

# CORRELATION OF TEACHER'S VOICE LEVEL WITH THE SPEECH COMPREHENSION AND FATIGUE DEGREE OF TEACHERS

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## ABSTRACT

Since the teacher's voice greatly affects the student's learning effect, accurate voice delivery must be important for the student's academic improvement. Also, voice level of teachers is closely correlated with both of teacher's fatigue and speech comprehension of students. The present study aims to investigate the appropriate voice level of teachers which could optimize the two other factors.

In order to this, field acoustic measurements and questionnaire survey were accomplished in 5 classrooms in a Korean elementary school. The subjects consist of 5 teachers and 115 students. Teacher's voice levels were classified into five stages from low level(55dB) to high level(73dB). Also, Teacher's voice levels were measured for 15 minutes to confirm the correct level of speech during the class.

As a result, it was found that the teacher's fatigue and speech comprehension are low when low level of vocalization was given. On the other hand, when high level of vocalization was given, teacher's fatigue was increased significantly while speech comprehension of students was increased. concerning the medium(62-64 dB) voice level, it was revealed that 81.8% of the satisfaction was acquired for speech comprehension with just one of five teachers feeling tired. Therefore, it can be suggested that 63dB could be an appropriate voice level of teachers in classroom.

**Keywords:** *classroom, voice level, speech comprehension, fatigue, questionnaire*

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## 1. INTRODUCTION

Teacher's accurate voice transmission is very important since it is a factor influencing student's progress [1]. It was found from the precedent study that speaker's acoustic quality affects the children's ability of acquiring language [2] and teacher's voice could influence the student's degree of concentration [3]. So, the value of teacher's voice is very high in the classroom because it is a major communication tool for the information transmission and it affects the learning ability of students [4].

Since teachers normally speak to many students in a classroom, they need to speak louder than the ordinary days for the accurate communication [5]. Also, they meet students for many hours teaching many subjects. When the classes are sequentially proceeded, teacher's overfunctional voice must be exposed for long time [6].

In Korea, acoustic standard of school classroom has been established through many acoustical researches [7-8]. The present study is a prior investigation aiming to set up senseful sound level of teacher's voice which could optimize the student's speech comprehension and teacher's fatigue degree using acoustic measurements and questionnaire to students and teachers in an elementary school.

## 2. RESEARCH METHODS

The present study consists of acoustic measurements and Questionnaire survey. The procedure of the investigation was as follows;

- 1) measurement of voice level of a teacher during school hours for 15 minutes
- 2) after finishing class, two questions were asked to the teacher and students in the class

3) repetitive measurements and questionnaires were carried out changing the sound level of teacher's voice

Speech level is different according to the vocalization effort of human's speaking. Sound levels of normal male are listed in Tab. 1 according to the vocalization effort. Pearsons investigated that the average vocal sound level of teachers was 63dB(A) [9]. Based on the result of the reference, teacher's voice sound levels were classified into five stages including quiet(54~56dB), slightly quiet(58~61dB), medium(62~64dB), slightly loud(66~68dB), and loud(70~72dB) levels. the five target vocal sound levels were selected with the interval of 4dB. The order of experiments was shown at Tab. 2 starting from normal sound(63dB) to louder sound(71dB). Also, Teacher's voice sound level was measured for 15 minutes to confirm the correct level of speech during the class.

**Table 1.** Vocal sound level according to the vocalization effort of normal males.

Vocal effort	$L_{p, A, s, 1m}$ (dB)
Very loud	78
Loud	72
Raised	66
Normal	60
relaxed	54

**Table 2.** The order of experiments.

Order	Loudness	Leq (dB(A))	Vocal sound level range ( $\pm 1$ dB)
1	Medium	63	62~64
2	Slightly quiet	59	58~60
3	Quiet	55	54~56
4	Slightly loud	67	66~68
5	Loud	71	70~72

Questionnaire survey was undertaken to 115 students and 5 teachers in 5 classes in an elementary school. Two questions were asked to the teacher and students respectively just after each class. Table 3 shows the contents of all the questions asked to teacher and students. Questions to students deal with the speech intelligibility and speech comprehension of students while questions to the teacher asked his/her subjective feeling of student's speech comprehension and his/her feeling of fatigue. During the

class, teacher's vocal sound level was measured at the center of the classroom with the height of 1.5m.

**Table 3.** Content of questions to students and teachers.

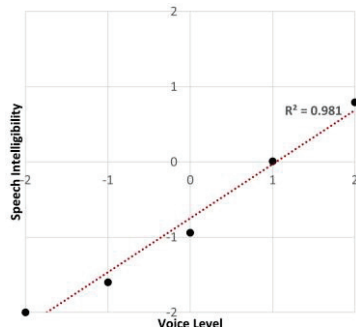
No	Content of questions	Subjects
1	How does the teacher's voice sound to you? (Speech intelligibility)	Student
2	How well do you understand the teacher's class? (Speech comprehension)	
1	Do pupils appear to comprehend the content well when you speak at your voice level? (Speech comprehension)	Teacher
2	Speaking with the designated voice level during the class, how do you feel tired? (Fatigue degree)	

### 3. RESULTS

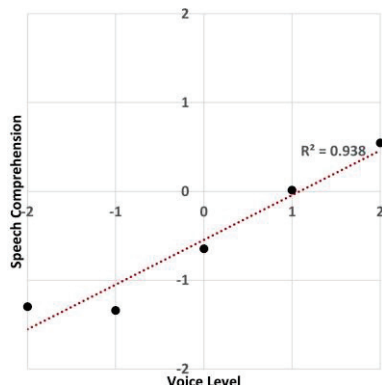
As a result from the questionnaire to students, it was shown that student's speech intelligibility and speech comprehension increase with the increase of the vocal sound level of teachers as shown in Tab. 4. When vocal sound level is loud, 89.6% of students responded that they can hear very clearly and 67.8% of students responded that they can understand very well. Changing both five semantic differential answers from students and five steps of teacher's vocal sound loudness into the numerical scores from -2 to +2, correlations between vocal sound level and each answer are displayed in Fig.1 and Fig. 2. As shown in Figs 1 & 2, it was found that very high correlations were found between teacher's vocal sound level and both the student's speech intelligibility ( $R^2 = 0.981$ ) and speech comprehension ( $R^2 = 0.938$ ). When teachers speak with medium voice level, it was found that student's satisfaction of speech intelligibility reach 81.7% and 84.3% for speech comprehension.

**Table 4.** Results of questionnaire survey to students.

Vocal loudness		Number of respondents				
		Quiet	Slightly quiet	Medium	Slightly loud	Loud
Speech intelligibility	Very blur	20 (17.4%)	0	0	0	0
	Blur	37 (32.2%)	22 (19.1%)	1 (0.9%)	0	0
	Normal	23 (20.0%)	39 (33.9%)	20 (17.4%)	4 (3.5%)	0
	Clear	21 (18.3%)	23 (20.0%)	38 (33.0%)	42 (36.5%)	12 (10.4%)
	Very clear	14 (12.1%)	31 (27.0%)	56 (48.7%)	69 (60.0%)	103 (89.6%)
Speech comprehension	Very bad	8 (7.0%)	0	0	1 (0.9%)	1 (0.9%)
	Bad	30 (26.1%)	8 (7.0%)	1 (0.9%)	1 (0.9%)	4 (3.5%)
	Normal	30 (26.1%)	37 (32.2%)	17 (14.8%)	10 (8.7%)	10 (8.7%)
	Good	25 (21.7%)	34 (29.5%)	43 (37.4%)	42 (36.5%)	22 (19.1%)
	Very good	22 (19.1%)	36 (31.3%)	54 (46.9%)	61 (53.0%)	78 (67.8%)



**Figure 1.** Correlation between teacher's voice level and speech intelligibility of student



**Figure 2.** Correlation between teacher's voice level and student's speech comprehension

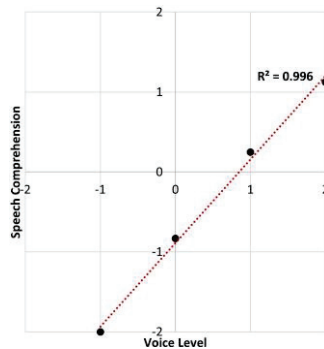
The responds of teachers to questions were listed and analyzed in Tab. 5. Also, teacher's five semantic differential answers were changed into numeric scores from -2 to +2. The correlation between teacher's vocal sound level and teacher's feeling of student's speech comprehension is displayed in Fig. 3 with very high correlation coefficient ( $R^2=0.996$ ). This denotes that teachers believe that students can understand the class easily when they speak loudly.

Also, correlation between teacher's vocal sound level and teacher's feeling of fatigue is plotted in Fig. 4 with high correlation coefficient ( $R^2=0.719$ ). It is showing that the louder teacher's voice is the more tired teachers feel.

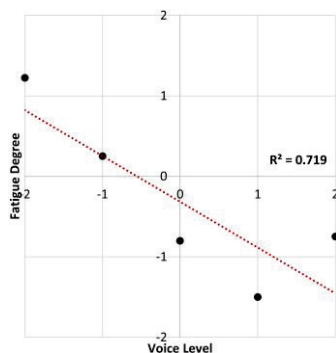
As a result, every teacher responded that they feel tired much when they speak with loud voice level. With slightly loud voice, it was found that 60% of teachers feel very tired and 40% of teachers feel tired. Only 1 people responded that he/she feels tired during speaking with normal voice level.

**Table 5.** Results of questionnaire to teachers.

Vocal loudness		Number of respondents				
		Quiet	Slightly quiet	Medium	Slightly loud	Loud
Speech comprehension	Very bad	0	0	0	0	0
	Bad	3 (60.0%)	0	0	0	0
	Normal	2 (40.0%)	3 (60.0%)	0	0	1 (20.0%)
	Good	0	2 (40.0%)	3 (60.0%)	2 (40.0%)	1 (20.0%)
	Very good	0	0	2 (40.0%)	3 (60.0%)	3 (60.0%)
Fatigue degree	Very tired	1 (20.0%)	0	0	3 (60.0%)	5 (100.0%)
	Tired	0	1 (20.0%)	1 (20.0%)	2 (40.0%)	0
	Normal	1 (20.0%)	2 (40.0%)	2 (40.0%)	0	0
	Untired	1 (20.0%)	1 (20.0%)	0	0	0
	Very untired	2 (40.0%)	1 (20.0%)	2 (40.0%)	0	0



**Figure 3.** Correlation between teacher's voice level and expected student's speech comprehension



**Figure 4.** Correlation between teacher's voice level and fatigue degree of teachers

**Table 6.** Results of the Chi-square test.

Vocal loudness	Chi-square value	p-value
Very quiet	4.473	0.315
Quiet	*	*
Normal	*	*
Loud	0.581	0.965
Very loud	0.931	0.920

Chi-square( $X^2$ ) test was done to know the statistical significance of speech comprehensions responded by two groups i.e. students and teachers. Calculated Chi-square values are listed in Tab. 6 according to the vocal sound level. Due to the small number of teachers, Chi-square values can not be obtained for the normal and quite vocal loudness. Also, there is no significant difference among teacher's vocal loudness concerning speech comprehension which was asked to both groups.

#### 4. CONCLUSION

The present study investigates the appropriate vocal sound level of teachers during the class which is related with the student's speech comprehension and the teacher's fatigue degree respectively. Through the questionnaire, it was found that student's speech intelligibility and speech comprehension increase with the increase of the vocal sound level of teachers. Also, it can be confirmed that most of students satisfied with the speech intelligibility and speech comprehension of the class when teachers speak

with normal vocal loudness which has eventually also low percentage of feeling tired ie. low fatigue degree. Thus, normal vocal sound of 63dB could be the appropriate sound level for the teacher's speaking. Also, it can be concluded that teacher's vocal sound level affects the student's understanding and academic achievement much. Unfortunately, due to the lack of teacher respondents, more objective statistical results could not be obtained. Though the present work is a pilot study for the next investigation, continuous and more objective research investigation should be undertaken in the future.

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