

VOCAL DEMANDS IN TEACHERS:
PRIMARY VS SECONDARY SCHOOLS

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DEDICATED TO TEACHERS

*Guru Brahmaa Guru Vishnu
Guru Devo Maheswara
Guru Saaksaat Param Brahma
Tasmai Shri Guruve Namaha*

The Guru, the enlightened spiritual teacher, is Brahma, the creator; Vishnu, the protector; and Maheshwara, the destroyer. The Guru is verily the Supreme Brahman. Salutations to That **Guru**.

"The syllable 'gu' of the word '**Guru**' means darkness & the syllable '**ru**' means light. Thus, Guru is the great one who takes a disciple from darkness (ignorance) to enlightenment (True Knowledge)." -Lord Shiva in Shri **Guru** Gita.

CERTIFICATE

This is to certify that this Dissertation entitled "**VOCAL DEMANDS IN TEACHERS: PRIMARY VS SECONDARY SCHOOLS**" is a bonafide work in part of fulfillment for the degree of Master of Science (Speech and Hearing) of the student (**Register No. 02SH0001**).

Mysore
May, 2004



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CERTIFICATE

This is to certify that this Dissertation entitled "**VOCAL DEMANDS IN TEACHERS: PRIMARY VS SECONDARY SCHOOLS**" has been prepared under my supervision and guidance. It is also certified that this has not been submitted earlier in any other University for the award of any diploma or degree.

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DECLARATION

This Dissertation entitled "**VOCAL DEMANDS IN TEACHERS: PRIMARY VS SECONDARY SCHOOLS**" is the result of my own study under the guidance of **MS. K. YESHODA**, Lecturer in Speech Sciences, Department of Speech-Language Sciences, All India Institute of Speech and Hearing, Mysore and not been submitted in any other University for the award of any degree or diploma.

Mysore,

May, 2004

Reg. No. 02SH0001

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My dearest Daddym Mummy and Vishu, "The inspiration and encouragement that you have given me has brought me a long way."

Raj- *"A ring is round, it turns forever and that's how long we'll be together!"*

Sapna- 'Thank you is too little word for all that you have done for me.

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When it is small it is a perturbation
When it is large it's a fluctuation
 Every jitter and shimmer
 Beyond a small glimmer
Results in a voice degradation
When it splits it is bifurcation
When it's stuck its constipation
 But a glitch in the pitch
 Is a sure way by which
You detect chaotic vibration.
Forbid that a large deviation
Would repeat as an oscillation
 Such a tremor **or** flutter
 Is the tone that you utter
Is perceived as a **voice** aggravation.
Avoid wow, the slow modulation
And bleet, the fast undulation
 But practice a trill
 You'll get a big thrill
It's the ultimate voice jubilation
On stage please follow this motto-
"Know the bounds of vocal vibrato!"
 a voice with a wobble
 Like a limp on a hobble
 Can draw a rotten tomato.

...Titze

INTRODUCTION

"A man is known by what he speaks and how he speaks" -Unknown

Since time immemorial, speech has been given considerable importance by man. The underlying basis of speech is voice. The importance of the human voice in modern society cannot be overstated. Voice has been defined as "the laryngeal, modulation of the pulmonary air stream, which is further modified by the configuration of the tract" [Micheal & Wendhal (cited in Travis, 1971)].

The impact of voice dysfunction on the quality of life is difficult to appreciate, as the capacity to communicate is taken for granted. Abuse or misuse of the vocal system leads to organic changes in the system. This in turn causes loss of voice or abnormal voice. Voice disorder is a condition in which a person's voice quality, pitch, or loudness differs significantly from those of other persons of similar age, sex, cultural background, and geographic locations (Moore, 1971; Greene, 1972; Aronson, 1985; Boone & McFarlane, 1988).

It is a well-established fact that voice disorder is seen more in professional voice users. The individuals who are directly dependent on vocal communication for their livelihood are called "professional voice users" (Stemple, 1993). The professional voice users constitute an ever-increasing segment of our population and their need for expert care of voice has inspired new interests in understanding the function and dysfunction of human voice.

Kouftnan and Issacson (1991) proposed a classification based on levels of vocal usage as follows,

- a) Level I: The level I Elite vocal performer is a person for whom even a slight aberration of voice may have dire consequences. Most singers and actors are in this group, the opera singers being the quintessential level I performer.
- b) Level II: The professional voice user, level II, is a person for whom a moderate vocal problem might prevent adequate job performance. This group includes teachers, lecturers, etc.
- c) Level III: The non-vocal professional, level III is a person for whom a severe vocal problem would prevent adequate job performance. This group includes lawyers, businessmen, etc.
- d) Level IV: The non-vocal non-professional, level IV is a person for whom vocal quality is not a prerequisite for adequate job performance. This group includes office workers, factory workers, venders, bus conductors, agriculturist/ coolie, and so forth. Although persons in this group may suffer very significant social liability because of voice disorders, they are not prevented from doing work.

Teachers belong to the Level II of this classification system and are highly susceptible to voice problems.

The human voice is exposed to various loading factors in the teaching profession. Teachers form a large group of professional voice users and are thought to be at higher risk for voice problems compared to the general population [Fritzell (cited in Russell, Oats, & Greenwood, 1998)]. The impact of voice problem on an individual

does not depend upon the severity of the problem alone but also on how an individual perceives, reacts and adjusts to the problem. Although benign voice problems are not life threatening conditions, they could have significant negative effects on teachers' occupational, social, psychological, physical and communicative domains of life.

The working environment of teachers includes many factors that challenge, load and place demands on the vocal organ. Loud speaking and very often a consequent increase of pitch and straining of voice followed by long continuous hours of voice use amidst unfavorable acoustical environment may, for obvious reasons, lead to vocal fold tissue damage [Stone & Sharf, 1973; Mossallam, Kotby, & Ghaly, 1986; Gray (cited in Gauffin & Hammarberg, 1991)]. Prolonged elevation in vocal loudness within the classroom with the extended amount of talking per day and the vocal loudness levels used during classroom instructions have been stressed as the factors causing voice problems in teachers (Gotass & Starr, 1993). Lack of vocal education and training has also been advanced as an important causal factor [Cooper (cited in Sapir, Keider, & Schmidt, 1993)]. There are other factors like stress and anxiety faced by teachers and factors related to teachers' career, like, length and type of teaching, which have also been emphasized.

Since voice plays a major role in speech and hence communication, it needs to be constantly monitored in the event of abnormal functioning. There has been an increased awareness for expert care of voice which has inspired new interests in understanding the normal functions of human voice, especially so in professional voice users, particularly in teachers.

Vilkman (2000) reported that though voice problems are common in general, they are even more common in professions where there is heavy vocal loading. He opined that such professions not only require prolonged voice use, but also involve extra loading factors such as background noise, long speaking distance, poor room acoustics, lack of adequate equipment like voice amplifiers etc. School teachers and kindergarten teachers can be considered to represent professions with heavy vocal loading.

Background noise levels in some workplaces have been found to be far above 50-60 dB for example, at preschools (Truchnon, Gagon, & Hetu, 1998; Sodersten, Granquist, Hamnerberg, & Szabo (in press) and schools (Hay, 1995). It has been reported that speakers tend to raise their voice with increase in background noise. The teachers of preschool/ primary school tend to speak more loudly as younger students are much noisier than the older ones and therefore show more severe and frequent voice problems compared to the teachers of secondary schools/ colleges (Pearson, Bennett, & Fidell, 1977).

NEED FOR THE STUDY

There have been various methods, such as inventories, acoustic analysis, analysis of the acoustic environment, etc. to evaluate the characteristics of voice in teachers. Generally, inventories have been devised such that they focus on clients' perception, reaction and adjustment to the problem, nature and frequency of voice problem, etc. There are very few inventories that incorporate factors related to teaching environment, vocal habits and classroom conditions.

It has also been noticed that studies that emphasize differences in the voice characteristics between different types of teachers, for example, pre/primary and secondary school teachers are very limited. Also, whether increase in background noise levels leads to an appreciable increase in vocal effort and subsequently to frequent and/or severe voice symptoms has not yet been studied in Indian context.

Primary teachers are teachers who teach classes till Vth standard. Secondary school teachers are teachers who teach from VIth to XIIth (National Policy on Education, 1992).

Therefore the present study was planned to inquire into the nature of voice characteristics in teachers of primary and secondary grades, using a questionnaire and objective measures. The newly devised questionnaire was used as one of the methods to collect information and opinions of teachers regarding their voice, vocal habits and teaching environment.

REVIEW OF LITERATURE

"What you want to avoid is a voice that sounds as if it's stuck in your throat."

((Room, 1997)

Voice, the vehicle of speech, is the musical sound produced by the vibration of vocal cords in the larynx by air from the lungs. Voice is the result of breath under pressure from lungs causing the approximated vocal cords to perform the rhythmic excursion of separation and closure (Greene, 1972)].

Voice is the primary instrument through which most of us project our professionalities and influence our listeners. Wilson (1972) opines that good voice should have the following characteristics:

- Pleasing voice quality.
- Proper balance of oral and nasal resonance.
- Appropriate loudness.
- A model frequency level suitable for his age and sex.
- An appropriate voice reflection involving pitch and loudness.

A large group of individuals (professional voice users) are, by the very nature of their occupations, at a greater risk of developing voice problems and laryngeal pathologies. Professional voice users are defined as those, who require the use of their

voice to maintain income (Murry & Rosen, 2000). They include singers, actors, teachers, attorneys, etc. Nature of the business (job), the physical environment in which voice usage occurs, the extent of voice usage, and the training they might have had determine the degree and nature of voice problems faced by them.

Professional voice users are of three types: (a) those who use voice for a long period of time (politicians, teachers in class rooms, telephone users, shopkeepers and vendors), (b) those who use voice under adverse circumstances (persons working in noisy environment and/ polluted environments) and (c) those who use voice for special purposes (singer, theater artists). Circumstances under which these professionals use their voice typically results in fatiguing and abusing the voice and particularly its generator as they also use their vocal mechanism under considerable psychological stress. Professional voice users neither have awareness of anatomy and physiology of the vocal mechanism nor do they understand the consequences of poor vocal hygiene. They form the high-risk group to develop voice problems (Sapir, Keider, & Schmidt, 1993).

Different professional groups experience different voice problems and these problems stem from different sources/practices. In such professions, there may or may not be a unique set of factors which play a predominant role in the development of voice disorders. Vocal misuse and abuse were the predominant causative factors for voice problems in vocations involving high demands on vocal mechanism (Sapir, Keider, & Schmidt, 1993). Cooper (cited in Sapir, Keider, & Schmidt, 1993) defines vocal misuse as the use of incorrect pitch, tone focus, quality, volume breath support

and rate either discretely or in combinations. He has further reported the predominance of voice disorders in certain occupations such as teachers, singers, lawyers and theologians.

Voice is the most effective tool of teachers' trade, as they use their voice regularly due to the specific occupational demand and hence are vulnerable to develop voice problems. There aren't many professions, except for teaching, that demand a person to go on a regular basis and within a split second, from talking at a normal level to shouting across the classroom to overcome poor acoustic conditions [Cooper (cited in Sapir, Keider, & Schmidt 1993); Vilkman, 2000]. Apart from the use of voice for normal day-to-day communication, it is also used for other professional purposes. The vocal pathology along with the high level of anxiety associated with it would have potential impact on the teachers' ability to make a living. They do affect the physical and psychological health.

On average, teachers talk for 6.3 hours during a school day. The most vulnerable teachers are either the newly qualified who have had little training in voice awareness, or those who have been doing the job for 15 or 20 years and who suddenly find their voice wearing out (Siebert, 1999). Allen (1995) and Gotaas and Starr (1993) reported that 80 percent of teachers in their study claimed that they had experienced vocal fatigue. More than 20 percent of teachers had reported that voice problems prevented them from attending work ranging from one day to one week during the academic year.

Teachers who work in schools with noisy classrooms must constantly raise their vocal volume in response to varying levels of background noise. Noisy ventilation systems that cycle on and off, poor insulation between classrooms that allows sound leakage, hard surfaces that reflect student noises, and as such outside noise sources like, traffic and airplanes cause teachers to strain their voices (Herrington-Hall, Lee, Stemple, Niemi, & McHone, 1988; Rantala & Vilkmán, 1999; Smith, Gray, Dove, Kirchner, & Heras, 1997; Titze, Lemka, & Montequin, 1997).

Added to the poor acoustics of classrooms, the use of chalk and blackboard would result in an environment, which assaults the vocal system of every teacher day in and day out (Harisinghani, 2000).

The nature and prevalence of voice problems found in teachers may be universal rather than population specific. Sapir, Attias and Shahar (1990) reported that teachers, who use their voice vocationally, often indulge in vocal overuse and abuse and form the high risk groups to develop voice problems, which are vocational dysphasia.

Lejska (cited in Russell, Oates, & Greenwood, 1998) conducted a screening program for 722 kindergarten, primary and high school teachers. He documented that 5% of the teachers experienced organic changes of the vocal folds, 1% complained of tiredness of voice and 3% reported throat discomfort or a hoarse voice. He also found a prevalence of vocal pathology in 5.7% of female teachers and 1.4% of male teachers.

Mjaavatn (cited in Matisse, Oates, & Greenwood, 1998) did a study in which 1000 primary school teachers participated. The study was conducted using a questionnaire and individual diagnosis by speech pathologists. The presence of either permanent or intermittent "voice difficulties" was detected in 50% of the subjects studied. Approximately 4% of the teachers experienced aphonia on a regular basis. He also reported that subjects who frequently worked in acoustically poor environment; dusty room and dry air were more likely to have periodic or permanent voice problem.

Marks (cited in Russell, Oates, & Greenwood, 1998) surveyed 339 teachers using mail, as a part of a large study of occupational voice use. The prevalence of voice problems prior to commencing work as a teacher was 6%. However 47% of the same teachers reported that they had experienced voice problems since becoming a teacher.

Chen, Chang, Fue, and Chang (cited in Matisse, Oates, & Greenwood, 1998) conducted a screening program for 5218 junior high school teachers. Initially all subjects were screened by the administration of questionnaires and perceptual evaluation of voice. Diagnoses of voice disorders were then confirmed by laryngeal examination. Results showed that 8% of the total sample population had vocal nodules, which led to hoarse voice.

Sapir, Keider, and Schmidt (1993) surveyed 237 teachers out of which 93% were teachers from kindergarten and primary school teachers. Results showed that 50% of teachers reported multiple symptoms of vocal attrition, 22% reported few symptoms and 27% reported no symptoms. A significant proportion of teachers reported that their

voice adversely affected their teaching and that they had to abstain from work because of vocal fold surgery and only 1% received voice therapy.

Urritkoetxea, Ispizua, Matellanes, and Aurrekoetxea (cited in Russell, Oates, & Greenwood, 1998) carried out a prevalence study of public school teachers. They reported that 21% of the teachers experienced voice problems related to vocal fold pathology with vocal nodules being the most frequent diagnosis. Smith, Gary, Dove, Kirchner, and Heras (1997) compared the frequency and effect of voice symptoms in teachers to a group of individuals employed in other occupations. Teachers were more likely to have reports of voice problems with 10 specific voice symptoms and 5 symptoms of physical discomfort. They averaged almost 2 symptoms when compared to none in non teachers. The teachers were more likely to perceive that a voice problem would adversely affect their future career options.

Preciado, Tapia, and Infante (1998) found that voice disorders were more prevalent in female teachers (19.3%) than in males (15.6%) and among teachers of the lowest grades: 36.4% in nursery schools, 25% in elementary school, and 20.8% in junior school. The width and depth of classrooms, larger number of students, longer classroom hours, and noise level were related with the frequency of voice disorders.

Orlova, Vasilenko, Zakharova, Samokhvalova, and Kozlova (2000) analyzed voice disturbances, their causes and specific features in teachers using questionnaires filled by 934 general educational teachers. The teachers were found to associate voice disturbances not only with changes in the voice timber, but also with different

subjective feelings that made their professional activity difficult. They also felt that the major factors that cause voice disturbances are factors that overloads voice (which differ in teachers of different specialties), psycho-emotional stresses, frequent colds, and combinations of several factors.

Teachers in the younger age group (below 40 years) were more prone to voice problems than older group. It was found that most of the female teachers presenting for voice assessment were less than 40 years of age (Labastida, 1961). Siegart (1965) reported that 67% of the teachers presenting for voice assessment were less than 40 years of age. Mjaavatn (cited in Mattiske, Oates, & Greenwood, 1998) reported that younger teachers reported greater difficulties due to longer working hours and poorer vocal hygiene techniques than their older, more experienced peers. Calas, Verhulst, Lecoq, Dalleas, & Seilhean (1989) reported that 67% of the teachers with voice problems were aged between 31 and 50 years.

Review of literature reveals that most studies have been done on western population. Also majority of these studies concentrates on incidence and prevalence of voice disorders in teachers. Studies exploring voice characteristics based on acoustic features in teachers are very limited. Awareness regarding the negative impact of disorders of voice has increased in teachers, resulting in teachers seeking professional help to maintain and conserve voice for effective and better job performance. Therefore, it is highly relevant and necessary to carry out studies in Indian contexts to understand the mechanisms of vocal load, extent of voice use, etc. in teachers.

In Indian contexts, classrooms are generally big, have more windows (leading to dissipation of voice energy), have more number of students (teachers' voice is absorbed in the front benches itself) and higher noise levels. The teachers have to generally teach for more number of hours, than their counterparts in the western world. All these factors put a heavy burden on the teacher's voice and thus more number of teachers can be expected to be susceptible to voice problem. More frequent voice problems manifested by our teachers include hoarseness, breathiness, and lack of volume and tiring of voice. In some instances, tiring of voice in teachers may incapacitate them to continue their speech after 5-10 minutes of talking (Harisinghani, 2000).

The present study was planned to inquire into some of the above issues.

AIMS OF THE STUDY

- 1) To obtain self-appraisal regarding their voice in pre/primary and secondary school teachers using a questionnaire.
- 2) Correlating vocal demand in these two groups of teachers using objective assessment - acoustic characteristics, aerodynamic and existing background noise in classroom situations.
- 3) Correlating objective acoustic characteristics and subjective information (self-appraisal)

METHOD

Teachers are more susceptible to voice changes due to the demands of their profession. Hence, the present study aimed at exploring the differences in voice characteristics in pre/ primary and secondary school teachers.

Subjects

Thirteen pre-school/ primary teachers and fourteen secondary school teachers in the age range of 20-50 years with at least two years of teaching experience participated in the study. All the teachers were bilinguals with English as their second language and were chosen from schools of Mysore city that permitted carrying out of noise measurements in their respective schools.

PROCEDURE

The procedure of the study was divided into three phases.

I Phase:

A Questionnaire was devised incorporating information pertaining to the following areas:

- a) Classroom Condition and general information,
- b) Life Style,
- c) Vocal Habits, and
- d) Symptoms exhibited.

A pilot study was conducted to check the validity of the questionnaire prior to the study. The questionnaire consisted of a total of 41 questions, in which few

questions required detailed answers and the remaining involved rating individual's preferences on 4-point scale. The subjects were informed about the purpose of the study, instructed appropriately and were appraised individually. The questionnaire is provided in the Appendix.

***II*Phase: Objective assessment**

- *Voice recording:* Teachers who had completed the questionnaire were selected for voice recording. Audio recording of voice was done in quiet situation during working hours (during free time) using the SONY mini-disc (MZ R-30) digital portable tape recorder with option for external microphone. The distance between the microphone and subjects' mouth was maintained. All the subjects were instructed appropriately and the following tasks were recorded,

Phonation of the vowel /a/

Speaking for two minutes about themselves

Reading standard passage (Rainbow passage)

- *Recording of vital capacity:* Vital capacity was recorded using the hand-held portable Vitalograph, Model 2120. The subjects were instructed to take a deep breath and release all the inspired air into the mouthpiece of the instrument. Three trials were obtained for all the subjects. Average of the three trials of vital capacities was noted in liters.
- *Noise measurement:* Noise measurement of existing background noise levels of the classrooms were carried out when the classes were in progress. Classrooms of all

the selected schools that were used by the subjects (teachers) were chosen for noise measurement and the following instrumentation was used:

1. Sound Level Meter (SLM) - Bruel & Kjaer, Type 2230

Following settings was selected for noise measurement: -

Detector: - RMS

Time weighting: - Slow

Display: -SPL

Sound Incidence: - Frontal

External filter: - Out

Frequency weighting scale: - 'A'

2. Microphone: - Bruel & Kjaer (Type- 4189) Prepolarised free-field $\frac{1}{2}$ Microphone
3. Pre- amplifier: - Bruel & Kjaer
4. Tripod stand
5. Measuring tape
6. Level meter/Sprit level

The tripod stand was adjusted such that SLM was one meter above the floor.

Level meter was used to ascertain that the SLM was horizontal to the floor.

Existing background noise levels were noted across five points in each classroom. And the average of three readings per point was noted in dB SPL.

III Phase: Analysis

An acoustic analysis of audio-recorded voice samples was done using the software, Multi-Dimensional Voice Program (MDVP) of Computerized Speech Lab (CSL) 4300b and Dr. Speech of Tiger Electronics.

MDVP: The audio-recorded data was line fed into the CSL module using a sampling rate of 50000 Hz and conversion rates of 50 kHz for phonation and 25 kHz for speech and reading respectively. The following parameters were extracted after acoustic analysis using MDVP for phonation of /a/:

I. Fundamental frequency information measures

1. Average fundamental frequency (F_0)
2. Average pitch period (T_0)
3. Highest fundamental frequency (F_{hi})
4. Lowest fundamental frequency (F_{lo})
5. Standard deviation of fundamental frequency (STD)

II. Short and long term frequency perturbation measures

1. Absolute jitter (Jita)
2. Jitter percent (Jitt)
3. Relative average perturbation (RAP)
4. Pitch perturbation quotient (PPQ)
5. Smoothed Pitch perturbation quotient (sPPQ)
6. Fundamental frequency Variation (vF_0)

III. Short and long term amplitude perturbation measures

1. Shimmer in dB (ShdB)
2. Shimmer percent (Shim)
3. Amplitude perturbation quotient (APQ)
4. Smoothed Amplitude perturbation quotient (sAPQ)
5. Peak-Amplitude Variation (vAm)

IV. Voice break related measures

1. Degree of voice breaks (DVB)
2. Number of voice breaks (NVB)

V. Sub-harmonic related measures

1. Degree of subharmonic segments (DSH)
2. Number of subharmonic segments (NSH)

VI. Voice irregularity related measures

1. Degree of Voiceless (DUV)
2. Number of unvoiced segments (NUV)

VII. Noise related measures

1. Noise to harmonic ratio (NHR)
2. Voice turbulence index (VTI)
3. Soft phonation index (SPI)

VIII. Tremor related measures

1. F_0 tremor intensity index (FTRI)
2. Amplitude tremor intensity index (ATRI)
3. F_0 tremor frequency (Fftr)
4. Amplitude tremor frequency (Fatr)

The following 6 parameters were noted for speaking and reading:

1. Average fundamental frequency (F_0)
2. Average pitch period (T_0)
3. Highest fundamental frequency (F_{hi})
4. Lowest fundamental frequency (F_{lo})
5. Standard deviation of fundamental frequency (STD)
6. Degree of voice breaks (DVB)

Dr. Speech: Only the phonation samples were subjected to the quality assessment.

The signals were line fed using 44100 Hz sampling rate. The quality was rated as Normal, Slight, Moderate, and Extreme under each of the following,

- Harsh
- Hoarse
- Breathy

Statistics: The acoustic data was subjected to statistical analysis using the software SPSS version 10.

RESULTS

The present study aimed at finding the differential effects of vocal demands on voice characteristics of primary and secondary school teachers.

QUESTIONNAIRE ANALYSIS:

The questionnaire consisted of 41 questions, drawn from the following four categories:

- I. General information and classroom conditions (13 questions)
- II. Life style (9 questions)
- III. Vocal habits (6 questions)
- IV. Symptoms exhibited (13 questions)

Some of the questions in the first section required detail answers and hence were not considered for estimation. Responses to questions in the last three sections were averaged and percentages obtained for both primary and secondary teachers. When both the groups were compared, the following results were observed:

I. General information and Classroom conditions:

- The numbers of students were more in classes of secondary teachers than primary teachers.
- Secondary school teachers had more years of teaching experience than primary teachers but the primary school teachers taught for more number of hours when compared to secondary teachers.

- Classroom conditions were quiet according to 53.8% of primary and 78.6% secondary school teachers respectively. Remaining of the teachers opined that they taught in noisy conditions.
- 84.6% of the primary school teachers used black board compared to 100% secondary school teachers.
- 35.7% of secondary and 38.85 % of primary school teachers respectively, reported that the surrounding noise did not disturb their teaching while it disturbed the rest of the teachers.
- 35.7% of secondary school teachers and 53.8% primary teachers reported that they did not indulge in throat clearing whereas rest of the teachers indulged in throat clearing.
- Histories of URT infections were present in 61.5% primary and 71.4% secondary school teachers respectively.

II. Life style:

- 56.4% of primary and 59.7% of secondary school teachers reported that they did not indulge in vocal abuse and excess vocal usage. But 9.4% of primary and 15.8% of secondary school teachers revealed that they indulged in such habits always.

III. Vocal habits:

- 47.4% of primary and 63.1% secondary school teachers reported that they did not exhibit any vocally abusive behaviors as per this section. 2.5% primary and 1.1% secondary school teachers opined that they exhibited vocally abusive

behaviors always, the remaining subjects reported of such behaviors either occasionally or frequently.

IV. Symptoms exhibited:

- 55.7% primary and 64.8% secondary school teachers opined that they did not suffer from any voice related symptoms, 3.2% primary and 1.7% secondary school teachers accepted that they always exhibited such symptoms.

OBJECTIVE ANALYSIS:

I. Acoustic and aerodynamic parameters:

The statistical analysis was carried out using the software, SPSS version 10. Descriptive statistics and independent sample 't' test for significance was performed. The results have been presented in tables in the subsequent paragraphs.

Table 1: Mean, SD and 't' values for the acoustic parameters and vital capacity for phonation of /a/ in male teachers.

<i>Parameters</i>	<i>Teachers</i>	<i>/a/</i>		
		<i>Mean</i>	<i>SD</i>	<i>t</i>
<i>Fo</i>	Pri	120.03	20.53	1.05
	Sec	141.12	35.14	
<i>To</i>	Pri	8.75	1.21	1.40
	Sec	7.36	1.63	
<i>Fhi</i>	Pri	117.9	14.36	1.80
	Sec	152.9	36.08	
<i>Flo</i>	Pri	111.4	13.10	1.18
	Sec	129.67	28.34	
<i>STD</i>	Pri	2.01	0.37	0.61
	Sec	2.40	1.19	
<i>Fftr</i>	Pri	3.34	1.67	1.09
	Sec	2.32	1.14	
<i>Fatr</i>	Pri	4.88	3.52	0.47
	Sec	6.25	4.14	
<i>Jita</i>	Pri	132.42	40.04	1.76
	Sec	82.01	44.38	
<i>Jitt</i>	Pri	1.36	0.8	0.58
	Sec	1.09	0.59	
<i>RAP</i>	Pri	1.06	0.39	1.58
	Sec	0.63	0.39	
<i>PPQ</i>	Pri	0.87	0.29	1.22
	Sec	0.62	0.32	
<i>sPPQ</i>	Pri	1.09	0.10	0.23
	Sec	1.03	0.52	
<i>vF₀</i>	Pri	1.44	0.17	0.60
	Sec	1.70	0.85	
<i>ShdB</i>	Pri	0.55	0.54	1.93
	Sec	9.40	3.36	
<i>Shim</i>	Pri	0.88	0.59	0.73
	Sec	1.11	0.32	
<i>APQ</i>	Pri	0.74	0.12	0.14
	Sec	0.77	0.28	
<i>sAPQ</i>	Pri	1.10	0.67	0.43
	Sec	0.95	0.38	
<i>vAm</i>	Pri	1.56	0.81	1.09
	Sec	2.50	1.53	
<i>NHR</i>	Pri	0.40	0.52	0.76
	Sec	0.22	0.10	

<i>Parameters</i>	<i>Teachers</i>	<i>/a/</i>		
		<i>Mean</i>	<i>SD</i>	
<i>VTI</i>	Pri	0.30	0.49	1.04
	Sec	7.80	1.92	
<i>SPI</i>	Pri	6.28	1.25	2.02
	Sec	4.54	1.30	
<i>FTRI</i>	Pri	0.67	0.51	0.008
	Sec	0.88	0.43	
<i>ATRI</i>	Pri	0.86	0.88	0.58
	Sec	0.60	0.42	
<i>DVB</i>	Pri	0	0	-
	Sec	0	0	
<i>DSH</i>	Pri	0	0	0.88
	Sec	1.26	2.81	
<i>DUV</i>	Pri	0	0	0.88
	Sec	10.74	24.01	
<i>NVB</i>	Pri	0	0	-
	Sec	0	0	
<i>NSH</i>	Pri	0	0	0.88
	Sec	1	2.23	
<i>NUV</i>	Pri	0	0	0.88
	Sec	15.80	35.3	
<i>NNE</i>	Pri	13.36	7.48	0.29
	Sec	12.10	5.57	
<i>Vital capacity</i>	Pri	2.84	1.07	0.23
	Sec	2.98	0.73	

It can be observed from Table-1 that the mean values for fundamental frequency information related parameters- Fo, STD, Fhi, Flo; Short and long term amplitude perturbation measures- ShdB, Shim, APQ, and vAm; Sub harmonic component related measures- DSH and NSH and Voice irregularity related measures- DUV and NUV were higher in secondary school male teachers but the same were not statistically significant.

Increased mean values were noticed for Short and long term frequency perturbation measures: Jita, Jitt, RAP, PPQ, and sPPQ, Noise related measures: NHR and SPI and NNE in primary school male teachers and significance was absent.

Though the mean value of vital capacity was higher in secondary school male teachers, it was not significant.

Table 2: Mean, SD and 't' values for the acoustic parameters for reading and speaking in male teachers.

<i>Parameters</i>	<i>School</i>	<i>Reading</i>			<i>Speaking</i>		
		<i>Mean</i>	<i>SD</i>	<i>t-Value</i>	<i>Mean</i>	<i>SD</i>	<i>t-Value</i>
<i>Fo</i>	Pri	150.07	36.01	0.26	139.05	46.49	0.58
	Sec	156.89	39.12		156.43	43.27	
<i>To</i>	Pri	6.61	1.77	0.28	7.21	2.29	0.13
	Sec	6.96	1.80		7.02	1.85	
<i>Fhi</i>	Pri	262.71	218.04	0.83	357.73	222.75	0.01
	Sec	365.30	152.95		355.88	196.95	
<i>Flo</i>	Pri	113.62	22.75	0.76	106.48	24.09	2.03
	Sec	103.37	17.59		72.98	24.95	
<i>STD</i>	Pri	30.55	44.63	0.12	16.94	13.12	1.31
	Sec	28.08	12.71		29.94	15.79	
<i>DVB</i>	Pri	37.49	18.62	1.83	42.59	8.66	2.85*
	Sec	19.31	10.97		24.59	9.90	

* Depicts significance $p < 0.05$

Table-2 reveals that the mean values for fundamental frequency information related parameters- F_o , T_o and F_{hi} were higher in secondary school male teachers but not statistically significant for reading. T_o , F_{hi} , F_{lo} and DVB had increased mean values for speaking in primary male teachers. However, a significant difference was noticed for DVB only in speaking task in primary male teachers.

Table 3: Mean, SD and 't' values for the acoustic parameters and vital capacity for phonation of /a/ in female teachers.

<i>Parameters</i>	<i>Teachers</i>	<i>/a/</i>		
		<i>Mean</i>	<i>SD</i>	<i>t-</i>
<i>Fo</i>	Pri	234.28	21.79	4.24*
	Sec	189.87	22.54	
<i>To</i>	Pri	4.15	0.63	3.58*
	Sec	5.26	0.68	
<i>Fhi</i>	Pri	253.68	27.84	0.31
	Sec	246.87	57.88	
<i>Flo</i>	Pri	222.29	20.86	3.51*
	Sec	159.81	49.14	
<i>STD</i>	Pri	3.77	1.66	1.24
	Sec	6.23	5.68	
<i>Fftr</i>	Pri	4.80	4.34	0.80
	Sec	3.26	1.78	
<i>Fatr</i>	Pri	4.83	2.06	0.41
	Sec	6.27	6.67	
<i>Jita</i>	Pri	53.79	32.68	1.59
	Sec	125.25	130.23	
<i>Jitt</i>	Pri	1.21	0.79	1.29
	Sec	2.26	2.31	
<i>RAP</i>	Pri	.74	0.46	1.19
	Sec	1.30	1.33	
<i>PPQ</i>	Pri	0.72	0.45	1.28
	Sec	1.37	1.47	
<i>sPPQ</i>	Pri	0.90	0.38	1.40
	Sec	1.53	1.29	
<i>vFo</i>	Pri	1.60	0.72	1.63
	Sec	3.37	3.18	
<i>ShdB</i>	Pri	0.23	0.24	0.56
	Sec	0.30	0.29	
<i>Shim</i>	Pri	1.76	1.08	1.21
	Sec	3.11	3.16	
<i>APQ</i>	Pri	1.27	0.79	1.24
	Sec	2.30	2.33	
<i>sAPQ</i>	Pri	1.54	0.92	1.34
	Sec	3.62	4.56	
<i>vAm</i>	Pri	3.51	3.19	1.74
	Sec	9.63	10.03	
<i>NHR</i>	Pri	0.14	6.30	1.04
	Sec	1.07	2.67	

<i>Parameters</i>	<i>Teachers</i>	<i>/a/</i>		
		<i>Mean</i>	<i>SD</i>	<i>t</i>
<i>VTI</i>	Pri	7.11	4.75	0.57
	Sec	6.11	2.14	
<i>SPI</i>	Pri	6.95	6.32	9.37
	Sec	11.00	11.3	
<i>FTRI</i>	Pri	0.39	0.35	1.55
	Sec	0.82	0.74	
<i>ATRI</i>	Pri	0.68	0.79	0.76
	Sec	1.43	2.52	
<i>DVB</i>	Pri	0	0	1.42
	Sec	0.93	1.96	
<i>DSH</i>	Pri	0.34	1.04	1.12
	Sec	1.40	2.61	
<i>DUV</i>	Pri	0	0	2.01
	Sec	10.51	15.63	
<i>NVB</i>	Pri	0	0	1.51
	Sec	0.22	0.44	
<i>NSH</i>	Pri	0.11	0.33	1.65
	Sec	1.22	1.98	
<i>NUV</i>	Pri	0	0	1.79
	Sec	11.66	19.45	
<i>NNE</i>	Pri	14.11	4.66	2.09
	Sec	8.8	5.98	
<i>Vital capacity</i>	Pri	2.58	0.47	1.95
	Sec	2.00	0.76	

* Depicts significance $p < 0.05$

The mean values for fundamental frequency information related parameters- F_0 , F_{hi} , and F_{lo} were higher in primary school female teachers but statistical significance was present for F_0 and F_{lo} . But a significantly higher mean T_0 was noticed in secondary female teachers, Table-3.

Short and long term amplitude perturbation measures- $ShdB$, $Shim$, APQ , and vAm ; Sub harmonic component related measures- DSH and NSH and Voice

irregularity related measures- DUV and NUV were higher in secondary school female teachers but the same were not statistically significant.

Increased mean values were noticed for Short and long term frequency perturbation measures: Jita, Jitt, RAP, PPQ, and sPPQ, Noise related measures: NHR and SPI in secondary school female teachers and significance was absent.

The mean values for vital capacity was more in primary school teachers but significance was not present.

Table 4: Mean, SD and 't' values for the acoustic parameters for reading and speaking in females.

<i>Parameters</i>	<i>School</i>	<i>Reading</i>			<i>Speaking</i>		
		<i>Mean</i>	<i>SD</i>	<i>t-Value</i>	<i>Mean</i>	<i>SD</i>	<i>t-Value</i>
<i>F_o</i>	Pri	237.57	23.13	3.88*	244.54	19.91	3.62*
	Sec	200.49	16.84		185.94	44.28	
<i>T_o</i>	Pri	4.56	1.12	1.50	4.59	1.26	1.44
	Sec	5.17	0.49		5.50	1.41	
<i>F_{hi}</i>	Pri	409.60	103.58	0.88	386.21	189.65	0.66
	Sec	353.43	159.39		339.47	95.18	
<i>F_{lo}</i>	Pri	150.45	36.79	0.24*	164.52	68.27	1.26
	Sec	109.13	41.22		131.89	36.75	
<i>STD</i>	Pri	32.47	14.28	0.86	61.04	83.78	1.17
	Sec	38.89	16.96		27.81	14.81	
<i>DVB</i>	Pri	38.63	15.71	0.61	46.12	21.17	1.09
	Sec	34.07	15.59		34.83	22.67	

* Depicts significance $p < 0.05$

Table- 4 depicts that the mean values for fundamental frequency information related parameters- F_o , F_{hi} , F_{lo} and DVB were higher in primary school female teachers and F_o and F_{lo} were statistically significant for reading. F_o , F_{hi} , F_{lo} , and STD

were higher in primary school female teachers statistically significance was noticed only for F_0 .

II. Dr. Speech: -

Out of 14 secondary school teachers, 12 teachers were found to have deviant quality, that is, either combination of hoarse/ harsh/ breathy or all the three. In primary school teachers 9 out of 13 showed deviant voice quality.

III. Noise measurements: -

Table 5: Range of background noise levels in primary and secondary school classrooms.

School	Minimum noise level	Maximum noise level
Primary	78.6 dBSPL	88.7 dBSPL
Secondary	75.2 dBSPL	82.3 dBSPL

The existing background noise levels in the primary grade classrooms ranged from 78.6 dBSPL to 88.7 dBSPL and in secondary grades the existing noise range was 75.2 dBSPL to 82.3 dBSPL (Table 5). Though the noise levels in primary grade classes were higher than the secondary grade classes, there was no significance difference noticed.

DISCUSSION

The results in general revealed that the secondary school teachers showed increased values for most of the voice parameters, especially F_0 related and frequency perturbation measures. When subjective information was correlated with objective measures, it could be speculated that the secondary schoolteachers experienced excess vocal loading. The following factors could have contributed to increased vocal load or demand,

- Majority of secondary school teachers were disturbed by surrounding noise while teaching in the class,
- Most of the secondary school teachers suffered from URTI,
- They also indulged in frequent throat clearing,
- They had longer duration of teaching experience,
- Also the number of students were reported to be higher in secondary school teachers' classroom thus increasing the vocal effort of the teacher in being heard by students,
- Most of the secondary teachers were in their middle ages. Calas, Lecoq, Dalleas, and Seihean (1989) reported that 67% of the teachers with voice problems were aged between 31 and 50 years.

Stample, Stanley and Lee (as cited in Rantala, Vilkmán, & Bloigu, 2002) reported that weakness of the thyroarytenoid muscle consequent to vocal loading causes increased mean F_0 . When the muscular layer of the thyroarytenoid slacken

resulting in stiffness of the cover and transition layers of the vocal folds, it leads to an increase in F_0 . According to Rantala, Vilkman, and Bloigu (2002) the compensatory reactions of the speakers alter the mucosa resulting in increased vocal fold vibration and glottal adductory forces (hyperfunction). Stemple, Stanley and Lee (as cited in Rantala, Vilkman, & Bloigu, 2002) stated that even two-hour of voice loading resulted in increased F_0 . These studies lend support to the findings of the present study wherein majority of frequency and its related parameters showed increased values.

Further, primary school teachers were younger, had few years of teaching experience, less number of students in their classes and these factors could have lessened the vocal load inspite of teaching for more number of hours per day in a relatively high background noise levels.

The findings of the present study cannot be generalized to all teachers because some individuals are neither sensitive to symptoms of vocal fatigue nor familiar with describing them. Therefore more number of subjects need to be assessed to confirm the findings.

SUMMARY AND CONCLUSION

Researchers have found that voice is exposed to various loading factors in teaching profession and teachers are found to be at high risk for voice problems. The main purpose of the present study was to open up new perspective towards the phenomenon of voice loading and fatigue and differences in voice characteristics in primary and secondary school teachers. The other purpose of the study was to understand the relationship between existing background noise in classrooms and teachers' teaching voice level, and also provide the data about the relationship of noise and teacher's vocal problems.

The nature of the present study was explorative rather than confirmative. The present study was a combination of a self-appraisal (questionnaire) and objective (aerodynamic, acoustic, noise measurement) methods. A questionnaire was devised assessing subjective opinions of teachers. A total of 27 teachers in the age range of 20 to 50 years from different schools of Mysore city with a minimum of 2 years of teaching experience were selected. Acoustic analysis was done using MDVP and Dr. Speech software and noise measurement was carried out in the respective classes of the subjects.

The most distinct result of the study was that secondary school teachers showed increased values in most of the parameters indicating greater vocal load through the same were not significant. Also 12 out of 14 secondary school teachers had deviant voice quality, whereas 9 out of 13 primary school teachers showed deviant voice

quality. The background noise levels in primary schools were found to be more than secondary schools though significant difference was not present. Since significant correlation could not be obtained between classroom noise level and teachers' teaching voice level it cannot be stated conclusively that the teaching environment is a major factor for increased vocal effort in these teachers.

Implications:

- Similar study can be done on a larger population.
- Norms could be developed for the questionnaire and then used in clinics regularly.
- The questionnaire can be used as High Risk Register for Voice to detect teachers who are at risk for developing voice problems.

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APPENDIX

Department of Speech-Language Sciences

Name: _____ Education: _____
Age/sex: _____ Marital status: Married/ Unmarried
Family setup: Joint / Nuclear
Address: _____
Personal: _____ School: _____

Instruction:

Section A: Answer in detail to the question no. 1 to 10.

Section B, C, and D: Indicate your choice by (V) ticking against the numbers. Each of the numbers refers to:

0: No	1: Occasionally
2: Frequently	3: Always

SECTION A: *Classroom condition & General information*

- 1) How many students are there in your class?
- 2) Do you teach primary or secondary grade classes?
- 3) Where is your school located—Noisy environment / Quite environment?
- 4) Since how long you are working as a teacher?
- 5) Mention the subjects you teach?
- 6) Did you change your teaching subjects?
- 7) What is the maximum number of hours you teach regularly?
- 8) What is the minimum number of hours you teach regularly?
- 9) Do you have history of ear infections or hearing problem?
- 10) Do you use black board or white board? Specify.

- 11) Do you suffer from frequent upper respiratory infections?
 0 1 2 3
- 12) Does surrounding noise disturb you during teaching?
 0 1 2 3
- 13) Do you clear your throat while teaching?
 0 1 2 3

SECTION B: *Life style*

- 14) Do you indulge in long continuous chat?
 0 1 2 3
- 15) Do you eat spicy or hot food?
 0 1 2 3
- 16) Do you live in noisy environment?
 0 1 2 3
- 17) Do you live in dusty environment?
 0 1 2 3
- 18) Do you smoke?
 0 1 2 3
- 19) Do you consume alcohol?
 0 1 2 3
- 20) Do you take tuition or teach your own children?
 0 1 2 3

If yes, for how many hours-

- 21) Do you indulge in any of the following -

Indicate the number of hours against your choice/s.

- Lecturing
- Chanting
- Announcement
- Singing
- Cheering

0 1 2 3

- 22) Do you use voice to discipline children at home?

0 1 2 3

SECTION C: *Vocal habits*

23) Do you indulge in loud talking?

0 1 2 3

24) Do you indulge in screaming or shouting in classroom?

0 1 2 3

25) Do you indulge in screaming or shouting at home?

0 1 2 3

26) Do you clear your throat frequently?

0 1 2 3

27) Do you have habit of singing loudly?

0 1 2 3

28) Do you practice any vocal exercises to project/improve your voice?

0 1 2 3

Specify.....

SECTION D: *Symptoms exhibited*

29) Does your voice tire very soon?

0 1 2 3

30) Do you perceive roughness in your voice?

0 1 2 3

31) Do you experience sensations like pain, soreness / irritation or lump in throat?

0 1 2 3

32) Do you use any solutions, salt water, mint, etc. to relieve your throat?

0 1 2 3

Specify.....

33) Do you feel that you have better voice in the mornings or evenings? Specify.

0 1 2 3

34) Do you feel difficulty in raising your voice (increase the loudness)?

0 1 2 3

35) Do you experience episodes of loss of voice/ voice breaks while speaking?

0 1 2 3

36) Have you under gone any of the following operations-?

- a. Thyroidectomy
- b. Adenoidectomy
- c. Tonsillectomy
- d. Others

If yes, did you notice any voice change after the operation?

0 1 2 3

37) Do you have sensation of dryness in your throat?

0 1 2 3

38) Are you allergic to A/C, dust/medicine? Specify-

0 1 2 3

39) Do you feel that your voice is influenced by any of the following medical problems and or subsequent medication?

- (a) Diabetes (b) High blood pressure (c) Others

0 1 2 3

40) Do you suffer from anxiety, mental tension or stress?

0 1 2 3

41) Comments about yourself: