Classroom Acoustics: A Survey of Educational Audiologists

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An electronic survey of 34 educational audiologists was conducted to obtain their perceptions regarding classroom acoustical conditions in their schools. Respondents indicated that 1) walls in their schools were constructed mainly of drywall and/or cinder blocks, 2) there was an approximately even distribution of carpet, vinyl, and area rug flooring, and 3) typically there are multiple windows without closed drapes. Commonly reported noise sources were unattached desks and chairs, frequent use of overhead projectors, and one or more classroom computers typically running during the school day. A large majority of the respondents reported that the HVAC systems were, in their opinion, loud enough to make listening to the teacher difficult, but noise from external sources (such as road traffic and aircraft noise) was reported to be less of a concern.

Introduction

It is widely recognized that acoustical conditions in the classroom play an important role in the learning process. Most daily instruction is verbal, and it is important for students to be able to hear their teachers, for teachers to be able to hear their students, and for students to be able to hear one another. Young students are particularly vulnerable to poor acoustics (Craig, Kim, Pecyna-Rhyner, & Bowen-Chirillo, 1993; Elliot, 1979; Johnson, 2000; Soli & Sullivan, 1997; Stelmachowicz, Hoover, Lewis, Kortekas, & Pittman, 2000; Talarico, Abdilla, Aliferis, Balazic, Giaprakis, Stefanakis, Foenander, Grayden, & Paolini, 2007).

A recent review of the literature concerning maturation of the human auditory system indicates that the nervous systems of young children are in the process of maturing throughout the first twelve years of life (Moore & Linthicum, 2007). During early childhood (ages 2 to 5 years), there is increased dendritic arborization and axonal maturation in the deep cortical layers (Moore & Guan, 2001). In later childhood (ages 6 to 12 years), there is continued axonal maturation in the superficial cortical layers (Moore & Guan, 2001). Evidence indicates that children are less sensitive than adults with respect to detecting small differences in acoustic cues (Elliott, 1986; Sussman & Carney, 1989), and they exhibit greater difficulty than adults in recognizing speech in reverberant conditions (Finitzo-Hieber & Tillman, 1978). Evidence also indicates that speech recognition in noise and reverberation may not mature until the middle to late teenage years and that development is different for different components of speech (Johnson, 2000). In addition, children lack adequate knowledge of their language to "fill in" when a portion of a message is unclear or missed. The acoustical quality of a classroom is even more critical to students with disabilities such as hearing impairment and learning disabilities and to students for whom English is a second language (Bradlow, Kraus, & Hayes, 2003; Crandell & Smaldino, 1996; Finitzo-Hieber & Tillman, 1978; Nabelek & Pickett, 1974).

Two characteristics used to assess acoustical conditions in the classroom are the level of background noise and the amount of reverberation. Background noise, which can be defined as unwanted sound that interferes with one's ability to hear a desired signal, can be generated from a variety of sources such as the heating and air conditioning (HVAC) system, computers, outside traffic, aircraft, and/or railroad noise, shifting chairs in the classroom, overhead projectors, and sounds made by the students themselves. Additionally, when students work in small groups, overall noise levels increase by 10dB (Picard & Bradley, 2001).

Another important consideration for classroom acoustics is reverberation. The term, reverberation,

refers to the reflection of sound off of surfaces in the classroom and the resultant persistence of that sound after it has been emitted. Early sound reflections can enhance the audibility of the teacher's words, but late reflections smear phonemes and decrease audibility (Boothroyd, 2004). Reverberation is measured in terms of reverberation time (RT) which is the amount of time required for a 60dBSPL sound in a specified space to dissipate. Long reverberation times contribute to poor listening conditions. It is important to note that combined excessive background noise and excessive reverberation have a synergistic effect on interference with speech understanding (Picard & Bradley, 2001).

The difference between the intensity of the signal (teacher's voice) to the intensity of the background noise is called the signal-to-noise ratio (SNR). When this ratio is small (e.g. +12dB or poorer), listening conditions can interfere with word understanding (Finitzo-Hieber & Tillman, 1978). Typical classroom SNRs have been estimated to be in the range of +3 to +9.5dB (Houtgast, 1981). Teachers sometimes attempt to improve the SNR by increasing their vocal intensity (signal). However, increasing vocal intensity can have deleterious effects on the teacher's vocal health. For example, teachers have a significantly higher risk of absence from work and doctor's visits related to voice-related problems (Allen's study, as cited in Anderson, 2001; Calas, Verhulst, & Lecoq, 1989; Gotass & Starr, 1993; Smith, Gray, Dove, Kirchner, & Heras, 1997; Urutikoetxea, Ispizua, & Matellanes, 1995).

One way to improve the SNR is to use systems that amplify the teacher's voice and deliver the amplified sound through classroom loudspeakers (sound field), desktop speakers, and/or personal hearing aids. However, evidence suggests that classroom speakers may not be beneficial for students who wear hearing aids when classroom acoustical conditions are poor (Anderson & Goldstein, 2004; Anderson, Goldstein, Colodzin, & Iglehart, 2005).

In 1994, the American Speech Language and Hearing Association (ASHA) published guidelines regarding acoustical conditions in classrooms (ASHA, 1995). These guidelines recommended that noise levels in unoccupied classrooms be 30dBA or less and that the reverberation times be 0.4 seconds or less. In 2002, the American National Standards Institute (ANSI) adopted guidelines for classroom acoustics in which unoccupied classroom noise levels were recommended to be 35dBA or less, and reverberation times were recommended to be 0.6 seconds or less (ANSI, 2002). The ANSI standards are intended for use in the design of new classrooms and in the renovation of existing classrooms.

One approach to evaluating classroom acoustics entails direct measurement of classroom background noise, reverberation, and speech intelligibility. There have been studies of classroom acoustics in many settings including daycare centers (Truchon-Gagnon & Hetu, 1988), preschools (Porter & Dancer, 1998) and college classrooms (Addison et al, 1999) (see Picard & Bradley, 2001 for a review). In one study by Knecht, Nelson, Whitelaw, & Feth, (2002), noise levels and reverberation times were measured in 32 unoccupied elementary classrooms in eight different public schools. When the HVAC system was turned on, recorded noise levels averaged 49.7 dB(A), and when the HVAC system was turned off, the average noise level was 39.8 dB(A). Both values exceed ASHA and ANSI recommendations. Approximately 41% of the rooms exceeded the maximum ANSI recommended reverberation times (Knecht et al., 2002). Similarly, high noise levels have been observed by many other investigators (e.g. Bradley, 1986, Johnson, Stein, Broadway, & Markwalter, 1997; Pekkarinen & Viljanen, 1991; Picard & Bradley, 2001; Slater, 1968), even in classrooms used for students who have hearing impairment (Bess, Sinclair, & Riggs, 1984) and in rooms used for speech-language therapy at Head Start centers (Porter & Dancer, 1998). It has been noted that HVAC systems are an important source of noise in the classroom (Knecht et al., 2002; Siebein, 2004), but high background noise levels have also been measured in schools in temperate climates in which other characteristics of classroom construction, such as open windows and doors, played an important role in classroom acoustical conditions (Polich & Segovia, 1999; Pugh, Miura, & Asahara, 2006).

Surveys can also provide valuable information about classroom acoustics, because this method yields information about a large number of schools. In 1995, the United States General Accounting Office conducted a survey to assess the physical and environmental conditions of a random sample of facilities directors and central administrators at approximately 10,000 schools representing over 5,000 school districts. The responders to that survey indicated that approximately 28% of schools in the United States have unsatisfactory conditions with respect to noise control.

Classroom noise was also found to be a concern in a recent survey of 2,036 British school-aged children in which children were asked to rate their ability to hear the teacher (Dockrell & Shield, 2004). With a rating scale in which a rating of 1 indicated hearing "very well" and a rating of 5 indicated hearing "not at all", children in their second year of school (6-7 year olds) averaged difficulty ratings of 2.29 when

the teacher was talking and moving, 2.47 when a classmate was speaking, and 2.70 when children were making noise outside. In general older children (ages 10 to 11 years) reported less difficulty hearing than the younger children.

Educational audiologists are uniquely qualified to evaluate classroom listening conditions, but, to date, no survey has been conducted to obtain information regarding their observations. Educational audiologists are likely to visit a larger variety of classrooms than a typical teacher or student would visit, and they have an educational background in acoustics and in hearing impairment. The purpose of the present study was to solicit information and observations from educational audiologists in order to add to our understanding of existing classroom acoustical conditions.

Method

Participants

Participants were self-reported educational audiologists who subscribe to the Educational Audiology Association (EAA) listserv. There are approximately 384 EAA listserv subscribers. (This estimate is based upon information provided by the EAA.) Participants were recruited through an email announcement on the listserv. They were assured of anonymity, and no identifying information was gathered. A total of 39 people accessed the questionnaire. Of those who did so, 34 participants indicated that they were currently working as audiologists in an educational setting in the United States and completed the remainder of the questionnaire.

Procedures

The questionnaire consisted of 30 multiple choice questions and one open-ended question. The first five questions called for respondent demographic information that did not compromise anonymity (e.g. questions asking if the respondent is currently employed as an educational audiologist, total number of years of experience as an educational audiologist, etc.). The next two questions concerned the schools about which responses were made. That is, one question called for the grade levels (i.e. elementary, middle, high school) and a second question asked for a description of the classrooms (i.e. self-contained, open-plan, portable). Because of survey formatting constraints, classroom features and characteristics (e.g. room construction materials, windows, noise sources, etc.) were grouped in lists in the subsequent three questions, and respondents were asked to check all that apply. Additional questions called for respondent opinions and experiences of reports of problems or concerns (i.e. noise from the heating, ventilation, and/or air conditioning [HVAC] system, classroom noise, vocal problems, etc.) that may have been expressed to the respondent by others such as students or teachers. Finally, the survey included questions about signal-enhancing devices, measurement of classroom noise levels and reverberation times, and requests for acoustical accommodations. The open-ended question asked respondents to list any other concerns that they may have about classroom acoustics issues in their schools. The complete survey is provided in the Appendix.

Prior to application for Auburn University Institutional Review Board approval, the survey questions were previewed by three educational audiologists to judge the ease of use of the questionnaire. The survey was modified on the basis of their comments regarding question clarity and survey length. The base structure of the survey was created using Flashlight Online, which is hosted by the CTL Silhouette system at the Center for Teaching, Learning, and Technology at Washington State University in Pullman, Washington.

List owner permission for posting of information regarding the survey was obtained from the EAA. Participants were contacted via the EAA listserv, where they accessed the anonymous, online questionnaire at a website address provided in the recruitment email message. Respondents who provided services at more than one school were instructed to select one of the schools and to base their survey responses on that school. Participants submitted their responses electronically.

The final questionnaire and the research protocol were approved by the Auburn University Institutional Review Board.

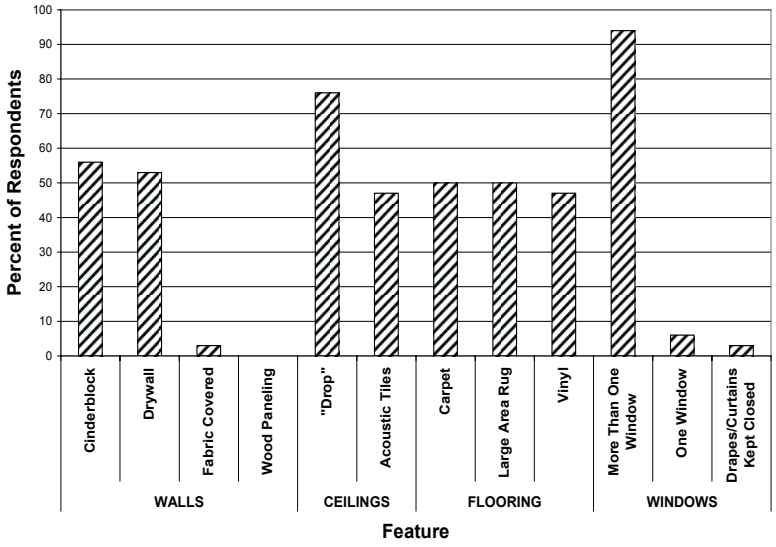
Results

Classroom Characteristics

Respondents were asked to select one of their schools and to answer all questions about that school. Thirty-two percent of the selected schools included 6th through 8th grade; 26% included grades 9th through 12th grade. Ninety-seven percent of the schools selected included kindergarten through 5th grade. Some schools included more than one category.

All respondents reported that the majority of the classrooms in the school they selected were “self-contained”(meaning not open-plan design), and all respondents reported that fluorescent lighting was used. Respondents were provided with lists of classroom characteristics which may be found in a classroom. They were asked to indicate all of the features that are typical in the majority of the classrooms in the school that they had selected. The most common wall materials were reported to be

Figure 1: Percent of Respondents Reporting Feature Typical in Majority of Classrooms



dry wall and cinder block, and 76% of respondents reported dropped ceilings and more than one window in the classroom. Three percent of the respondents reported that drapes or curtains were maintained in a closed position over windows. Respondents were asked to select all kinds of flooring that were typical in the majority of classrooms at their selected school. Selections indicating carpet, vinyl, and area rugs were approximately evenly divided. Ninety-four percent of respondents reported that the majority of classrooms in their school contained posters, pictures, artwork, and bulletin boards, etc. on the walls. Response results concerning typically reported features are shown in Figure 1.

Noise Sources in the Classroom

Ninety-seven percent of all respondents reported that chairs were not attached to desks, and 91% reported that at least one computer was turned on in the classroom throughout the school day. Sixty-two percent of respondents reported that use of an overhead projector for instruction was typical in a majority of classrooms. These data are shown in Figure 2.

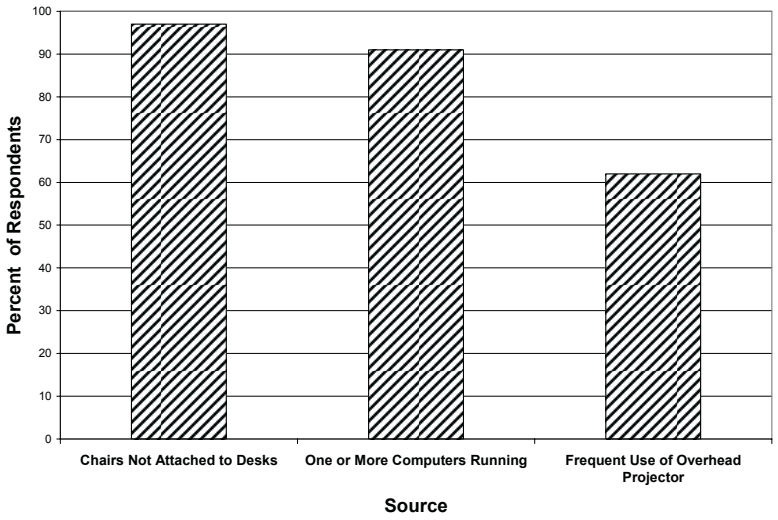
Forty-nine percent of the respondents indicated that a closed classroom door was typical in the majority of classrooms for their school. Open doors can also be a source of noise, as they may allow sounds from the outside to reach the classroom.

Respondent Perceptions and Opinions

Respondents were asked if, in their opinion, the HVAC system in any classroom in the school they selected was ever loud enough to make listening to teacher instruction difficult. The response was "yes" for 79% of the responses. Respondents were also asked if they had concerns about external traffic noise from cars, trucks, aircraft, or construction work interfering with teachers' instruction in the classroom. The response was "no" for 79% of the responses. Forty-four percent of the respondents reported being aware of a student reporting difficulty hearing teacher instruction in the classroom due to internal and/or external sources of noise. Forty-four percent of the respondents also indicated awareness of teacher-reported vocal problems or vocal stress resulting from having to raise his/her voice in order for students to hear classroom instruction over noise.

Measurement of Noise Levels and Reverberation. Seventy-six percent of the respondents indicated that they have access to a sound level meter to measure noise levels. Of the respondents who indicated that they have access to a sound level meter, 59% indicated that they use the meter to measure noise levels as part of their duties. In response to a question that asked if any of the recorded noise levels were ever at a level that caused the respondent concern that the noise may be interfering with daily

Figure 2: Percent of Respondents Reporting Noise Source Typical in Majority of Classrooms



classroom instruction, 86% of those participants responded affirmatively. In response to questions regarding reverberation times, 88% of respondents reported being unsure about or having no access to equipment used to measure reverberation times, and 97% reported being unsure or having no knowledge of any professional measurement that had been performed to determine reverberation times in the classrooms. (However, in the open-ended section of the questionnaire, one respondent reported calculating estimated reverberation times.)

Classroom Acoustics and Individualized Education Program (IEP) Recommendations

Respondents were asked if acoustical improvements (e.g. window drapes or carpet installation, placement of tennis balls on chair legs, implementation of an FM system) were common requests at IEP meetings for students with hearing impairment. Forty-four percent of the respondents replied affirmatively. Of those respondents, 47% indicated that these requests were always implemented.

Signal-Enhancing Devices

Sixty-five percent of the respondents indicated that signal enhancing systems (i.e. sound-field FM systems or personal FM systems) were implemented only when there is a child with hearing loss in the classroom, and 29% of the respondents indicated that signal-enhancing systems were also implemented in classrooms without students with known hearing loss. Seventy-three percent of the respondents indicated that the majority of teachers always use the system, and 24% of the other respondents indicated that the majority of teachers use the system only when they feel it is really needed.

Open Ended Question: Reported Concerns and Comments

There were 6 comments made in response to the open-ended question regarding other concerns about classroom acoustics issues in their schools. These comments were unique, and there was no common theme. One comment concerned resistance by "poorer districts" to address classroom acoustics issues. Another comment indicated that the respondent was not viewed by the administration as an appropriate person to raise concerns about classroom acoustics. A third respondent reported the existence of classrooms that are designated "self-contained" but have moveable walls through which sound can be heard from adjacent classrooms. One comment concerned a particularly responsive school that has led the way for improved classroom acoustics at the other two elementary schools in the district. One of the remaining responses concerned the lack of access to equipment to measure reverberation time, but the respondent reported using measurements and calculations as a substitute for equipment. Finally, one respondent reported that acoustical improvements such as tennis balls on chair legs or an FM system were common in IEPs but that carpeting and drapes were not common. This respondent also noted that expensive, new hand dryers in bathrooms were causing loud broad spectrum noise to be heard in the classrooms even though the classroom doors were closed.

Discussion

The responses in the present survey provided perceptions and observations by educational audiologists regarding classroom acoustics. Nearly half of the respondents reported being aware of student and teacher problems related to classroom acoustics. Many respondents reported access to and use of sound level measurement equipment to measure classroom noise levels, but reported measurement of reverberation time was rare.

The present results add to information currently available in the literature by providing a first-hand report of classroom acoustical conditions by educational audiologists who visit many classrooms and are qualified to evaluate listening conditions. Through direct measurements, previous studies have shown that ANSI and ASHA guidelines for noise levels and reverberation times are frequently exceeded (e.g. Knecht et al., 2002), and the responses in the present study suggest a widespread presence of features known to contribute to these conditions. In the present study, the HVAC systems were widely reported to be a concern, and this concern has been supported by studies in which direct measurements were made of HVAC systems (e.g. Knecht et al., 2002; Siebein, 2004) and found to contribute significantly to measured noise levels. It is of interest that, in the present survey, external noise (from traffic, etc.) was not reported to be a concern, and that this result contrasts with direct measurement studies in temperate climates where windows are frequently kept open for ventilation (Polich & Segovia, 1999; Pugh, et al, 2006).

It has been suggested that improvement in classroom acoustics requires that educational administrators, school board members, and legislators recognize and understand that poor classroom acoustical conditions interfere with the learning process (Anderson, 2004). The respondents in the present survey indicated their awareness of student and teacher concerns regarding classroom acoustics. It is reasonable to suggest that educational audiologists

such as those who responded in the current study can contribute important information to school decision-makers when classroom acoustics issues are considered.

It is noteworthy that many of the respondents reported that they measure noise levels, but very few reported measuring reverberation times. It may be that educational audiologists would benefit from training opportunities regarding reverberation time measurement and/or calculation.

Certain limitations in the present study should be noted. The sample size in this study was small. In addition, respondents to the present survey were self-selected and may not be representative of all educational audiologists, particularly since participation required the use of computers and participants were contacted via the EAA listserv to which all educational audiologists do not subscribe. Also, because of the way the electronic survey was conducted, there is no way to determine if one person submitted more than one survey form or to ensure that the demographic information was accurate. However, it is important to note that no incentives were provided to respond to the survey, and there was no reward for false responses and/or multiple questionnaire submission. Finally, there is no way to verify the accuracy of the information provided. With regard to the survey questions, it may have been useful, in retrospect, to obtain information regarding rooms other than classrooms (e.g. physical education facilities, music rooms, shop classrooms), and to obtain information, if possible, about build dates of the schools and typical teaching styles (e.g. use of learning stations, group learning, teacher movement in the classroom).

Teacher concerns reported in the present study suggest that future research designed to obtain teacher perceptions would add a useful perspective regarding classroom acoustics. Studies of student ratings of classroom listening conditions have been conducted (Dockrell & Shield, 2004; Kennedy, Hodgson, Edgett, Lamb, & Rempel, 2006), but there is very little information available about the teachers' perceptions and experiences.

In summary, the results of the present survey indicate the reported perceptions and concerns of educational audiologists regarding classroom acoustics in schools where they work. The reported perceptions are consistent with a large body of research. It is possible that this report will be useful to educational audiologists and/or educational decision-makers in their efforts to improve the listening environments for students in their schools.

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APPENDIX

Classroom Acoustics Survey for Educational Audiologists

The purpose of this survey is to gather subjective impressions of currently-employed educational audiologists working in school settings about classroom acoustics issues. ALL answers given in this survey will be kept completely anonymous with no personal, identifying information attached. Please click the "Submit" button when you have completed the survey questions. THANK YOU FOR YOUR PARTICIPATION!

1. Are you currently employed as an audiologist for a school or other educational setting? (* If your answer is "no", you have completed the survey. Please do not continue answering the remaining questions and click "Submit" at the end of the survey.*)
   - ☐ Yes
   - ☐ No

2. What degree(s) have you attained? Please mark all that apply.
   - ☐ Bachelor's degree
   - ☐ Master's degree
   - ☐ Doctor of Audiology (Au.D.) degree
   - ☐ Doctor of Philosophy (Ph.D.) degree
   - ☐ Doctor of Education (Ed.D.) degree
   - ☐ Other doctorate
   - ☐ Other degree

3. How many total years have you provided audiological services in schools or other educational settings?
   - ☐ Less than 5 years
   - ☐ 5—10 years
   - ☐ 11—15 years
   - ☐ 16—20 years
   - ☐ 21—25 years
   - ☐ More than 25 years

4. How many total years have you worked as an audiologist overall?
   - ☐ Less than 5 years
   - ☐ 5—10 years
   - ☐ 11—15 years
   - ☐ 16—20 years
   - ☐ 21—25 years
   - ☐ More than 25 years

5. In which country do you currently provide audiological services for a school(s)?
   - ☐ United States of America
   - ☐ Canada
   - ☐ Mexico
   - ☐ Puerto Rico
   - ☐ Other

6. PLEASE ANSWER ALL REMAINING QUESTIONS ABOUT THE SCHOOL AT WHICH YOU ARE CURRENTLY EMPLOYED TO PROVIDE AUDIOLOGICAL SERVICES. IF YOU PROVIDE SERVICES AT MORE THAN ONE SCHOOL, PLEASE CHOOSE ONE OF THE SCHOOLS TO ANSWER ALL QUESTIONS ABOUT THAT SCHOOL. (PLEASE REMEMBER THAT ALL ANSWERS WILL BE KEPT COMPLETELY ANONYMOUS WITH NO PERSONAL, IDENTIFYING INFORMATION ATTACHED.) The school that you will be referring to when answering all the questions to this survey accommodates which grade level(s)? Please mark ALL choices that most closely represent the school's grade levels.
   - ☐ Elementary school (approximately Kindergarten through 5th grade)
   - ☐ Middle or junior high school (approximately 6th through 8th grade)
   - ☐ High school (approximately 9th through 12th grade)

7. Most classrooms in the school for which I work are:
- ☐ "Self contained", individual rooms in a fixed building
- ☐ "Open plan" arrangement in a fixed building, where many classes share the same open space
- ☐ "Portable" classrooms/trailers

8. THE FOLLOWING THREE QUESTIONS ARE SUBDIVIDED TO DESCRIBE CHARACTERISTICS OR FEATURES WHICH MAY BE FOUND IN A CLASSROOM. PLEASE MARK ALL CHOICES THAT APPLY TO YOUR SCHOOL. Which features are typical in the MAJORITY of classrooms in the school for which you work?
- ☐ Walls are made mostly of drywall material
- ☐ Walls are made mostly of cinder blocks
- ☐ Walls are mostly covered in wood paneling
- ☐ Walls are mostly covered with fabric
- ☐ Bulletin board is on at least one wall
- ☐ Posters, pictures, or artwork are on the walls
- ☐ “Drop" ceiling (grid-like ceiling panels)
- ☐ Acoustic tiles, which dampen sounds, on ceiling or walls

9. Which features are typical in the MAJORITY of classrooms in the school for which you work? Please mark ALL choices that apply.
- ☐ Fluorescent lights
- ☐ Desks with chairs that ARE attached to them (CANNOT separate the chair from the desk)
- ☐ Desks which have chairs that are NOT attached to them (CAN separate the chair from the desk)
- ☐ Tennis balls (or similar items) have been cut and placed on the bottom of chair legs
- ☐ No window(s) in the classroom
- ☐ One window in the classroom
- ☐ More than one window in the classroom
- ☐ Drapes or curtains are kept closed over windows

10. Which features are typical in the MAJORITY of classrooms in the school for which you work? Please mark ALL choices that apply.
- ☐ Carpet flooring
- ☐ Vinyl flooring
- ☐ Area rug (large rug) on the floor
- ☐ Classroom doors are kept closed while students are in the classroom
- ☐ Overhead projector is used frequently by the teacher for instruction
- ☐ One or more computer is turned on in the classroom throughout the school day
- ☐ Signal enhancing devices, such as sound-field FM systems, are implemented (teacher uses a microphone and speakers are in place throughout the classroom)
- ☐ Portable signal-enhancing devices, such as portable FM systems, are implemented (teacher uses a microphone and the student uses a personal speaker that is placed on the student's desk)

11. In your opinion, is the heating, ventilation, and/or air conditioning (HVAC) system in any classroom ever loud enough to make listening to teacher instruction difficult?
- ☐ Yes
- ☐ No

12. If you answered "yes" to the previous question (#11), have you expressed your concern about the HVAC system to the school administration?
- ☐ Yes
- ☐ No
- ☐ I did not answer "yes" to the previous question

13. Have YOU ever had concern about external traffic noise from cars, trucks, aircrafts, or construction work interfering with teachers' instruction in the classrooms?
- ☐ Yes
- ☐ No

14. If you answered "yes" to the previous question (#13), have you ever expressed your concern to the school administration?
- ☐ Yes
- ☐ No
- ☐ I did not answer "yes" to the previous question

15. To your best knowledge, has any TEACHER ever expressed concern about outside noise from cars, trucks, aircrafts, or construction work interfering with classroom instruction?
- ☐ Yes, the teacher expressed concern to me.
- ☐ Yes, the teacher expressed concern to the school administration.
- ☐ Yes, the teacher expressed concern to both me and the school administration.
- ☐ No teacher has expressed any concern.

16. To your best knowledge, has any TEACHER reported vocal problems or vocal stress as a result of having to raise his/her voice in order for students to hear classroom instruction over noise?
- ☐ Yes, the teacher reported to me.
- ☐ Yes, the teacher reported to the school administration.
- ☐ Yes, the teacher reported to both me and the school administration.
- ☐ No teacher has reported any problems.

17. To your best knowledge, has any STUDENT ever reported having difficulty hearing teacher instruction in the classroom due to internal and/or external sources of noise?
- ☐ Yes, the student reported to me.
- ☐ Yes, the student reported to the teacher.
- ☐ Yes, the student reported to the school administration.
- ☐ No student has reported any difficulty.

18. To the best of your knowledge, are signal-enhancing devices, which amplify teachers' voices, promptly provided by the school system for students with hearing loss (i.e., sound-field FM systems or personal FM systems - where the teacher uses a microphone and there is at least one speaker provided for the child or speakers throughout the classroom)?
- ☐ Yes, signal enhancing systems are implemented only when there is a child with hearing loss in the classroom.
- ☐ Yes, but signal-enhancing systems are also implemented in classrooms even if there is not a student with known hearing loss.
- ☐ No
- ☐ Not sure

19. To your best knowledge, if a signal-enhancing system is put into place, do the majority of teachers seem to comply with using the system (for example, actually uses the microphone and reports problems with the speakers)?
- ☐ Yes, they always use it.
- ☐ Yes, but they use it only when they feel it is really needed.
- ☐ No, they never use it.
- ☐ Not Sure

20. To the best of your knowledge, are acoustical improvements in the classroom common requests in Individualized Education Program (IEP) meetings for students with hearing impairment (for example, carpeting is put into the classroom, drapes are hung, an FM system with a microphone is implemented, tennis balls are put on the bottom of chair legs, etc.)?
- ☐ Yes
- ☐ No
- ☐ Not Sure

21. If you answered "yes" to the previous question (#20), are these IEP requests for acoustical improvements in the classroom accommodated?
- ☐ Yes, always
- ☐ Sometimes
- ☐ No, never
- ☐ Not sure
- ☐ I did not answer "yes" to the previous question

22. If you answered “yes” or “sometimes” to the previous question (#21), are acoustical improvements made in what you consider to be a timely manner?

- ☐ Yes, always
- ☐ Sometimes
- ☐ No, never
- ☐ Not sure
- ☐ I did not answer "yes" or "sometimes" to the previous question

23. Do you have access to a sound-level meter to measure noise levels?

- ☐ Yes
- ☐ No
- ☐ Not sure

24. If you answered “yes” to the previous question (#23), do you ever measure noise levels using a sound-level meter in any classroom as part of your job duties?

- ☐ Yes
- ☐ No
- ☐ I did not answer "yes" to the previous question

25. If you answered “yes” to the previous question (#24), are any of the recorded noise levels ever at such a level that is causes you concern that the noise may be interfering with daily classroom instruction?

- ☐ Yes
- ☐ No
- ☐ I did not answer "yes" to the previous question

26. To the best of your knowledge, does any other professional (such as an acoustical engineer, etc.) ever measure noise levels using a sound-level meter in the classrooms?

- ☐ Yes
- ☐ No
- ☐ Not sure

27. Do you have access to equipment used to measure reverberation time in the classrooms?

- ☐ Yes
- ☐ No
- ☐ Not sure

28. If you answered “yes” to the previous question (#27), do you ever measure reverberation time in any classroom as part of your job duties?

- ☐ Yes
- ☐ No
- ☐ I did not answer "yes" to the previous question

29. If you answered “yes” to the previous question (#28), are any of the recorded reverberation times at such an amount that it causes you concern that reverberation could be interfering with daily class instruction?

- ☐ Yes
- ☐ No
- ☐ I did not answer "yes" to the previous question

30. To the best of your knowledge, does any other professional (such as an acoustical engineer, etc.) ever measure reverberation time in the classrooms?

- ☐ Yes
- ☐ No
- ☐ Not sure

31. Please list any other concerns you have about classroom acoustics issues in the school(s) for which you work that were not specifically listed in this survey. THANK YOU for your participation!