

Voice complaints for physical education teachers and class teachers

The Voice Handicap Index used to examine the voice related quality of life compared among two types of teachers

Lisette Planjer

Supervisor: Prof. Dr. P.H. Dejonckere

Abstract

Introduction: Due to different internal and external causes teachers seem to be at higher risk to develop a voice problem than the general population and other professional voice users. Because previous research can give no definite answer to the question if pe teachers are more prone to develop voice problems than traditional class teachers further research is needed on this subject. The aim of this study is to examine the voice related quality of life for class teachers and teachers in Physical Education (pe).

Method: The voice related quality of life will be measured using the Voice Handicap Index, a questionnaire of 30 propositions. This questionnaire is filled out by 41 class teachers and 62 physical education teachers.

Results: The median VHI score of the class teacher was 8,0 and of the pe teachers 9,5. When performing a Mann-Whitney test with this results no significant difference between both types of teachers is found $p=0.167$. No significant difference for gender is found (pe teacher $p=0.17$; class teachers $p=0.06$)

Conclusion: There is no significant difference in the voice related quality of life between the class teachers and the pe teachers.

Keywords:

Voice Handicap Index (VHI) * teachers * Voice related quality of life * Occupational voice complaints

Introduction

In some occupations voice is the primary tool of trade. Voice professionals often use their voice more intensively than the normal population, and are at risk for occupational voice disorders.

Occupational voice problems

De Jong et al. (2003) describe four different types of causes for occupational voice problems. The problems can be due to physical, functional, psychological and environmental factors. Which factor(s) caused the problem is important to know for further therapy. If you treat the physical factor but the problem is also due to the psychological factor the therapy might not be as effective as possible (de Jong et al., 2003). De Jong et al. (2003) propose that after treatment of the physical and functional factors, and if the problem could not be solved with this therapy, the psychological and environmental factors should be considered and possibly treated.

Voice problems can imply complaints and symptoms like vocal fatigue, hoarseness, voice weakness and an abnormal throat sensation during speech (Mattiske et al., 1998), as well as vocal fold lesions particularly vocal fold nodules. These problems can cause personal, social and economic problems for example a long time of work absenteeism or even losing a job as teacher because of the voice problems (Mattiske et al., 1998).

Voice problems of teachers

Voice problems seem to be a common problem for teachers. Kooijman (2006) found that more than 50% of the Dutch teachers have or had a voice problem and in 20% of the cases these problems lead to a sickness absence from at least three days. The voice problems can be due to internal causes or external causes. Some possible internal causes are, a weak voice (lack of robustness), poor vocal technique, poor hygiene (e.g. smoking), talkative temperament or vocally loading hobbies (Vilkman, 2000). Possible external causes are vocal loading due to duration or intensity, acoustics of the environment, background noise, distance, humidity of the air or stress (Vilkman, 2000). For teachers all of the external causes mentioned can play a role in developing a voice problem but the duration and the intensity are great risk-factors. Different kind of teachers tend to have different risk factors. De Jong et al. (2006) found that secondary school teachers had a lower voice related quality of life compared to the primary school teachers.

De Jong et al. (2006) found that the voice related quality of life for the general population without professional voice use did not significantly differ from that of the professional voice users (teachers excepted). The teachers (primary education and secondary education) score significantly lower on the voice related quality of life compared to the general population with and without professional voice use (De Jong et al., 2006). The general population compared to the general population with professional voice use gave a $p=0.086$, but when these both groups were compared with teachers in primary education and secondary education the following significance levels were reached : $p=0.015$ and $p=0.001$ (De Jong et al., 2006). This might implicate that the risk to develop a voice problem is not only due to the intensive voice use, but that other causes – related to the teaching activity - might influence the risk, such as stress and mental pressure (Kooijman, 2006).

Roy et al. (2004b) found that teachers had more voice problems than non-teachers. Roy et al. (2004b) interviewed by phone 2401 participants (1243 teachers and 1279 non teachers of which 130 were unemployed) and they found - beside that teachers have more voice problems - that they more often say that these voice problems are due to their occupation. The group of teachers was more likely to change profession because of the voice problems (Roy et al., 2004b). On the basis of telephonic interviews Roy et al. (2004a) showed that being a teacher, being a women, having more than sixteen working years in education, being between 40 and 59 years old and a family history of voice problems are all associated with voice problems. These factors might be indicating a bigger chance to develop a voice problem.

Difference between physical education teachers and traditional class teachers

Williams (2003) did a literature study about occupational voice use and concludes that a lot of researchers use generic job titles like “ *teachers* “. In this literature review studies about occupational voice disorders in singers, teachers and aerobics instructors were compared. Williams (2003) only found one article (between 1966 and 2000) that discriminates between different types of teachers (Smith et al. 1998).

Smith et al. (1998) had sent questionnaires to teachers and non-teachers and 554 completed questionnaires from teachers were collected. For the non-teachers 220 completed questionnaires were collected. The questionnaire completed by both groups (teachers and non-teachers) pertained to sociodemographic characteristics, smoking and alcohol use, voice symptoms, frequency of voice problems (acute and chronic), duration of these problems and medical treatment, absenteeism due to voice problems and types of communication problems. For the teachers some additional questions about teaching related activities were asked : The subject or subjects taught, the number of hours in

front of the class, the vocalization needs in the classroom and the types of limitations in teaching activities due to voicing.

Smith et al. (1998) found no course specific voice impairments except for the physical education (pe) teachers.

Thibeault et al. (2004) conducted a telephonic interview with 1243 teachers from Utah and Iowa. Both elementary school and secondary school teachers were questioned. The questionnaires used in this survey included three characteristics, the symptoms, the consequences and the potential risk for voice disorders. For the teachers some additional work-related questions were asked: frequency of vocal activities (singing, talking, loud talking, quiet talking, shouting, yelling and cheering), exposure to chemicals, number of years teaching, grade taught, course taught, working hours in front of the class, teaching environment and duration of the school year.

Thibeault et al. (2004) found that de voice pattern may influence the risk of developing a voice disorder. Teachers of special and vocational education reported more quiet talking and less talking loudly than other teachers and had the lowest risk of developing a voice disorder. The teachers with more vocally demanding classes like vocal music, drama and performing arts were more prone to develop a voice disorder. This implicates that singing might increase the risk of vocal fold tissue injury (Thibeault et al. 2004).

Compared to other types of teachers, pe teachers often talk loudly and are most likely to shout during their classes, so it is vocally demanding. But Thibeault et al. (2004) found no difference in risk of having a voice disorder between pe teachers and teachers of other courses. This is in contrast to the results of Smith et al. (1998). Thibeault et al. (2004) present some possible explanations, it might be because pe teachers may be more likely to use amplification systems. Pe teachers may also have more intense but short periods of voice use, the shouting and yelling might not be all day long, these brief intense periods might be insufficient to increase the risk of vocal fold tissue injury. An other suggestion based on previous research might be that pe teachers are not in front of the class all the time they work, so beside the periods of intensive voice use (during class) there are some periods of voice rest (administration or other non teaching tasks) (Woods & Allen, 1997).

Teachers in the working population

Teachers are quite a big part of the working population in the Netherlands, in 2007 the entire education sector contains 484.400 jobs out of a total working population of 8.610.000 (CBS, 2009b), this is 5,6 percent of the working population. From the 484.400 people working in the education sector 114.000 (CBS, 2009a) work in secondary education. The population of teachers this research focus on is 1,3

percent of the working population. Although no exact percentage of pe teachers is published in secondary education, approximately 7,5 percent of the teachers is pe teacher.

Because previous research can give no definite answer to the question if pe teachers are more prone to develop voice problems than traditional class teachers further research is needed on this subject. Novel research needs to rely upon a validated and quantitative instrument and not only on telephone interviews. If there is a difference, emphasis could be put on prevention.

The aim of this research is to investigate and compare the voice related quality of life for class teachers and pe teachers. An interesting additional group are swimming teachers : they could be compared to pe teachers, but have to cope with more unfavourable environmental conditions (acoustics and irritating effect of chlorine water).

As literature is controversial, in this study the voice handicap index (VHI) is used to compare the amount of complaints dealing with voice related quality of life among basically two different types of teachers. This can be due to difference in circumstances between teachers in different kinds of classes. The first group are the teachers of normal 'traditional' classes where the teacher is standing in front of the class teaching the children in front of them. The second group are the teachers in physical education teaching either in a gymnastics classroom (which is much bigger than a normal classroom) or outside. Swimming teachers form a small separate group.

Material and Methods

Questionnaires

To measure the voice related quality of life the voice handicap index (VHI) is used (Jacobson et al., 1997). This questionnaire is about the subjects perception of his or her own voice use and possibilities. The VHI is a questionnaire with 30 propositions where the subject is requested to check a box in a five point scale on three different categories, physical, emotional and functional. Example 1 shows different propositions in the three different categories. In example 2 the scale used for the score of the propositions is shown.

Example 1: Propositions in the voice handicap index

*Physical

- Example: *I run out of air and need to take frequent breaths when talking.*

*Functional

- Example: *I have trouble speaking loudly or being heard in noisy situations.*

*Emotional

- Example: *I tend to avoid groups of people because of my voice.*

Example 2: scale used in the VHI

Never	Almost never	Sometimes	Almost always	Always

For the answer 'never' a score of zero points and for 'always' four points is given. A total of 120 points can be acquired if all questions are answered with always.

The VHI is primarily intended to examine voice patients, to compare voice patients with a normal population or to compare voice patients pre- and post therapy (Neumann & Dejonckere, 2009). The VHI is also used to compare different groups within the normal population, for example to compare professional voice users with the working population without special voice use (De Jong et al. 2006).

Because the subjects of the current study are Dutch teachers we use the Dutch version of the VHI developed by De Bodt et al. (2001). For this translation ("*lege artis*") the original test was first translated by two speech therapists and by a linguist. Those translations were compared and a native speaker made a back translation. Then the translation is compared with the original VHI by the original authors and some changes are made before it was translated back to the Dutch version. Hakkesteeft et al. (2006) found that the test-retest reliability of the Dutch version of the VHI is good.

Subjects

For this experiment 104 completed questionnaires were collected. One of those was rejected because the teacher was retired at the moment the questionnaire was filled out. After this rejection the

questionnaires of 41 healthy class teachers and 62 healthy pe teachers were available for statistical analysis.

The median age of the class teachers was 44,0, with a median of 16,0 working hours per week and 12,0 working years in education there were 26 male teachers and 15 female teachers.

The pe teachers had a median age of 37,5; 21,0 working hours a week and the average of their years working as a pe teachers was 13,7 there were 25 male pe teachers and 36 female. In table 1 there is a schematic overview of these results.

	Age	Male	Female	Working hours	Working years
Class teachers	44,00	26	15	16,0	12,0
PE teachers	37,5	25	36	21,0	13,7

Table 1: Schematic overview of the characteristics of the class- and the pe teachers

An additional group could be collected of nineteen certificated swimming teachers with a median age of 33, nine male and ten female, their median of working hours per week is 10,0 and their average of working years in this profession is 7 (12,0). This means that this additional group clearly differs (particularly for the amount of working hours per week) from the two other groups.

Analysis

A total of 120 points can be acquired, four points for each proposition. To analyse the results acquired by the VHI a variance analyses should be done.

The results from the 62 pe teachers and the 41 class teachers are not normally distributed, and when performing the Levine's test for the equality of variances a significant difference between both groups is found ($p=0.013$). Thus a non-parametric test was required. This test will be a Mann-Whitney test.

Results

In table 2 the groups statistics of the VHI_{total} shows that the median of the of the pe teachers score on the VHI is 9,5 and for the class teachers the median score is 8,0. These results are made visual in the boxplot in figure 1 were the median of the class teachers is slightly lower than the pe teachers.

Type		N	Median
VHITotal	PE-teachers	62	9,5
	Class teachers	41	8,0

Table 2: The group statistics of the VHI-scores of the pe- and the class teachers

When performing a Mann-Whitney test no significant difference between the pe teachers and the class teachers is found ($p=0.167$).

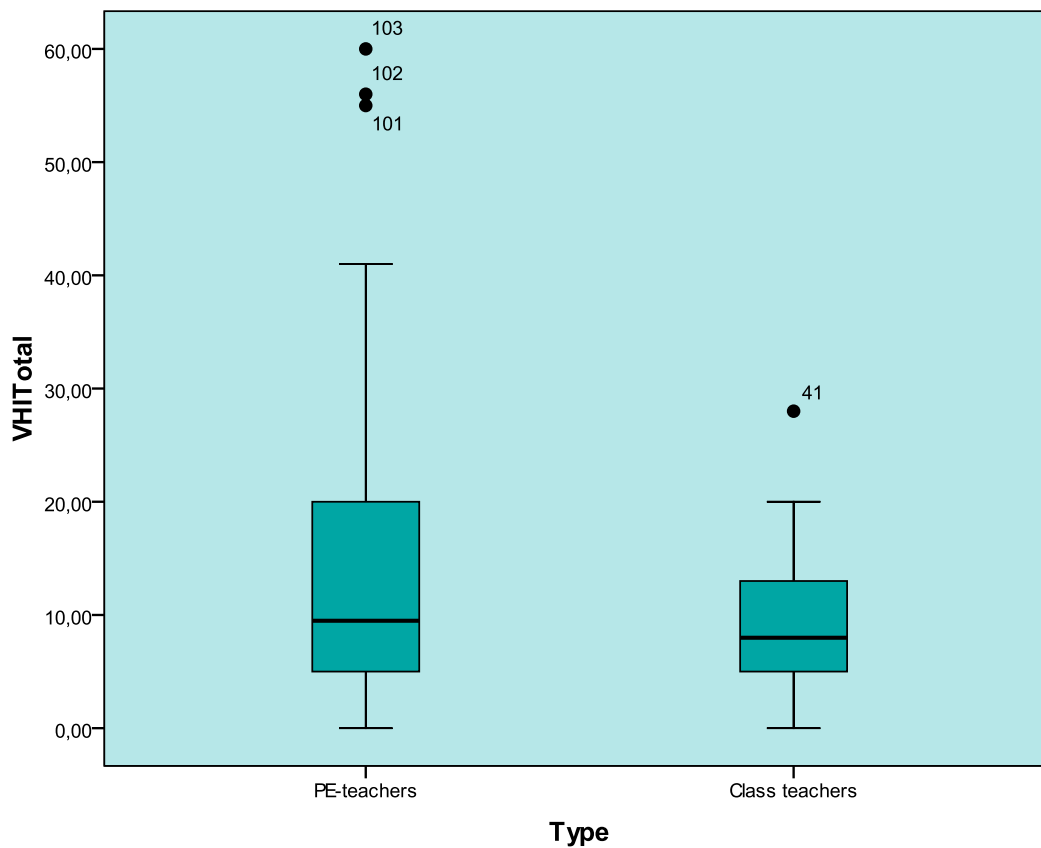


Figure 1: Boxplot of the VHI scores of the pe- and the class teachers

Maertens & de Jong (2007) found a median of 6 points on the VHI Total score. To find out if the distribution from the VHI scores of the class teachers and the pe teachers above and under this median a chi-square test is done. The cross table of this chi-square test is shown in table 3.

Type * Score Crosstabulation

			Score		Total
			≤6	>6	
Type	Pe	Count	21	41	62
		Expected Count	23,5	38,5	62,0
Class	Class	Count	18	23	41
		Expected Count	15,5	25,5	41,0
Total		Count	39	64	103
		Expected Count	39,0	64,0	103,0

Table 3: Cross table of the VHI-scores

With this cross table a chi-square test is performed with a chi-square of 1,056; 1 degree of freedom and $p=0,3$. So no significant difference is found between the distribution of the scores of the pe teachers and the class teachers.

To show the difference in distribution between the pe teachers and the class teachers in the histograms in figure 2 and figure 3.

Histogram

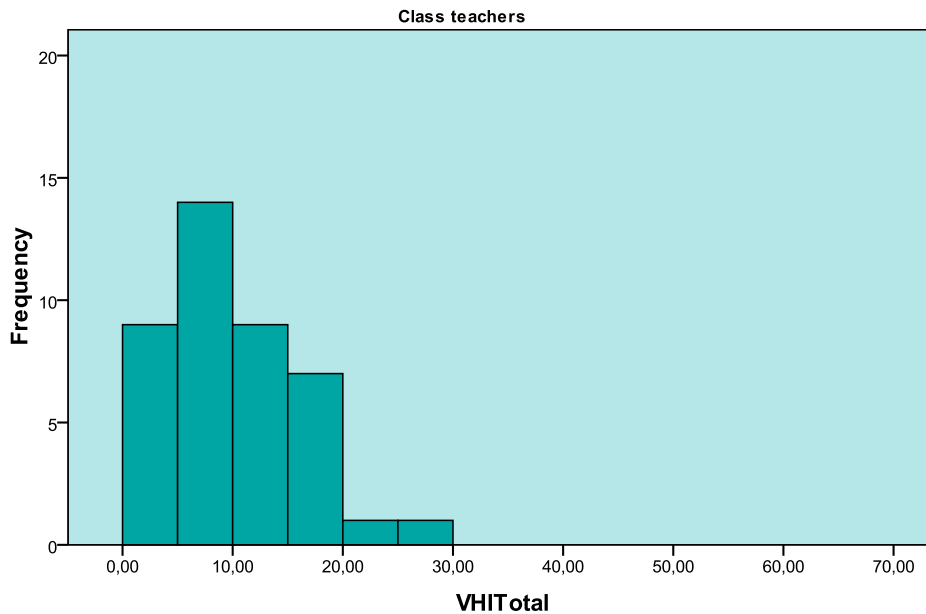


Figure 2: Histogram of the VHI scores class teachers

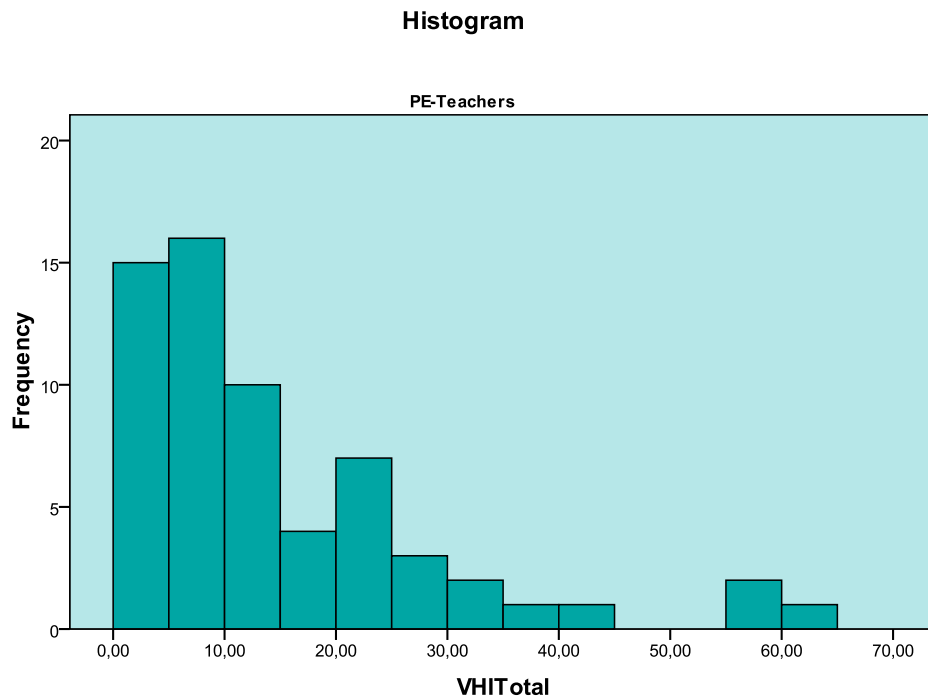


Figure 3: Histogram of the VHI scores the pe teachers

For the pe teachers no significant difference of the VHI-total is found between the male (median 9,0) and the female teachers (median 10,0) ($p=0.17$) The boxplot is in figure 4.

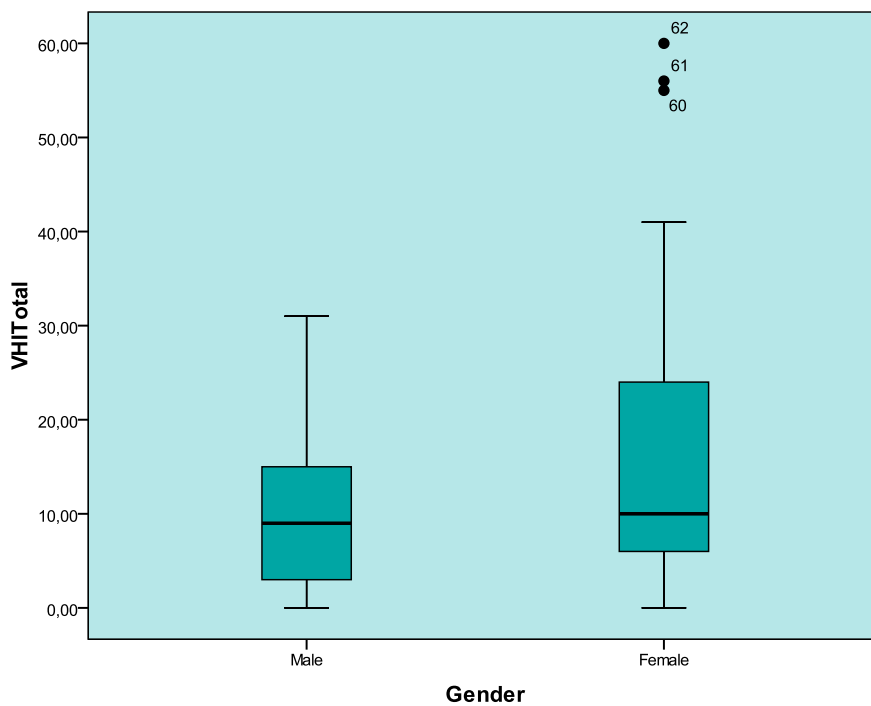


Figure 4: Boxplot of the VHI scores from the male and female pe teachers

For the class teachers no significant difference is found in the VHI-Total scores between male (median 9,5) and female (median 4,0) teachers($p=0.06$). The boxplot of these results are in figure 5.

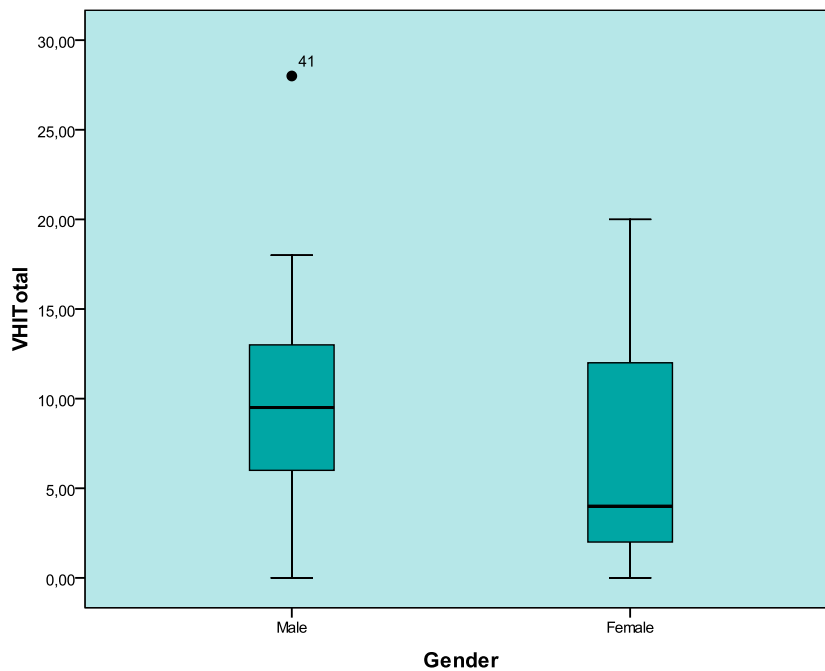


Figure 5: Boxplot of the VHI scores from the male and female class teachers

These results make that the VHI-scores for male and female teachers can be used in the study as a whole group. These findings are in agreement with the results of Maertens & De Jong (2007), they conclude that no significant difference is found in the VHI total score for gender.

No significant difference between the two types of teachers on the smoking habits ($p=0,27$) and vocally loading hobbies ($p=0,09$) is found either.

Besides the difference in gender it is interesting to look at the difference between the three subcategories of questions in the VHI, the emotional, physical and functional subscales.

The median for the pe teachers for the different subscales are emotional 3, physical 2 and functional 4. For the class teachers the median VHI scores on the different subscales are emotional 1, physical 4 and functional 2.

When performing a Kruskal-Wallis analysis with the results for pe teachers no significant difference is reached ($p=0.54$). For the class teachers a significant difference is reached between the scores in the different subscales with a Kruskal-Wallis analysis ($p < .01$). All the subscales are significantly different compared with the Mann-Whitney test, VHI-Functional and VHI-Physical ($p=0.007$), the VHI-Functional

and the VHI-Emotional ($p=0.002$) and the difference between the VHI-Physical and the VHI-Emotional with the Mann-Whitney test ($p < .01$). In the boxplot in figure 6 the results of the different subscales for the class teachers is shown.

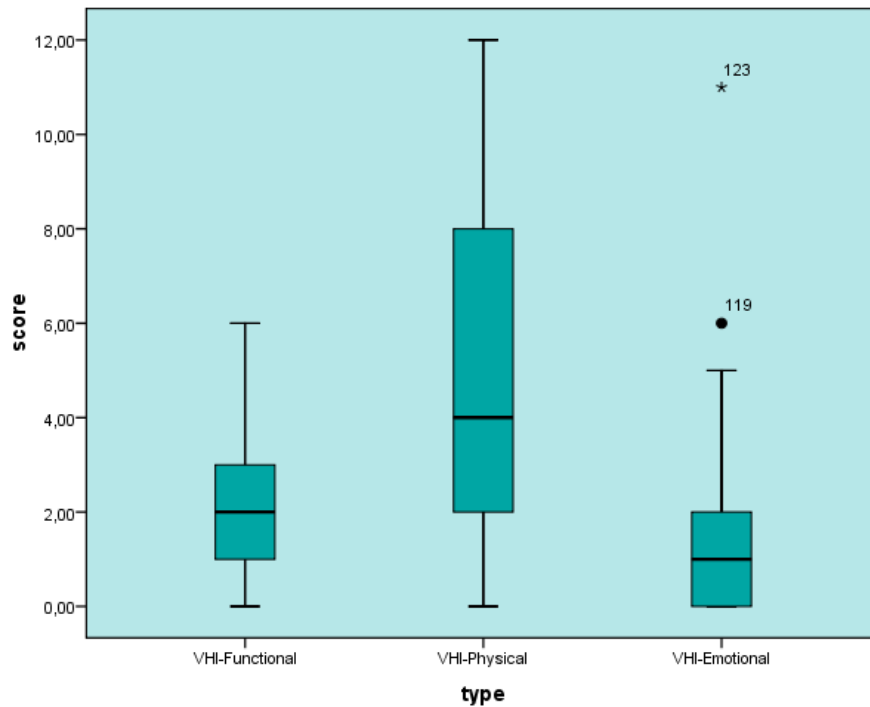


Figure 6: Boxplot of the different subscale VHI scores for class teachers

The results of the total score on the VHI is shown in figure 7 with the extra group of swimming teachers. As seen in the boxplot, the median of the pe teachers (9,5) lays slightly higher than the class teachers (8,0) and the swimming teachers (7,0).

When performing a Kruskal-Wallis test for these results no significant difference is found ($p=0,36$).

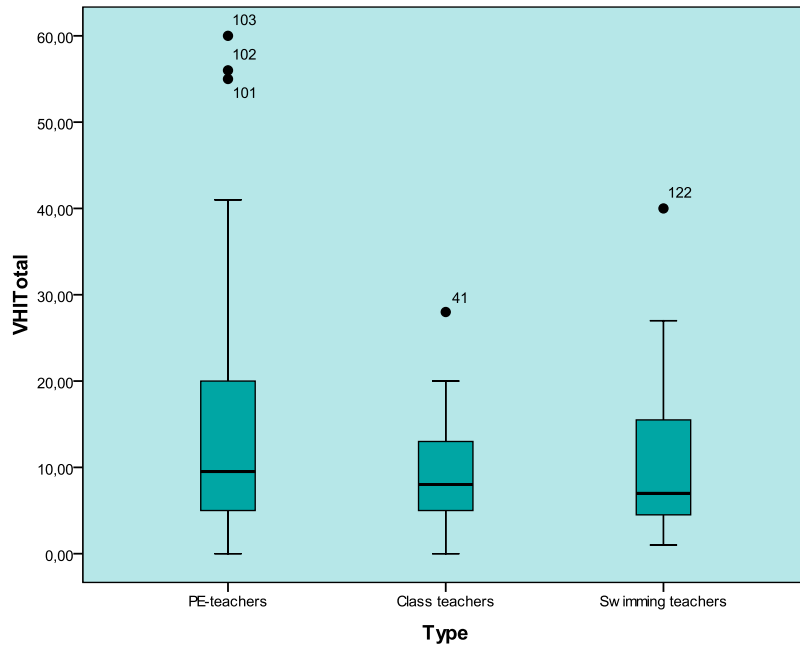


Figure 7: Boxplot of the VHI scores of the pe-, the class and the swimming teachers

The histogram of the distribution of the VHI total for the swimming teachers can be found in figure 8.

For swimming teachers the median total VHI score for men was 7,5 and the median score for women was 7. When performing a Mann-Withney test with these results the significance level was $p=0.6$, so no significant difference was found in on gender for swimming teachers.

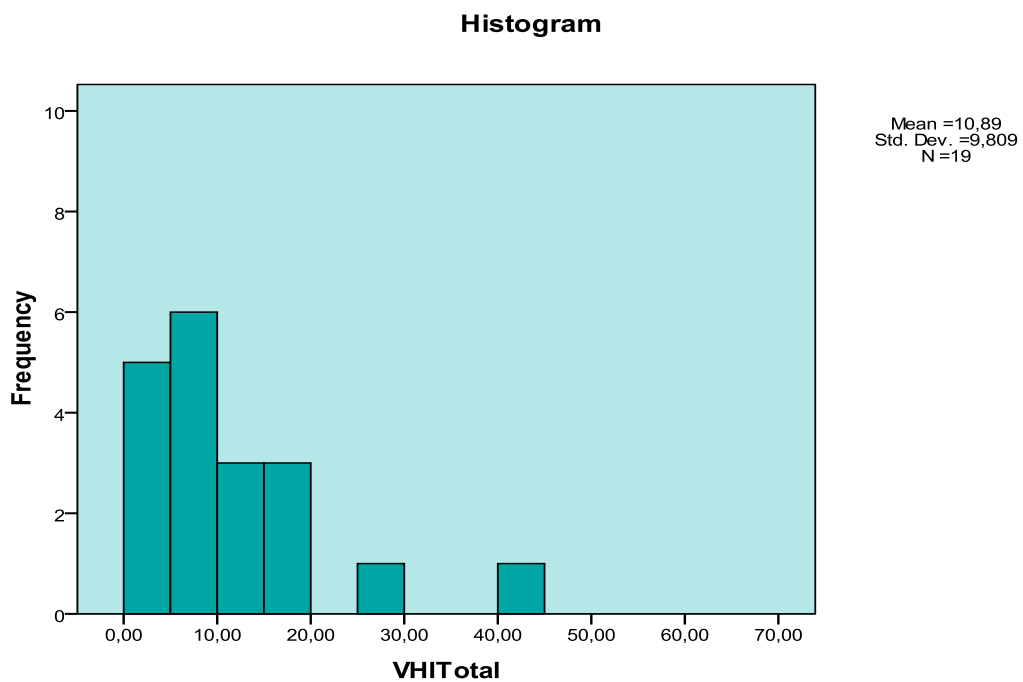


Figure 8: Histogram of the VHI scores swimming teachers

All of the three categories were looked at on their own as well. The median VHI functional score for pe teachers is 4, for class teachers 2 and for swimming teachers 3. Performing a Kruskal-Wallis test on these results gives a significance level of $p=0,03$. The median for the VHI physical for pe teachers is 2, for class teacher it is 4 and for swimming teachers 3 with the Kruskal-Wallis analysis these results gave a significance level of $p=0,24$. The VHI emotional has quite lower scores for all types of teachers, with a median of 3 for pe teachers, 1 for class teachers and 1 for swimming teachers, a Kruskal-Wallis analysis gave significance level of $p=0,01$.

There is no difference between the three types of teachers in smoking habits ($p=0,44$) and vocally loading hobbies ($p=0,24$).

Discussion

Because previous research wasn't clear about the occupational voice problems for class teachers and pe teachers it was important to do extra research because it might influence the education for the teaching profession.

This study tried to make clear if there is a difference between the voice related quality of life for pe teachers and class teachers.

At first the VHI-score of the pe teachers did not significantly differ from the results of the class teachers, they have a similar voice related quality of life. This is an interesting result because previous research could not be clear about the possible difference of the risk for voice problems or voice complaints in different types of teachers. The result in this research that there is no difference between pe teachers and class teachers is in agreement with the results of Thibeault et al. (2004).

In contrary, another study by Smith & al. (1998) indicated that pe teachers are more prone to develop a voice problem or have voice complaints : the most obvious explanation is the heavier voice load. However there are some possible explanations. It might be because pe teachers may be more likely to use amplification systems. Pe teachers may also have more intense but short periods of voice use, the shouting and yelling might not be all day long, these brief intense periods might be insufficient to increase the risk of vocal fold tissue injury. Another suggestion based on previous research (Woods & Allen, 1997) might be that pe teachers are not in front of the class all the time they work, so beside the periods of intensive voice use (during class) there are some periods of voice rest (administration or other non teaching tasks). The last explanation is not suitable for this study because the working hours in front of the class were significantly different for pe teachers and class teachers ($p=0.04$) but the pe teachers had a median of 21 hours and the class teachers of 16 hours. The additional question about working hours specifically asked for the working hours in front of the class.

Some other possibilities are that instead of yelling or shouting for attention a whistle could be used. And if the pe teachers want to explain something they might ask the class to come closer so they don't have to raise their voice for a long period.

Beside these possible explanations an other aspect of the risk to develop occupational voice complaints might be interesting to investigate in further research. Vilkman (2000) and De Jong et al. (2006) found that stress or work pressure is a risk factor for developing voice complaints. It might be possible that class teachers experience more stress then pe teachers because the children like physical education better than other courses.

Finally, one could also argue that the general health condition of pe teachers is probably better in average than that of traditional class teachers (Kooijman et al. 2006)

Although some research find more vocal fold tissue problems for women the voice complaints are not different for male and female teachers (Maertens & De Jong (2007), this result is confirmed in this study so male and female teachers could be used as one group to test the significant difference in the voice related quality of life for class teachers and pe teachers.

The chi-square test performed gave a significance level of $p=0,3$. If the results from the cross table are used and multiplied by three still no significant difference is reached $p=0,09$.

So it seems that if there are more subjects there still would not be a significant difference between the class teachers and the pe teachers.

With the selection for swimming teachers a problem occurred. Although at first there was looked for full time swimming teachers this seem to be very hard. Only nineteen swimming teachers were found to participate in this study. These swimming teachers had a median of 10,0 working hours per week. It might be that swimming teachers do have less working hours a week in general so these results could be compared with the other groups of teachers. If further research is done with swimming teachers it would be interesting to look at what they do with the rest of their time. If they just have a part time job or if they have other occupations in the rest of their time. This can influence the risk of developing voice complaints. Because this questionnaire was filled in anonymously and there were no phone numbers of the participants it is hard to check that for the subjects in this study. This is also a problem in the question about the working hours. Some of the swimming teachers might have understood the question 'working hours in front of the class' wrong and answered it with zero hours a week (four subjects). In further research this question must be more specified for swimming teachers as well.

No significant difference is found between the swimming teachers and the class teachers or the pe teachers. This might be explained because the swimming teachers have significantly less working hours in front of the class. It might also be because they don't talk all the time and only have to explain when the students are close to them so they should not raise their voice very often. In further research it could

be interesting to see if swimming teachers do have the feeling they have to raise their voice during their work or not.

In this study a lot of the participants were non smokers (hundred), there were eleven smokers and eleven who quit smoking. No significant difference is found between the smokers and the non smokers ($p=0.96$). And also the proportion of smokers and non-smokers in all three types of teachers were not significantly different ($p=0.44$). There was no significant difference for vocally loading hobbies between the types of teachers either ($p=0.24$).

The difference between the different sub categories for the class teachers is difficult to explain. The class teachers seem to experience a worse voice related quality of life of the physical subscale than on the functional subscale and the best voice related quality of life on the emotional subscale. This indicates that the voice complaints the class teachers experience most are the ones on the physical part of the voice. The questions in this subscale were about differences in the voice during the day for example a creaky voice or problems with keeping the voice on the same level all day long. These complaints seem to occur more often than de functional complaints about the problems in everyday conversations or emotional problems where the feeling about the voice problem is questioned. The reason why the emotional subscale had a significantly lower score might be because the questions might a little to specified for people with a voice problem and not about the voice complaints. One of the questions for example is 'my voice problem upsets me', if a teacher have some complaints about his voice but not experience it as a voice problem this might influence the answer. If a study wants to investigate the difference between the subscales (in a study with healthy subjects) it might be good to look at the type of questions especially in the emotional subscale.

In the pilot study with the swimming teachers a significant difference is found on the emotional and the functional subscale. The reason why the pe teachers score significantly higher on the functional and emotional subscale is not clear it might be because they are more aware of their voice but no suitable explanation could be given. Previous research though found no correlation between the score in the subgroups so no conclusions could be drawn from the results over the subscales (Neumann & Dejonckere, 2009; Rosen et al., 2004).

Conclusion

There is no significant difference in the voice related quality of life between the class teachers and the physical education teachers. There is no significant gender effect for the voice related quality of life either. Further research should be performed with a bigger group of swimming teachers to find out if their voice related quality of life is different than class or pe teachers.

References

Hakkesteegt, M.M., M.H. Wieringa, E.J. Gerritsma and L. Feenstra (2006). Reproducibility of the Dutch Version of the Voice Handicap Index. *Folia Phoniatica et Logopeadica*. 58; 132-138.

Jacobson B.H., A. Johnson , C. Grywalski , et al: (1997). The Voice Handicap Index (VHI): development and validation. *American Journal of Speech-Language Pathology*. 6; 66–70.

Jong, F.I.C.R.S., B.E. Cornelis, F.L. Wuyts, P.G.C. Kooijman, H.K. Schutte, M.J. Oudes and K. Graamans (2003). A psychological cascade model for persisting voice problems in teachers. *Folia Phoniatica et Logopaedica*. 55; 91-101.

Jong, F.I.C.R.S., P.G.C. Kooijman, G. Thomas, W.J. Huinck, K. Graamans, H.K. Schutte (2006). Epidemiology of voice problems in Dutch Teachers. *Folia Phoniatica et Logopeadica*. 58; 186-198.

Kooijman, P.G.C., F.I.C.R.S. de Jong, G. Thomas, W. Huinck, R. Donders, K. Graamans, H.K. Schutte (2006). Risk factors for voice problems in teachers. *Folia Phoniatic et Logopeadica*. 58; 159-164.

Kooijman, P. (2006). The voice of the teacher. A multidimensional and dynamic process. *Proefschrift Radboud Universiteit Nijmegen*.

Mattiske, J.A., J.M. Oates and K.M. Greenwood (1998). Vocal problems among teachers: a review of prevalence, causes, prevention and treatment. *Journal of voice*. 12; 489-499.

Maertens, K. and F. de Jong (2007). The voice handicap index as a tool for assessment of the biopsychosocial impact of voice problems. *B-Ent*. 3(2); 61-66.

Neumann, K.J. and P.H. Dejonckere (2009). Voice related quality of life in spasmodic dysphonia : a detailed analysis before and after botulinum treatment. In: "*Models and analysis of vocal emissions for biomedical applications*." C. Manfredi, Ed. Firenze University Press pp.65-67

Rosen, C.A., A.S. Lee and T. Murry (2004). Development and validation of the Voice Handicap Index-10. *The Laryngoscope*. 114; 1549-1556.

Roy, N., R.M. Merril, S. Thibeault, R.A. Parsa, S.D. Gray and E.M. Smith (2004a). Prevalence of voice disorders in teachers and the general population. *Journal of Speech, Language and Hearing Research*. 47; 281-293

Roy, N., S. Thibeault, S.D. Gray and E.M. Smith (2004b). Voice disorders in teachers and the general population: effects on work performance, attendance and future career choices. *Journal of Speech, Language and Hearing Research*. 47; 542-551.

Smith, E., J. Lemke, M. Taylor, H. Lester Kirchner and H. Hoffman (1998). Frequency of voice problems among teachers and other occupations. *Journal of Voice*. 12; 480-488.

Thibeault, S.L., R.M. Merrill, N. Roy, S.D. Gray and E.M. Smith (2004). Occupational risk factors associated with voice disorders among teachers. *Annals of Epidemiology*. 14; 786-792.

Vilkman, E. (2000). Voice Problems at Work: A Challenge for Occupational Safety and Health Arrangement. *Folia Phoniatica et Logopeadica*. 52; 120-125.

Williams, N.R. (2003). Occupational groups at risk of voice disorders: a review of the literature. *Occupational medicine*. 53; 456-460.

Woods M, P. Allen (1997) Characteristics of physical education teachers. *Physical Educator*. 54; 150–160.

Websites

CBS website (2009 a):

<http://statline.cbs.nl/StatWeb/publication/?VW=T&DM=SLNL&PA=71814ned&D1=a&D2=803-826&D3=1-2&HD=090216-1509&HDR=G2,T&STB=G1> (last visit: 20-01-2010)

CBS website (2009b):

<http://statline.cbs.nl/StatWeb/publication/?VW=T&DM=SLNL&PA=7511nr&D1=0-4,7,14-16,18&D2=0&D3=a,!0-12&HD=080401-1658&HDR=T&STB=G1,G2> (last visit: 20-01-2010)