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The Effect of Sound Field Amplification Systems on Vocal Dose in Teachers

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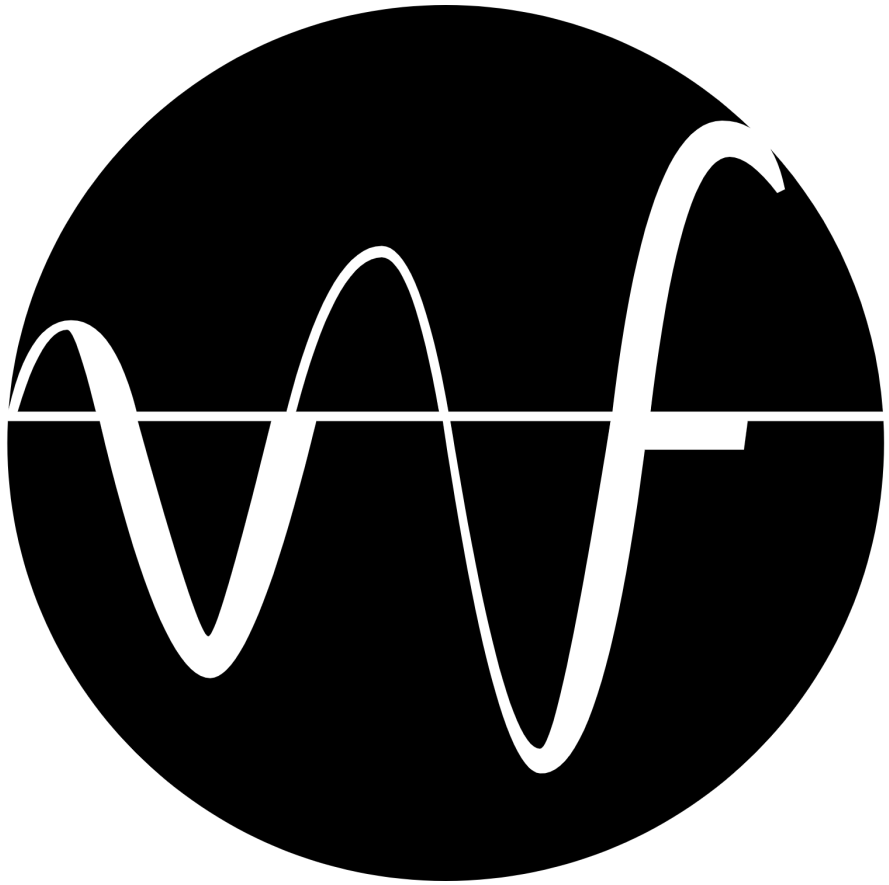


SPEAKER DISCLOSURE

Baiba Trinite,

Dina Barute

We have no Relevant Financial/Non-Financial Relationships and no actual or potential conflict of interest in relation to this program

Introduction

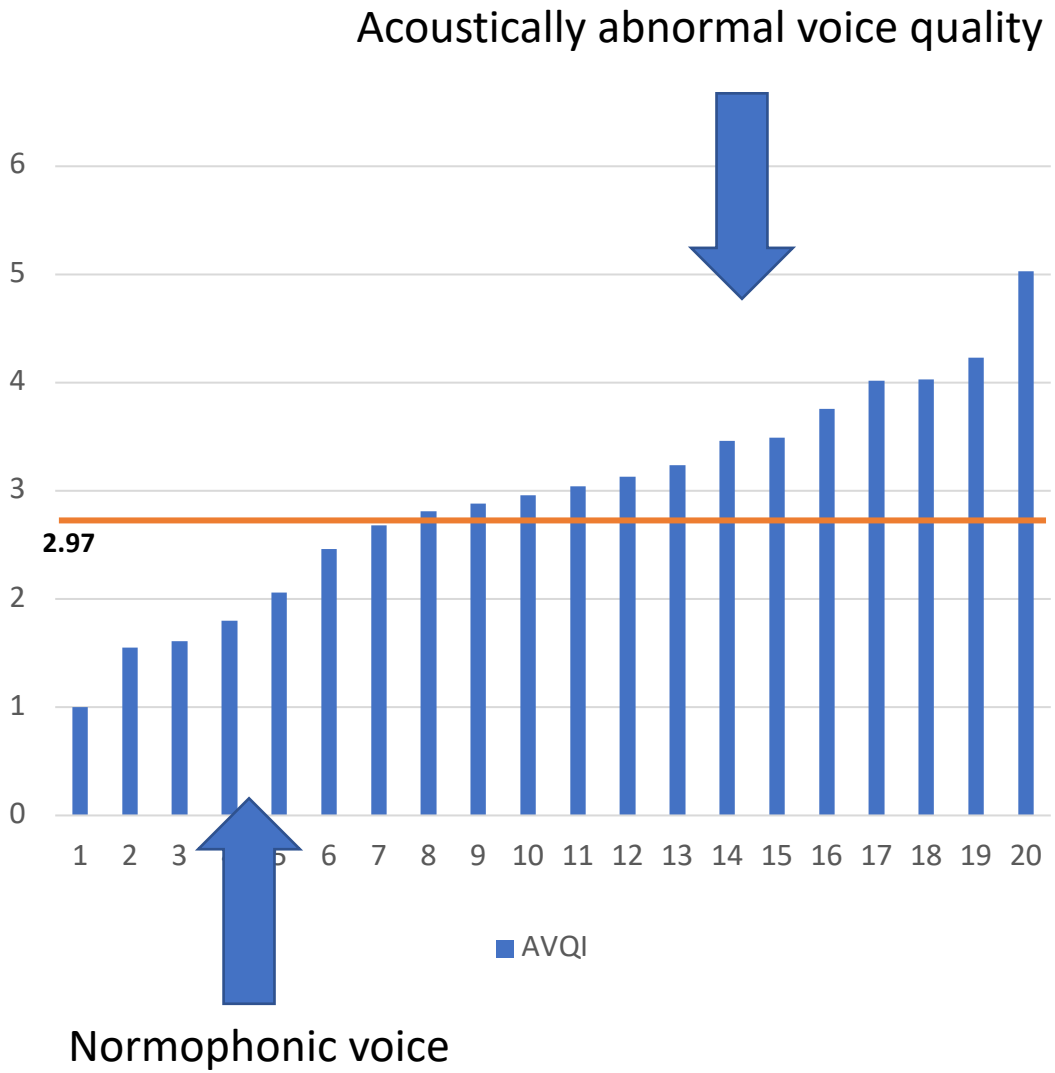
- High vocal demand response is one of the most common etiological factors of teachers' voice disorders
- The use of voice amplification systems in classrooms is one way to decrease vocal demand response in teachers and improve their vocal health (Sala & Rantala, 2019)
- There are not many evidences confirming the impact of speech amplification systems on change of vocal parameters and following vocal demand response, especially in teachers with different acoustical voice quality (Assad et al., 2019; Gaskill et al., 2012; Morrow & Connor, 2011)

The aim of the study

To find out an impact of sound field amplification systems on vocal parameters in teachers during lessons

Study participants

- Female teachers (N = 20)
  - Age: M = 49.9 (6.7), 38-62
  - Years in teachers' profession:
    M = 23.9 (9.0), 8-38
  - Elementary and high school
  - No music and sport teachers
- AVQI (PRAAT)
  - M = 3.07 (0.96), 1.00-5.03
- Laryngoscopy
  - Initial vocal nodules (n = 7)



Methods

Voice dosimetry
VHM (PR.O.Voice S.r.l.)

Lessons

No SFAS

1-2 days (M = 1.3)
Total dosimetry duration: 75 h 52 min
Average dosimetry/teacher: 228 (135) min.

SFAS
PentaClass Runa (Certes, Latvia)

1-3 days (M = 1.7)
Total dosimetry duration: 84 h 14 min
Average dosimetry/teacher: 253 (144) min.

($t(19) = -0.618$, $P = 0.272$)

Methods

Obtained parameters

- Phonation time ($D_{t\%}$)
- Voice intensity (SPL, dB)
- Fundamental frequency (F_0, Hz)
- Background noise level (L_{AF90}, dB)

Calculated parameters (Švec, Popolo, & Titze, 2003)

- Cycle dose (D_c)
  - $D_c = \int_0^{t_m} k_v F_0 \, dt \quad cycles$
- Distance dose (D_d)
  - $D_d = 4 \int_0^{t_m} k_v \, AF_0 \, dt \quad meters$

Results

Mean values, standard deviations, range and difference of means for vocal parameters in teachers in classrooms with and without amplification (Wilcoxon signed-rank test)

Vocal parameters	No SFAS		SFAS		*MD*	*Z*	*P*
	M (SD)	Range	M (SD)	Range			
D_t (%)	31.6 (17.2)	1-98	27.5 (15.0)	1-99	-4.1	-4.605	< 0.001
$SPL_{@1m}$ (dB)	62.6 (3.1)	55.8-69.2	62.0 (3.1)	53.2-71.0	-0.6	-7.550	< 0.001
F_0 (Hz)	214.1 (26.9)	143.7-287.6	210.2 (23.0)	139.5-380.6	-3.9	-11.747	< 0.001
D_c (kcycle)*	4.2 (2.3)	0.1-12.3	3.5 (1.9)	0.1-12.9	-0.7	-7.264	< 0.001
Dd (m)*	12.0 (6.5)	0.3-31.2	9.9 (5.4)	0.2-29.9	-2.1	-8.155	< 0.001

SFAS – sound field amplification system
MD – difference of means
* per minute

Results, cont.

Correlation coefficients between AVQI and voicing time percentage ($D_{t\%.}$), vocal intensity ($SPL_{@1m}$), fundamental frequency (F_0), cycle dose ($Dc_{\_1\ min}$), and distance dose ($Dd_{\_1\ min}$) in two acoustical conditions

Vocal parameter	AVQI	
	No SFAS	SFAS
D_t (%)	-.092**	NS
$SPL_{@1m}$ (dB)	.590**	.356**
F_0 (Hz)	-.187**	-.201**
D_c (kcycle)	-.107**	NS
Dd (m)	NS	.100**

$P \leq .001$ (Spearmen's Correlation)

Conclusions

- Voice amplification significantly decreased SPL, F_0, $D_{t\%}$, D_c, and D_d in teachers
- Voice amplification created conditions that changed the teachers' vocal parameters and reduced vocal demand response to satisfy communication requirements
- The impact of SFAS on vocal demand response could be different in teachers with different acoustical voice quality therefore this aspect should be investigated in the future

Thank you for the attention!

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