The Effects of Sound-Field Amplification on Attending Behaviours

Effets de l'amplification en champ libre sur le comportement d'écoute

Shauna Cornwell
Charlotte J. Evans

Abstract

Students in elementary classrooms spend a significant portion of their school day in "listening" activities. The use of sound-field amplification systems in classrooms has been suggested as a way to improve the listening environment for a variety of different learners, including students with mild-to-moderate hearing losses, students with fluctuating hearing losses, and students learning English as a second language. The current study considers the effects of using a sound-field amplification system to improve the attending behaviours of students with and without attending and focusing difficulties. The results indicate a trend toward increased "on-task" time when amplification is used. Student and teacher responses to the use of the system also were found to be favourable.

Abrégé

Les élèves au primaire consacrent une partie importante de leur journée scolaire à des activités d'écoute. L'utilisation de système d'amplification en champ libre est suggéré pour améliorer les conditions d'écoute de plusieurs enfants. On le suggère aux enfants qui présentent des pertes auditives légères, moyennes ou fluctuantes, de même qu'à ceux qui apprennent l'anglais comme langue seconde. La présente étude porte sur les effets de l' utilisation de système d'amplification en champ libre sur le comportement d' écoute des élèves qu'ils présentent ou non des problèmes d'audition ou de concentration. Les résultats indiquent qu'avec l'utilisation de système d'amplificationen champ libre, le temps consacré aux tâches a tendance à augmenter. Par ailleurs, les élèves et les enseignants réagissent positivement à l'utilisation de tels systèmes.

Key words: sound-field amplification, attending behaviours, attending difficulties, listening skills

Shauna Cornwell
University of Manitoba
Winnipeg, Manitoba

Charlotte J. Evans
University of Manitoba
Winnipeg, Manitoba

Educators are continually searching for ways to improve the quality of education offered to students. Teachers strive to introduce beneficial new curricula or programs and search for ways to implement innovative resources and technology. Attempts are made to make the classroom environment safe and comfortable for all. School personnel are constantly making a dedicated effort to enrich the caliber of education they offer their students; however, one area that may be commonly overlooked is improving the students' listening environment.

Young children spend considerable time engaged in the listening process. In fact, they may spend between 45% - 60% of their school day in listening activities (Butler, 1975). This may include listening to the teacher during lessons and direct instruction, or listening to peers when reading or working in small groups. They also listen to videos, music, and engage in regular conversations.

Studies show that the use of sound-field amplification systems can enhance the listening environment in school classrooms. A sound-field amplification system is a wireless speaker and microphone system. The speakers are placed in strategic spots throughout the classroom and the teacher is equipped with either a lavaliere (clip-on) or head-worn boom microphone. The system raises the volume of the teacher's voice above background noises, and mildly amplifies it so that all students can hear regardless of positioning in the classroom.

The need for sound-field amplification in the classroom is to ensure that the teacher's voice is highly audible and intelligible to all children. According to Bennett (1994), "As many as one-third of the students in a typical classroom run the risk of academic difficulties because of the acoustical conditions present" (p.45). Imagine any school classroom on a typical day and all of the sounds that are part of the students' listening environment. This would include the papers that are rustling, the hum of the heating system or the overhead projector, the voices of people talking, noises coming in from the hallway, and the traffic sounds or voices from outside that filter their way inside the room. In fact, research studying the noise levels in both occupied and unoccupied classrooms shows disturbing results. In Crandell's (1991) study of 32 unoccupied classrooms, he found the average noise level to be 50 decibels (dB) sound pressure level (SPL) using a B-weighting network (dBB). An earlier study conducted by Sanders (1965) found occupied classrooms to range from 52dBB to 69dBB-SPL. These results are alarming, particularly since the recommended acoustical level for normally hearing children is 35dB(A). In some of the classrooms studied, the noise level exceeded almost twice this amount. The increased noise level in classrooms makes it difficult for the students to hear the teacher and certainly can increase the likelihood for distraction (Blake, Field, Foster, Platt, & Wertz, 1991).

An average student with normal hearing (15 dB HL or better) can hear best when the speaker's voice is 15dB – 20dB above the background noise. This is typically not happening in classrooms where the background noise level is already at 50dB(A). These students will spend much of their time struggling to hear the teacher's voice clearly, or may be distracted or unfocused due to the amount of background noise around them. A sound-field system is able to amplify the teacher's voice and put it in the forefront, therefore, reducing the interference of the background noises (Crandell, Smaldino, & Flexer, 1995). In this way, the teacher's voice is heard more clearly by the students, which helps them to pay closer attention to information and directions given verbally in the classroom. In short, it makes it easier for them to listen.

A number of studies have explored the question of why schools should consider placing sound-field systems in classrooms, and how this can benefit students. A study conducted by Flexer, Richards, Buie, and Brandy (1994) considered the use of amplification systems with students who had fluctuating hearing losses. They found that up to one-third of the students in 12 typical kindergarten and grade one classrooms did not hear normally (defined as 15dB HL or better at all frequencies with normal middle ear function) on any given day. This minimal hearing loss would not be detected in a typical school screening. These students did not require medical attention for their hearing condition, but they were not hearing at an optimal level. Six of the 12 classrooms involved in the study were amplified and six were not amplified.

The teachers in the 12 classrooms completed the Screening Instrument for Targeting Educational Risk (SIFTER; Anderson, 1989), four times throughout the school year for each of their students. The SIFTER is a classroom performance checklist that considers a child's performance in the following areas: academics, attention, communication, class participation, and school behaviour. The results of the study showed that throughout the year the children in amplified kindergarten and first grade classrooms, regardless of whether they had hearing problems or not, performed significantly better on the SIFTER checklists than the children in the unamplified classrooms (Flexer et al., 1994).

Sound-field amplification can also have an impact in the area of second language learning. Crandell (1996) conducted a survey with 20 students for which English was a second language (ESL). The word perception of the 20 students was assessed at three speaker-listener distances, 6, 12, and 24 feet. The testing was conducted both in the amplified and unamplified setting and the results of the two settings were compared. With the use of a sound-field system in the classroom, speech perception scores for the ESL students showed a statistically significant increase ($p = <.0001$), particularly at the 12 and 24 feet distances. This emphasizes the importance of an improved signal-to-noise ratio (SNR) for ESL students (Crandell, 1996).

A study conducted by Zabel and Tabor (1993) considered the effects of sound-field amplification on spelling performance of elementary school children. One hundred forty-five students in grades four to six were given two taped curriculum-based spelling tests. One test was presented in an unamplified environment with the audio tape player situated at the front of the classroom. The other test was administered with the tape played through the speakers of the classroom sound-field amplification system. A statistically significant improvement in spelling scores ($p = .001$) was achieved in the amplified environment.

Several longitudinal studies have been conducted to assess the overall effects of sound-field amplification on academic achievement. The first of these projects, entitled the Mainstream Amplification Resource Room Study (MARRS), took place from 1977-1980 in southern Illinois (Sarff, 1981). This project compared the academic progress of students in grades four through six in both amplified and unamplified settings. Results indicated that the greatest academic improvements were demonstrated by the students in the amplified classrooms, and that these students were also achieving at a faster rate and at a higher level in the area of reading and language arts (Ray, Sarff, & Glassford, 1984).

Another three-year study called Mainstream Amplification Regular Classroom Study (MARCS) involved 17 amplified kindergarten through grade three classrooms, as well as 17 unamplified classrooms in the Putnam County area (Osborn, VonderEmbse, & Graves, 1989). Using the Iowa Test of Basic Skills, results showed higher scores in the experimental amplified group during the first year in a number of areas, including listening and language (K and Grade 1), vocabulary (Grade 1), math concepts (Grades 2 and 3), and math computation (Grade 3). In the second year more significant findings were noted in the experimental group as they scored higher in word analysis (K and Grade 1), math concepts (Grades 1 and 2), math problem solving (Grade 1), and math computation (Grade 3). The students who were least successful on the tests were those that had failed hearing screenings and were in unamplified settings (Osborn et.al., 1989).

Classroom observations were also part of Project MARCS and suggested that when amplification was in place the following was noted: an increased number of students participating, better student transition between activities, and fewer special education referrals. Informal evaluations by teachers also suggested more consistent attending skills by students, a reduction in teacher's voice strain and fatigue, and increased diversity in teaching techniques (Osborn et al., 1989).

There have been a few anecdotal reports documenting an improvement in attending behaviours and academic performance for students with attention deficits and normal hearing when the FM sound-field system is implemented in the classroom. Allen and Patton (1990) studied a group of Grade 1 and 2 students using a systematic observational protocol. They studied the differences of on-task behaviour of these students in both an amplified and unamplified environment. In the amplified setting they found the students to be more attentive, less distractible, and that they needed fewer repetitions from the teachers. Overall, they found on-task behaviour to increase 17% during the amplified setting in comparison to time on task without the sound-field amplification. Palmer (1998) found an increase in appropriate behaviour in a kindergarten classroom when the SNR was increased through sound-field amplification.

Benafield (1990) also studied the effect of sound-field amplification on the attending behaviours of preschoolers. He found that the children were more likely to give an appropriate subject comment when amplification was being used, and that there was an increase in a number of physical attending behaviours, such as appropriate body position and eye contact. This suggests the value of sound-field amplification on attending behaviours.

There is a lack of quantitative data in the literature about the effectiveness of sound-field amplification in relation to attending and focusing behaviours. This may be partly due to the difficulty of defining and measuring these skills. The purpose of the current study was to investigate the effects of classroom sound-field amplification systems on students with attending and focusing difficulties, and to find out whether the use of an enhanced listening environment could increase the amount of time students spend focused on-task. The study also considered the effect amplification would have on students who were demonstrating good listening and attending skills.

Method

Participants

The 15 student participants (seven girls and eight boys) observed in this study were chosen from three different classrooms in a public school in Winnipeg, Manitoba, Canada. Twelve students were chosen by their classroom teacher based on the following criteria: demonstrated difficulty attending, focusing, and getting involved during classroom discussions and lessons, were easily distracted, and frequently needed to have directions repeated. One student from each of the three class-

rooms was selected as a student who had good active listening skills based on the following criteria: were usually involved and attentive during classroom discussions and activities and followed directions independently. Students that participated in the study were in Grades 4, 5, and 6 and between the chronological ages of 8 and 11 years. None of the students had any experience with the use of an amplification system in their classroom prior to this study.

Table 1
Criteria for Observing Classroom Attending Behaviour

On-Task Behaviour	Off-Task Behaviour
Making eye contact with the person speaking, whiteboard, overhead, etc.	Distracted
Appropriate responses	Interrupting/inappropriate
Appropriate body position and control	Body movement or slouching
Demonstrates an ability to follow directions	Playing with items (pencil, etc.)
Is engaged in lesson and focused on the speaker	No eye contact
	Little involvement in discussion or activity

Instrumentation

The study was conducted in two classrooms that were equipped with free-field FM amplification systems. One classroom used the Phonic Ear 210 – Easy Listener system (Phonic Ear, Ltd., Mississauga, ON). This system has four speakers situated in the corners of the room and the teacher uses a boom or head-worn microphone. The other classroom used a Telex Prostar receiver and belt pack transmitter receiver (Telex Communications, Inc., Burnsville, MN), with a Peavy Achitectural Acoustics amplifier (Peavey Electronics Corporation, Meridian, MS). In this setting one main speaker was situated in the middle of the room, hanging from the ceiling, and the teacher used a lavaliere, clip-on microphone. A digital timer was used to collect data in specific time intervals.

Procedure

Data were collected by observing the amount of time students spent on-task during a 20-minute interval in the school day. Three sets of these twenty-minute observations were completed for each student in both unamplified and amplified settings. The first set of observations was collected before the amplification systems were in place in the classrooms. After the amplification systems were implemented in the classrooms, the second set of three observations (per student) was completed. Three separate 20-minute observation periods were completed for each student in each of the settings to ensure that his/her typical attending and focusing behaviours were represented. The data for each individual student, including both the unamplified and amplified settings, were collected within a 60-day period.

In order to facilitate the comparison of data between the unamplified and amplified settings, several variables were kept constant across observations. These variables included time of day, school subject area, and instructional format (sitting at desks, presentation of lesson with overhead projector, circle group on carpet, and so on). A sample of the form used to collect observational data in each of the three classrooms is included in Appendix A.

Data collection in the classrooms was conducted by one of the investigators and two teaching assistants, who had been working in the classrooms regularly throughout the year. Table 1 outlines the criteria used to consistently determine on-task and off-task behaviour throughout the observations by all data collectors. These behaviours are based on descriptions previously developed by Blake et al. (1991).

The final procedure for data collection was to administer surveys to both students and teachers who experienced a classroom sound-field amplification system. The student questionnaire was given to all the students in each of the three classrooms in written form. A total of 71 students responded to questions regarding the experience of using a sound-field amplification system in their classroom. The student questionnaire was adapted from Stefanishyn (1997) and included the following questions:

1. Do you think amplification of the teacher's voice has helped you in your school work? Please tell how it has or has not helped.

2. Would you like to see amplification used in more classrooms?

3. If you could change the FM system in some way, what would you do?

Five classroom teachers also completed written surveys that permitted feedback about the advantages or disadvantages, both for their students and themselves, on the influence of having an amplification system in their classrooms. The questionnaire also asked teachers to indicate what they would change about their FM system if they could.

Results

Classroom Observations

This preliminary study involved a small number of participants, therefore, descriptive statistics were used to analyze the data related to time students spent on-task. The students were divided into two groups, those with attending difficulties (n = 12) and those with good listening skills (n = 3). For each of these groups the minimum and maximum amount of time spent on-task (within a 20-minute interval) was determined, as well as the ranges and the means for both unamplified and amplified settings. These data are presented in Table 2.

The minimum amount of time on-task for a student with an attending difficulty in an unamplified environment was five minutes, 50 seconds (5:50). This increased to 9:40 in the amplified setting. An increase was also noted in the maximum amount of time students with attending difficulties were on-task, from 16:30 in the unamplified classroom to 18:30 in the amplified classroom. The mean amount of time spent on-task by the twelve students in this category increased from 12:25 to 15:41. This reflects a 16% increase in the amount of on-task behaviour demonstrated by the students with attending difficulties.

The remaining three students who were selected to participate because of their good listening skills, also demonstrated an increase in their on-task behaviour in the amplified setting. The incremental changes (in percentage) in this group were not as large simply because they did not have as much room for improvement. In the unamplified setting the mean amount of time on-task for this group was 18:43 out of a 20-minutes period, indicating that they were attending appropriately 92% of the time. This mean time on-task increased slightly, by 18 seconds or 3%, in the amplified setting to reflect an overall performance of 95% time on-task.

Results remain positive and consistent when the group is considered as a whole. Thirteen of the 15 students showed an increase in on-task behaviour in the amplified setting. The two students whose time on-task did not increase in the amplified setting were within 20 seconds of their unamplified times. One of these students was in the group with good listening skills and had high on-task times in both settings. The mean amount of time on-task for all the students in the unamplified setting was 13:40 (67% of the time), and this increased to 16:22 (81% of the time) in the amplified setting, which reflects an overall increase of almost three minutes (2:42), or 14% more time on-task.

Written Surveys. Surveys were used to gather feedback about the use of the sound-field amplification system from both students and teachers. The results from the students indicated that the majority of them felt positive about the system. Eighty-six percent of the students indicated that they felt it helped them in their schoolwork, and 80% of the students wanted to see it used in more classrooms. Some of the explanations for

Table 2
Data for Time On-Task in Classroom Amplification Study

Descriptive Statistic	12 Students with Attending Difficulties		3 Students with Good Listening Skills	
	Unamplified	Amplified	Unamplified	Amplified
Minimum Time On Task (out of 20 minutes)	5:50	9:40	17:28	18:40
Maximum Time On Task (out of 20 minutes)	16:30	18:30	19:30	19:20
Range (minutes)	10:40	8:50	2:02	0:40
Mean Time On Task (minutes)	12:25	15:41	18:43	19:04
% Time On Task	61%	77%	92%	95%

how it was helpful included, "I don't have to ask for the directions over again," "If someone else is talking you can still hear the teacher," and "It is easier to listen."

The students also had some suggestions for how to improve the sound-field amplification systems. These included, "I would make it so you never heard feedback," "I would put a speaker by each desk," and "Each of us should have out own headsets so we can answer questions." Complete survey responses are presented in Appendix B.

Previous studies indicate that teachers consider sound-field amplification systems valuable tools in the classroom for facilitating teaching and listening, reducing voice fatigue, decreasing requests for repetition, and increasing teacher mobility (Allen, 1993; Crandell, Smaldino, & Flexer, 1995). The teachers surveyed responded similarly. All five teachers indicated that the system was beneficial for both the students and themselves. Some of the reasons they noted were:

"The students respond more quickly to directions, thus being spared from being nagged."

"I believe there is more time spent teaching/learning and less time trying to understand/clarify instructions."

"Two students had been diagnosed with auditory processing difficulties, yet in my classroom with the amplification system they were able to process information more easily."

"I am always able to speak using a soft voice. This makes it much easier on my throat. I believe this enhances my teaching."

"Mentally I feel more positive at the end of the day, as I did not need to 'nag' students or raise my voice over 28 other voices."

The improvements to the system suggested by the teachers were related to mechanical or technological aspects of the systems. They preferred head-worn microphones for more consistent voice pick-up, rechargeable batteries to avoid interruption of the signal, and four speakers rather than one central speaker to keep the level transmission of sound throughout the classroom. A complete list of responses to the survey questions can be found in Appendix B.

Discussion

The results from this exploratory study of a small number of students in three classrooms reveal an important trend that warrants further research. It appears that students with attending difficulties can benefit from the use of sound-field amplification in the classroom. The students with attending difficulties in this study demonstrated a 16% increase in on-task behaviour when amplification was in place. This growth of three minutes and sixteen seconds over a 20-minute period, could translate into valuable amounts of classroom instruction and direction that the student will no longer be missing in the amplified environment. An increase of three minutes and sixteen seconds for every 20 minutes means an increase of nine minutes and forty-eight seconds every hour, or almost one full hour of increased time on-task in every school day. If a student spends 60% of their school day engaged in the listening process (Berg, 1987), this may mean 33 extra minutes daily that a student is involved in the task at hand as opposed to daydreaming or focusing on other things. These 33 extra minutes a day can represent 6,600 minutes, or 110 hours, in an average school year. This is a significant amount of time that could have an impact on the academic future of students with attending difficulties. The data suggest that amplification is an effective way of increasing the on-task behaviour of students with listening difficulties.

The students involved in the study who were designated as good listeners also showed an increase in on-task behaviour. This increase was small (3%), however, these students did not have much room to improve. It is reassuring that the data suggest that good listeners remain good listeners, or become even better listeners in an enhanced listening environment.

The use of a sound-field amplification system was considered beneficial from both the students' and teachers' perspectives. Use of the system may also have an economic impact on school divisions for it can influence the number of sick days taken by teachers in a year, particularly those with chronic voice problems. A study conducted by Allen (1993) surveyed 56 teachers in Iowa. The number of sick days used because of voice, jaw, or throat problems before the teachers had access to amplification was approximately 52 days or 0.93 days per teacher. The estimated sick days used after the amplification systems were implemented in their classrooms dropped to 19 days or only 0.34 sick days per teacher. This has money saving implications in terms of reducing the need for hiring substitute teachers.

There were also some disadvantages noted in the use of amplification systems in classrooms. These primarily involve the cost and convenience of the systems themselves, as well as some negative reactions from students with auditory sensitivity. The cost of the equipment and installation may range from $600 to $1,500. Typically, a higher cost results in better sound quality, but it is important to evaluate the systems available before making a purchase. The feedback from teachers and students indicated that a system that includes four speakers lo-

cated around the room was preferable to the one central speaker; also the head-worn microphone was preferred to the clip-on microphone, so that the signal was not lost when the speaker turned his or her head. Both options (more speakers and a head-worn microphone) were part of the more expensive system.

Another consideration is that the system must be maintained once it is installed. This requires someone in the school to have the technical expertise, as well as the time to monitor, troubleshoot, and fix any problems that arise. Teachers must also be willing to take the responsibility to care for the system, by recharging microphones each evening, or having extra batteries on hand. If the system is not convenient to use it will not be used consistently, and therefore its effectiveness will be reduced.

A sound-field amplification system also can be a disadvantage to a small percentage of students who find it too loud and are annoyed by the increased intensity of the signal. In the current study, only one of the 71 students surveyed responded in this way.

Something else to consider is whether the students are being done a disservice if only certain settings of their school day are being amplified. If students are accustomed to amplification in one classroom and then move on to a different room where the system is not in place, do they become less effective listeners in this new environment? What happens to students who have amplification one year and not the next? The issue of consistency and its importance and the potential impact that this has on the listening skills of students is critical. To date, these issues have not been studied and require further investigation.

Some of the limitations in generalizing the current findings to other classrooms relate to differences in classroom noise levels and the amount that the SNR is improved by different sound-field amplification systems. The current study did not measure the SNR improvement that was provided by the sound-field amplification systems or the general range of noise levels in the classrooms. If these measurements had been obtained, a comparison to other studies may have revealed that the amount of improvement in students' attending behaviours could be attributable to acoustic differences in the test environments. If the amplification systems and classroom noise levels are similar across studies, with regard to both acoustics and benefits, then the generalization of results to other classrooms is more likely. However, further research is necessary to confirm this suggestion.

Also, although the results of this study suggest that amplification can help increase the amount of "on-task" behaviour demonstrated by students with attending and focusing difficulties, it does not tell us whether or not this behaviour actually leads to increased comprehension. Though students appear to be listening, they may not necessarily be processing the information being offered to them. This study has suggested an important trend related to increases in on-task behaviour in the presence of sound-field amplification. However, further investigation with larger numbers of students and a greater variety of measures, including classroom noise levels and changes in students' overall school performance, is needed before generalizations can be made.

Conclusion

Sound-field amplification may be very useful in the classroom. Overall, students demonstrate an increase in the amount of time spent on-task in an amplified environment by as much as 16%. Dependent on the student, more time on task may turn into a greater ability to learn information, follow directions, and exhibit higher academic achievement. Students see amplification as a positive device used in classrooms. They feel they are able to hear and listen better when amplification is in place. This may enhance their potential as learners. Teachers also see amplification as beneficial in their classrooms both for their students and for themselves, as it reduces voice fatigue and gives them more mobility. Sound-field amplification has the potential to be a powerful pedagogical tool, and although this study suggests its potential value, further verification via carefully designed studies with more participants and in a variety of settings is needed. As further information becomes available, it may be beneficial for schools to consider implementing this technology in classrooms.

Author Note

Please address all correspondence to Shauna Cornwell, 105 Rushmore Road, Winnipeg, Manitoba, R2G 3V9.

References

Allen, L. (1993). Promoting the usefulness of classroom amplification equipment. *Educational Audiology Monograph 3*, 32-34.

Allen, L., & Patton, D. (1990, November). *Effects of sound-field amplification on students' on-task behaviour*. Paper presented at the American Speech, Language and Hearing Association Convention, Seattle, WA.

Benafield, N. (1990). *The effects of sound-field amplification on attending behaviours of specch and language delayed preschool children*. Unpublished master's thesis, University of Arkansas at Little Rock.

Bennett, L. (1994, September/October). Acoustical factors that interfere with learning. *The Canadian School Executive*, 45-46.

Blake, R., Field, B., Foster, C., Platt, F., & Wertz, P. (1991). Effect of FM auditory trainers on attending behaviours of learning disabled children. *Language, Speech, and Hearing Services in Schools, 22*, 11-114.

Butler, K. (1975). *Auditory perceptual skills: Their measurement and remediation with preschool and school-age children.* Paper presented at the American Speech-Language-Hearing Association Convention, Washington, DC.

Crandell, C. (1991). *The effects of classroom amplification on children with normal hearing: Implications for intervention strategies*. Paper presented at the Callier Center for Communication Disorders, University of Texas, Dallas, TX.

Crandell, C. (1996). Effects of sound-field amplification on the speech perception of ESL children. *Educational Audiology Monograph, 4*, 1-5.

Crandell, C., Smaldino, J., & Flexer, C. (1995). *Soundfield FM amplification: Theory and practical applications*. San Diego, CA: Singular.

Flexer, C., Millin, J., & Brown, B. (1990). Children with development disabilities: The effect of soundfield amplification on word identification. *Language, Speech, and Hearing Services in Schools, 21*, 177-182.

Flexer, C., Richards, C., Bluie, C., & Brandy, W. (1994). Making the grade with amplification in classrooms. *Hearing Instruments, 45*(10), 24-26.

Osborn, J., VonderEmbse, D., & Graves, L. (1989). *Development of a model program using sound field amplification for prevention of auditory-based learning disabilities*. Unpublished study, Putnam County Office of Education, Ottawa, ON.

Palmer, C. (1998). Quantification of the ecobehavioral impact of a soundfield loudspeaker system in elementary classrooms. *Journal of Speech, Language, and Hearing Research, 41*, 819-833.

Ray, H., Sarff, L., & Glassford, F. (1984). Soundfield amplification: An innovative educational intervention for mainstreamed learning disabled students. *The Directive Teacher, 6*(2), 18-20.

Sanders, D. (1965). Noise conditions in normal school classrooms. *Exceptional Child, 31*, 344-353.

Sarff, L. (1981). Why not amplification in every classroom? *Hearing Aid Journal, 34*(12), 11.

Stefanishyn, K. (1997). Student FM evaluation. [Brochure] Phonic Ear, Ltd., Mississauga, ON.

Zabel, H., & Tabor, M. (1993). Effects of soundfield amplification on spelling performance of elementary school children. *Educational Audiology Monograph, 3*, 5-9.

Manuscript received: September 3, 2000

Accepted: May 2, 2001

Appendix A

Classroom Observation Data Collection Form

Name of Student								
Variables	**Un-Amp**	**Amp**	**Un-Amp**	**Amp**	**Un-Amp**	**Amp**	**Un-Amp**	**Amp**
Time of Day								
Date								
Participant								
Time On-Task (in 20 min.)								
% of Time On-Task								
Difference								

Appendix B

Student and Teacher Survey Responses

Student Evaluation of Classroom Amplification

1. Do you think amplification of the teacher's voice has helped you in your school work?
   Yes – 86% No – 14%

Please tell how it has or has not helped.

It has helped me because if someone else is talking you can still hear the teacher.
It is easier to listen.
It helps me because it goes throughout the classroom and helps me listen more closely.
It helps me because I don't have to ask the teacher what to do after she said it anymore.
It helps me because it is louder than most things so I can hear.
I don't have to ask for the directions over again.
It helps me to understand the teacher.
It has helped me because now the teacher sounds clear instead of a mumbling voice.
It is louder and clearer.
I hear better.
I listen better.

2. Would you like to see amplification used in more classrooms?
   Yes – 80% No – 17% Maybe – 3%

3. If you could change the FM system in some way, what would you do?

I would make it a little more louder.
I would put one in every classroom and also give every kid one so the teacher sounds louder and so do the kids.
I would make it so you never heard feedback.
I would put a speaker by each desk.
Each of us should have our own headsets so we can answer questions.
We should have more speakers.
We should get a headset microphone.
I would make the hole where the sound comes out bigger.

FM Amplification System Teacher Survey

1. Do you think that having the amplification system is your classroom benefits your students?
   Yes – 100%

2. If yes, how is it beneficial?

   The children stop talking almost immediately when I want their attention because my voice overrides theirs.

   The FM system seems to make it easier for students to single out/focus on my voice without having to strain their ears to listen. The students respond more quickly to directions, thus being spared from being nagged.

   It is easier for students to hear instructions, and clearer for those at the rear of the room. It reduces the noise level and amount of off-task conversation as students are more aware a lesson is about to begin. I believe there is more time spent teaching/learning and less time trying to understand/clarify instructions.

   My voice is much clearer. Children can hear me even if the children around them are making noise (talking, rustling papers, moving chairs, etc.). My voice is clearly heard regardless of where I am standing.

   The students are very motivated by the opportunity to use the microphone themselves.

   A few students who have had many difficulties in past years have been very successful in my classroom. Two of these had been diagnosed with audio-processing difficulties, yet in my classroom with the amplification system they were able to process information more easily, follow directions, and were more successful academically.

3. Do you think using the amplification system is beneficial to you as a teachers?

   Yes – 100%

4. If yes, explain how.

   It allows me to move around more as a teacher. I can be walking anywhere in the room or even in the hallway and my students can still hear me. I can be facing the whiteboard or getting materials ready while I am talking and they can still hear me.

   The system can be plugged into televisions or stereos as well and makes this type of listening situation much more enjoyable – like surround sound.

   I am able to always speak using a soft voice. I no longer need to change the volume of my voice. This makes it much easier on my throat. I believe this enhances my teaching.

   It keeps me from straining my voice and I think it makes me more conscious of the words I am communicating. It helps make me a more careful/succinct communicator.

   I have nodules on my vocal chords which have distorted my voice. With the use of the amplification system I do not have to project my voice, but I can be heard easily. I have noticed an improvement in my voice with the use of the system.

   There is less strain on my voice and I am not hoarse at the end of the day. Mentally I feel more positive at the end of the day as I did not need to "nag" students or raise m y voice over 28 other voices. Less time is spent in transitions, therefore there is increased teaching and learning time. I also believe I am more conscious of my pronunciation and what I am trying to say.

5. If you could change your FM system in any way, what would you do?

   I would appreciate a head microphone rather than the lapel microphone for it does not pick up sound when you turn your head.

   A better quality system may sound more natural and be less susceptible to feedback and interference.

   More speakers would be good for students close to our one speaker claim the volume is too loud.

   I would have a headset. The clip-on microphone that I have is often in the way. It bangs against books that I'm reading. It is difficult to position the clip-on microphone in such a way that it picks up my voice. The headset would be closer to my mouth. Also, the on/off switch is not convenient on my power pack. I would prefer it to be more accessible.

   A rechargeable microphone would be good, for the batteries have a short life.