instructions, the five test words were presented by live voice (as scheduled previously) by the main tester ; and trials taken to repeat the words correctly were noted down

by both the testers. Two consecutive correct repetitions of a word was considered to indicate that the word was mastered. In this way, all the five words were presented and the number of trials required to master each word were noted down by both the testers. Great care was taken by the main tester to present the test words in a normal conversational level and exaggeration of the articulators was avoided or limited. Whenever the subject made a mistake, the main tester stopped presenting the words and said 'No' and continued presenting it after few seconds.

2. Audition plus Direct Vision condition (AV)

In this condition, the subject and the main tester were facing each other at a distance of $1\frac{1}{2}$ ft. (approximately). The second tester gave the following instructions :

" Now with these earmuffs on your ears, you should look directly at the tester (showing her) and correctly repeat the words of the tester as you hear and see them."

"ನೋಡು, ಈಗ ಇದನ್ನು (ಕಿವಿಗೆ ಹಾಕುವುದನ್ನು ತೋರಿಸುತ್ತಾ) ಹಾಕಿಕೊಂಡು ಇವರನ್ನೇ (ಟೆಸ್ಟ್‌ರನ್ನು ತೋರಿಸುತ್ತಾ) ನೋಡುತ್ತಾ ಇವರು ಏನು ಹೇಳುತ್ತಾರೋ ಅದನ್ನು ಕೇಳಿಸಿಕೊಂಡು, ನೋಡಕೊಂಡು ಅದನ್ನೆಲ್ಲಾ ಮತ್ತೆ ನೀನು ಹೇಳಬೇಕು".

With these instructions, the main tester presented the test words by live voice and the number of trials taken to master the words were noted down by both the testers. Whenever there was an error in a particular word, the main tester said 'No' and the presentation of that word was continued until there was mastery of that particular word.

3. Audition plus vision using a Mirror condition (AVM)

In this condition, a mirror was introduced. It was placed on a table and was leaning against the wall. The mirror was placed at a distance of 1 ft. from both the subject and the main tester. The subject and the main tester looked directly into the mirror. The subject repeated the words of the main tester as heard and seen through the mirror. The second tester gave the instructions similar to the ones used in above AV condition, but with appropriate changes.

"Now, you should look at the tester (showing her) through this mirror. You should observe the tester presenting the words and then repeat them as heard and seen through this mirror".

"ಈಗ ನೀನು ಅವರನ್ನು (ಟೆಸ್ಟ್‌ರನ್ನು ತೋರಿಸುತ್ತಾ) ಕನ್ನಡಿಯಲ್ಲಿ ನೋಡಬೇಕು. ಇವರು ಏನೆಲ್ಲಾ ಹೇಳುತ್ತಾರೋ, ಅದನ್ನೆಲ್ಲಾ ಕನ್ನಡಿಯಲ್ಲಿ ನೋಡಿಕೊಂಡು, ಚೆನ್ನಾಗಿ ಕೇಳಿಸಿಕೊಂಡು ಮತ್ತೆ ಹೇಳಬೇಕು".

The test procedure was the same as in the other two conditions.

condition were 29.43 and 7.66 respectively. Thus there was not much of a difference between these two auditory-visual conditions.

Table (3) shows the performance of boys under A, AV and AVM conditions.

	Audition alone	Audition + Vision	Audition + Vision through mirror
Total	302	202	206
Mean	43.14	28.86	29.43
S. D.	10.30	8.57	7.66

On testing the significant differences between means of the three different conditions in boys, it was found that there were significant differences between audition alone condition and and audition plus direct vision condition 't' was 3.71. Similarly, there were significant differences between audition alone condition and the audition plus vision using a mirror condition, 't' was 4.35. However, there was no significant difference between the two auditory-visual conditions, 't' was 0.57.

Results of the girls indicated that the mean under the Audition condition was 39.88 with S.D. of 7.68. The mean values under the two auditory-visual conditions were 24.50 and 25.50 respectively, showing not much of a difference between the two conditions. The S.D. values under the two auditory-visual conditions were 5.90 and 4.20. The variability among girls was greater under Audition condition and was smaller under the condition using a mirror.

Table (5) shows the performonce of the eight girls under the three different conditions.

	Audition alone	Audition + vision	Audition + Viison through mirror
Total	319	196	206
Mean	39.88	24.50	25.50
S.D.	7.68	5.90	4.20

Table (6) shows the 't' values in girls for the three different conditions.

Conditions	' t '	Significance levels
A and AV	7.93	0.05 & 0.01
AV and AVM	0.78	not significant
AVM and A	6.14	0.05 & 0.01

There were significant differences between two auditory-visual conditions and the Audition alone condition. The 't' value between A and AV condition was 7.93, significant at the 0.01 level, Similarly, 't' value between A and AVM was 6.14 which was significant at 0.01 level. But the 't' value between AV and AVM conditions was found to be non-significant, with a 't' value of 0.78.

Table (7) shows the 't' values when the sexes were compared for the three different conditions.

Conditions	' t '	Significance
A_G and A_B	1.34	not significant
AV_G and AV_B	2.22	0.05
AVM_G and AVM_B	2.26	0.05

It was found that under Audition alone condition, there was no significant difference between the sexes. 't' was 1.34 indicating no significance at 0.01 level.

Under Audition plus direct vision, the comparison revealed that there was significant difference between the two means, 't' was 2.2, significant at the 0.05 level.

Under Audition plus vision using a mirror condition, the comparison revealed a significant difference between the two mean at the 0.05 level. ' t ' was 2.26.

III Relation between the number of trials with respect to the age of the subjects :

The study included 15 normal children ranging in age between 5 years and 12 years. But these number of children differed from group to group.

Table (8) shows the relation between the number of trials with respect to the age levels.

Subjects' age	No. of subjects	Total number of trials
5 years	3	73, 75, 125
6 years	1	133
7 years	5	90, 94, 97, 112, 115
8 years	1	66
9 years	1	100
10 years	2	92, 102
11 years	2	75, 84

Although, the results showed that there was a tendency towards decreasing number of trials with increasing age levels. There were three exceptions to this general finding. Two 5 year old subject scored the least (66) of all the subjects.

Reliability of the two testers :

There was fairly good agreements between the scoring of two testers independently. The correlation was 0.85.

Discussion :

The results of the present study provided evidence pertaining to the three research questions.

As there was no significant difference between the means of the two visual conditions, one employing direct vision and the other using a mirror, the finding cast a doubt upon the usefulness of a mirror in speech training. This finding is in support of Pflaster (1979) who also found similar results on a group of deaf children. Thus the hypothesis (1) stating that there will be no difference between the two auditory-visual conditions was accepted.

The two auditory-visual conditions were found to be superior to the audition alone condition the children required significantly more number of trials to master the words under audition alone condition than in the other two auditory visual conditions. Thus, the hypothesis (2) stating that there will be no difference between the two auditory-visual conditions and the audition alone condition was rejected.

The better results obtained under the two auditory-visual conditions are in agreement with many of the studies dealing with audio-visual methods of speech training (Hudgins, 1951; Sumby and Pollack, 1954: O'Neill, 1954; Sanders, 1961; Berger, 1962; Erber, 1975; Binnie and Montagomery, 1976).

Regarding sex differences between the three different conditions of the study, it was found that there was no significant difference between the means of boys and girls under audition alone condition. However, there were significant differences between means of boys and girls under the two auditory-visual conditions. Thus, the hypothesis (3) stating that there will be no sex difference between the three conditions was partly accepted for audition alone condition and rejected for the two auditory-visual conditions.

The hypothesis (4) stating that there will be no reduction in the number of trials with increasing ages was rejected. It was observed that children at younger age group of 5-6 years required more number of trials when compared to older age group of 10 and 11 years. Even though there was reduction in the number of trials with increasing age levels, there were exceptions to this group finding. Two five year old subjects scored very less when compared to their peers. Further, one 8 year old subject scored the least of all the subjects.

It was observed that most of the children in the study were distracted by the introduction of mirror and there was not much of a difference between the two visual conditions. This finding casts doubt upon the value of using a mirror as a general aid in speech training.

From the study it can be implied that in speech training, the use of mirrors have limited value. They may not provide any more clues than a condition which provides a combination of audition and direct vision. Thus, a mirror is not useful in eliciting desired words

The tasks in the present study were identification and repetition of speech stimuli rather than discrimination. Taking Pflaster's (1979) view, 'a closed set of discrimination task would be more sensitive and more appropriate, because it relates more closely to a typical speech teaching situation-one in which small sets of sounds are evoked, compared and contrasted', we can expect different results from discrimination tasks. But Pflaster (1979) suggested that the discrimination task would take more trials under each conditions.

Failure to demonstrate significant differences between the two visual conditions in this study does not imply that such differences would not have been found in studies employing different types of subjects or different types of speech tasks. Quite different results might be expected from adult subjects with hearing-imparied children with misarticulation problems but no hearing impairment.

It is also possible that deaf children of similar age who have had less auditory training might perform better under the AVM condition (if it actually provides more useful cues than direct vision) because they would rely more heavily on visual information. Conversely, the deaf children who have had more auditory training or more residual hearing might perform poorly under auditory plus vision using a mirror condition because the mirror could divert their attention from the auditory pattern.

These speculations serve to emphasize the need for further research.

Recommendations for future studies :

1 A similar study may be carried out using a large sample of subjects.
2 The study may be extended to deaf children and also to children with misarticulation problems.
3 The study involving the discrimination task may be carried out instead of just identification and repetition of speech stimuli.
4 Further studies using varied linguistic materials like phrases, sentences may be carried out to determine, the use of a mirror.

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