

The Pursuit of Technology: Obtaining Classroom Sound Field Amplification Systems in a Rural Setting

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A vast amount of research regarding classroom sound field amplification technology (also called Classroom Audio Distribution Systems – CADS) has resulted in the recognition of benefits to both teachers and students using these systems. Among the many advantages, research has shown that many children, regardless of hearing status, demonstrate improved listening and learning behaviors that enhance the literacy learning of early readers in amplified classrooms (Heeney, 2004; Mainstream Amplification Resource Room Study, 1992). In addition, teachers are able to benefit from improved vocal health and control of classroom behavior (Sapienza, Crandell, & Curtis, 1999; Crandell, Smaldino, & Flexer, 1995; Flexer, 1989; Rubin, Aquino-Russell, & Flagg-Williams, 2007; Eriks-Brophy & Ayukawa, 2000). In spite of these undeniable benefits, many schools still lack this technology. This could be attributed to limited equipment funding as well as the need for educating teachers and administration as to the potential benefits that sound field amplification can provide to everyone in the classroom. In this field report, these two areas of concern were addressed within a rural elementary school system that defined and achieved a goal of classroom amplification systems for all kindergarten through third grade classes. The teachers and administrators were educated as to the benefit that classroom amplification could provide in an effort to garner support for the project. In addition, various avenues of funding resources were explored and subsequently obtained. The defined goal was achieved within two years, in spite of limited funding options available in the rural community. An initial informal survey of teachers showed that they are pleased with the amplification systems and using them consistently.

Introduction

Many audiologists are aware of the published research showing the benefits of sound field amplification devices (also called Classroom Audio Distribution Systems – CADS) in the classroom to young learners as well as their teachers.

Benefit to Students

Various studies have shown improved reading skills, math achievement, and listening behaviors when sound field amplification systems are used in the classroom. For example, Millett and Neil (2010) examined reading outcomes for first grade students in 24 classrooms. Half of the classrooms had amplification and the other half did not. The authors reported that the amplified classrooms had a higher percentage of students reading at grade level over those in unamplified classrooms. In another study, Heeney (2004) observed improvements in amplified classrooms students' listening comprehension, reading comprehension, reading vocabulary, and mathematics over peers in unamplified classrooms in his study, which included students in grades one through six. In a third study, Updike (2006) shared results that documented academic improvement in language and math sections of a standardized state assessment when comparing third grade students who had access to classroom amplification to students from the previous year who did not have this technology.

Additionally, the frequently referenced Mainstream Amplification Resource Room Study (MARRS) provides audiologists with data that academic achievement is improved for all students with the use of sound field amplification in classrooms (Mainstream Amplification Resource Room Study, 1992).

Benefit to Teachers

Previous research also suggests that sound field amplification systems provide benefit to teachers in terms of vocal health, reduced muscle tension, and increased behavior management in the classroom. When examining the profession as a whole, teachers have a greater incidence of voice disorders as well as missed work days due to vocal problems over non-teachers (Ray, Merrill, Thibeault, Gray, & Smith, 2004). Several studies showed that when sound field amplification devices were used in the classroom, teachers reduced their vocal loudness, which subsequently led to reduced vocal strain and fatigue resulting in fewer missed work days (Sapienza, Crandell, & Curtis, 1999; Crandell, Smaldino, & Flexer, 1995; Flexer, 1989; Gilman & Danzer, 1989; Edwards, 2005).

The health of teachers as well as the need to keep them in the classroom is important, and yet, classroom amplification can provide benefits to teachers that go beyond these issues. Increased efficiency in the classroom as well as improved student responses to the teacher were documented in research by Rubin, Aquino-

Russell, and Flagg-Williams (2007). In addition, Eriks-Brophy and Ayukawa (2000) conducted a study that found on-task behavior and attending behaviors of students improved in amplified classrooms after just three months of use. Increased student attention as well as improved listening behavior was also noted by Edwards (2005) with the use of sound field amplification systems. In another study, researchers reported that children who have Attention Deficit Hyperactivity Disorder (ADHD) as well as emotional or behavioral related disorders were able to respond more quickly to the teacher when in an amplified versus unamplified classroom (Maag & Anderson, 2006, 2007). Finally, when sound field amplification systems were installed in grades kindergarten through second, the children's inappropriate classroom behaviors decreased (Palmer, 1998). Furthermore, Blair (2006) documented in another study that all teachers using amplification systems in the classroom found them to be useful. These studies show clear support of benefits teachers experience related to improved control of the classroom environment with the use of sound field amplification.

In summary, the aforementioned research studies showed that a better signal-to-noise ratio improved the educational environment for students and teachers. Recently, this research was put into practice when it became a reality for one rural elementary school. This field report will illustrate how creative thinking, education, and the support of the community were required to successfully find and obtain funds for CADS in this rural setting.

Creating an Achievable Goal

It would be ideal to have sound field amplification systems in all classrooms within an elementary school for grades kindergarten through six as the MARRS study supports the benefit of classroom amplification for all children under the age of 15. However, after reviewing the research and assessing the feasibility of this objective, a specific, defined, and achievable short-term goal was formed. The method of implementing evidenced-based practice helped the small group of parents and teachers formulate the school's goal as follows: provide sound field amplification to all classrooms grades kindergarten through three in order to support and enhance the educational environment of early readers and their teachers. This goal was formulated in the fall of 2009 and was designed to support the school's focus of improved reading comprehension and achievement in state test scores related to enhanced literacy.

Methods and Results

The School

The targeted elementary school for this project had approximately 500 students enrolled in grades kindergarten

through six, and 45% of these students qualified for free or reduced lunch. This enabled the school to provide programs through Title 1 federal funding, such as supplemental resources for reading and tutoring. Given the financial need of this population, asking students' families for additional funds to support the expense of classroom amplification systems would not likely yield fruitful results. In addition, outside funding sources were limited in this agricultural and manufacturing area.

Step 1: Fostering Excitement Through Education

The first step in meeting this goal of sound field amplification systems in all elementary classrooms from kindergarten through at least third grade began with gaining the support of the administration, the teachers, and the parent-teacher council. Each grade level in this particular school had three classrooms; therefore, 12 amplification systems would be needed to complete the defined goal. Unless all parties were supportive and also excited by this project, progress would not be made. Therefore, contact was made with teachers who had used amplification systems in the past. One teacher was so supportive of this initiative that she was willing to demonstrate her system during formal presentations to the administration and the parent-teacher council. Incorporating a live demonstration of the benefit of this technology was also supported in the literature as an example of one method for educating and sharing the enhancement that is provided to the listening environment when the signal-to-noise ratio is improved (Ostergren, 2006).

The demonstration of the device was highly effective as compared to a simple, informative session with verbal and written facts and figures regarding the benefits of the systems. As the teacher shared her personal experience with this system, she turned on the amplification, and in every instance, there was an audible gasp as the audience witnessed the impressive change in acoustics provided by this system. This powerful demonstration changed the tone of the presentation from one of general agreement and support to one of excitement and need for these devices in the school. The teachers, administration, and parent-teacher council came together with a new understanding and appreciation of these systems that would create the best listening and learning environment for students.

Step 2: The Funding Struggle

Once the support and excitement of the administration was obtained, the next step was to identify potential funding sources and to obtain monies to support this venture. This particular portion of the mission was addressed in several ways:

Parent-Teacher Council. The parent-teacher council took ownership of this sound field amplification project and began

setting fundraiser monies aside for the purchase of these systems. The fundraising activities included the sale of trash bags in the fall and spring semesters, a fall carnival, food sales, a restaurant partnership (i.e., receipt of a percentage of profits from 2 to 3 hour time period on a specified date), and a spring bingo game.

The shift in expenditures of their funds resulted in a significant financial contribution toward this project, but it would take many years before the goal of having a system in every classroom could be met. At the same time, the involvement of the parent-teacher council provided an avenue through which grant applications could be submitted. An organization applying for a grant would be more powerful and effective than an individual.

Philanthropic Organizations. Several philanthropic organizations in the community were identified as potential contributors to this project: Psi Iota Xi, Tri Kappa, Lion's Club, and Rotary. Other communities may also have access to Sertoma, Optimists Club, or other benefactors with missions designed to improve education, assist children, support literacy, and enhance speech and language development. Applications to these types of organizations vary, and presentations, such as the demonstration described earlier, can be powerful in garnering financial support for the project.

Private Industry Grants. Often, local hospitals, auto manufacturers, and utility companies offer grants to community-based organizations in support of various projects. Unfortunately, the school and parent-teacher council were disqualified from many local, company-based grants because of the tax related status [501(c)(3)].

Community-Based Grants. Many communities have funds identified as 'Community Foundation' or 'Community Improvement' in which qualification for grant monies vary, but may not exclude school based projects. The site DonorsChoose.org is a web-based option for sharing a project idea, which provides donors the opportunity to contribute to a cause. Fortunately for this project, the Attica Community Foundation (part of the West Central Indiana Community Foundation) did not eliminate the school or parent-teacher council based on the tax status. After completing the grant, attending a meeting to answer questions, and providing resources supporting the need for the project, funds in the amount of \$3,600 were awarded from this foundation. This funding allowed for the purchase of four classroom amplification systems. Again, the opportunity to educate the members of these groups was invaluable because the message of creating the best listening and learning environment for the children in this community was received and then acted upon.

As a requirement of the awarded grant, announcements were made to the local newspapers and the school newsletter. These brief announcements shared the news of the grant award, included

a picture of the teachers with the equipment, and shared quotes from the teachers relaying their appreciation of the award monies. The Attica Community Foundation was thanked for their support of this important project and for providing the improved listening and learning environment for students. In addition, a summary report detailing the expenditures and successes of the project was provided to the Attica Community Foundation.

Step 3: System Installations & Teacher Surveys

Funding was obtained to purchase and install all twelve classroom amplification systems in grades kindergarten through three. During and following the installation period, several steps were taken to ensure consistent use of the systems. First, teachers were provided with information early in the process regarding the benefits of the amplification systems. The importance of educating teachers regarding the value of these systems was also supported in the literature (Blair, 2006). Second, there was a great deal of initial excitement about receiving the equipment, which was produced through the device demonstrations. These two factors increased the likelihood of continued use of the sound field amplification; however, even minor concerns regarding device use were alleviated once teachers had the opportunity to utilize the amplification systems.

After the systems were used for at least one semester, an informal follow-up survey (provided in the Appendix) was created and provided to the teachers in the 12 classrooms. The goal of the subjective questionnaire was to ascertain any changes in student behavior that may be attributed to the installation of the amplification systems. The intention was to share the information that was gathered with the grant organization, school administration, and neighboring school districts.

Nine of the 12 surveys were returned and seven were complete. kindergarten through third grade teachers were represented in these seven surveys, and the seven classrooms represented a total of 138 students (i.e., 17 to 22 students per room). According to the survey, attention and behavioral issues were identified in 24 of these 138 students (~17% of students). The seven classrooms were all of comparable size (approximately 50' x 50') and had carpet, ceiling panels, and blinds over the windows. No other sound-dampening strategies or devices were in place.

On the seven completed surveys, all teachers agreed or strongly agreed that, since installation of the equipment, students were better able to maintain attention during a lesson and throughout the day. Additionally, five of the seven teachers agreed or strongly agreed that students were quieter since the sound systems were installed, and four of the seven reported that students were able to follow verbal instructions the first time they were given (Figure 1). The information obtained from the surveys was subjective, but did

provide insight into the teachers' perceived benefit of the sound systems.

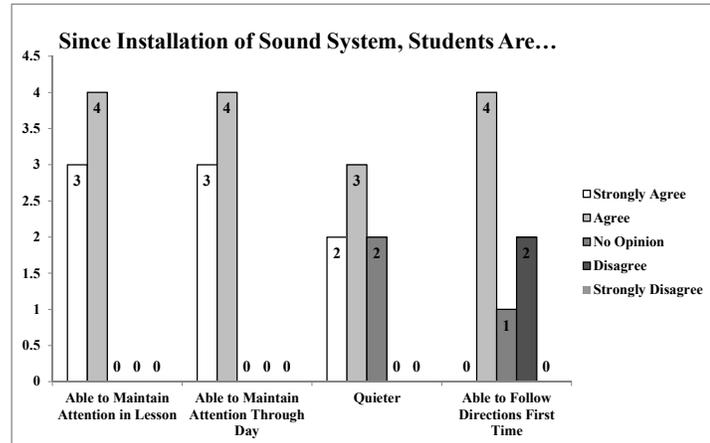


Figure 1. Teacher survey results.

The survey also elicited information regarding teachers' health and revealed that teachers noted reduced vocal strain, muscle fatigue, and headaches after installation of the sound field amplification systems. In addition, teachers generally noted improved classroom behavior, attending and listening behaviors, and felt that the sound field amplification had a positive impact on their classroom. This was notable considering that approximately 17% of the children in these classrooms had attention and behavioral problems (Table 1).

Even before the survey was offered, teachers verbally shared

Table 1. Teachers' Perceptions of the Benefit of Classroom Amplification.

Response	Number Responding
Strongly Agree	5
Agree	2
No Opinion	0
Disagree	0
Strongly Disagree	0

Responses were given to the statement "Based on my knowledge and observations, I believe the amplification system is beneficial to each student's overall attention, listening and learning in the classroom."

experiences of calmer classrooms, students prompting use of the systems, and less frequent reinstruction and redirection of students throughout the day. Several teachers wrote comments on the survey to share the experiences they had with the equipment (Table 2). The technology was appreciated and continues to be used for all hours of the school day in every classroom that is equipped with amplification.

Table 2. Additional Teacher Comments from Survey

"The improvement for me in terms of reducing stress has been amazing. I hope I never have to go without one." (referenced vocal stress and tension headaches/muscle fatigue)

"It seems to help my hearing impaired student.

The children love it when I speak right in it to get their attention when we interview our friend for classroom book and individual take home Friend Books, they get to wear it and that is 'fun'."

"I love the system. I see a huge difference in the student's attention span and listening skills!"

Discussion and Conclusions

The goal of obtaining sound field amplification in every classroom from kindergarten through third grade was achieved within two years. The community as a whole, the administration, the parent-teacher council, and the Attica Community Foundation should be proud of their efforts and acknowledged for the important roles they played in achieving this impressive accomplishment. Providing classroom amplification was truly a community endeavor and a successful undertaking for this rural location because of the support of many persons and organizations. Sharing the steps that were taken to define and meet the goal of classroom amplification with other audiologists, speech language pathologists, and rural school system administrators will benefit students in other communities.

The teacher survey form that was created and utilized as a post-evaluation measurement of satisfaction with classroom amplification had several limitations. Because of a lack of data prior to installation of the equipment, caution should be exercised in drawing conclusions to the amplification attributing to improved student attention. If this survey were to be used in the future, additional modifications to several questions would also be warranted. With that in mind, the subjective reports of teachers and students suggested that this project was successful and should be expanded to the upper grade levels.

In addition to eliciting verbal feedback and basic survey results from teachers, students in grades kindergarten through two in this school system complete beginning, middle, and end of year reading and math standard assessments. These scores are being monitored for trends regarding academic changes that could be attributed to classroom amplification. Any noted trends will be reported in a future research.

Appendix. Teacher Survey

**Sound Field (SF) System Teacher Survey
Developed by: Shannon Van Hyfte, AuD, CCC-A**

School: _____ Teacher: _____

Grade Level: _____ Date: _____

Approximately how long have you had your SF equipment? _____

What is the approximate size of your classroom? _____

Is the classroom carpeted? YES NO

Does the classroom have drapes over the windows? YES NO

Does the classroom have fabric on the walls? YES NO

Are there any other sound dampening items in the classroom?
If yes, please explain. YES NO

How many students are in the classroom? _____

How many students have attention/behavioral issues? _____

How many students have chronic ear infections/hearing loss? _____

How many wear hearing aids? _____

How many use personal FM systems? _____

How many students function below grade level in reading and/or spelling? _____

Have you previously suffered from vocal problems (i.e., loss of voice, laryngitis,
hoarseness)? YES
NO

If so, how frequently do these problems arise? _____

Have you previously suffered from tension headaches or muscle fatigue in your neck or
shoulders? YES NO

If so, how frequently do these problems occur? _____

1= Strongly Agree 2= Agree 3 = No opinion 4 = Disagree 5 = Strongly Disagree DNA = Does Not Apply

Since installation of the equipment:

Students are able to maintain attention throughout a lesson.

1 2 3 4 5 DNA

Students are able to maintain attention throughout the day.

1 2 3 4 5 DNA

My classroom seems to be quieter.

1 2 3 4 5 DNA

I frequently have to redirect my students in order to keep them on task.

1 2 3 4 5 DNA

My students are able to follow directions the first time they are given.

1 2 3 4 5 DNA

I have vocal problems (i.e. hoarseness, bouts of laryngitis, times of loss of voice).

1 2 3 4 5 DNA

I have headaches/muscle tension (i.e. muscle fatigue in head, neck, or shoulders).

1 2 3 4 5 DNA

Based on my knowledge and observations I believe the amplification system is beneficial to student's overall attention, listening and learning in the classroom.

1 2 3 4 5

Overall, I am satisfied with the sound field amplification system in my classroom.

1 2 3 4 5

Please add comments to help us understand any benefits or lack of benefits received from this equipment. Any specific data you have regarding changes in student grades would help us assess long-term benefit of the equipment. One example might be an average class grade in reading prior to installation of the sound field equipment compared to the average class grade after 3 months of installation. Additional comments:

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