Abstract

The CLASSROOM AMPLIFICATION pilot project was intended to study the effects of classroom amplification on the listening and learning behaviours of learners in regular education classrooms.

Data was collected from seven classrooms in three different schools in the Gauteng district. Four classes between grade 2 and grade 7 (primary grade level) and three grade 10 maths classes (secondary grade level) were involved in the project.

The PhonicEar RADIUM Sound Field system produced a vocal amplification of between 8 – 10 decibels over the existing classroom noise. Learners in amplified classrooms showed great improvement in listening and learning behaviours.

The project was compiled by H.A.S.S. Communications, a Pretoria based company.

Purpose

Listening and learning opportunities for children are often compromised when they are subjected to less than optimum acoustic educational environments. The CLASSROOM AMPLIFICATION 2002 project was aimed to determine if learner’s listening and learning behaviours improved due to an enhanced acoustic classroom environment created by using FM Sound Field classroom amplification.

Methods

Subjects were 95 Primary School students and 72 Secondary School students in three different schools. All classes were in regular education schools.

Additional information was obtained about each classroom using the Classroom Profile worksheet.

The PhonicEar Radium Sound Field system was installed in all the classrooms with a portable two-channel column speaker placed in one of the corners in the front of the classroom. Specialists from H.A.S.S. Communications provided teachers with information and training on the usage of the systems. Information included topics such as basic classroom acoustics, the effect of noise on speech recognition, use of FM Sound Field amplification and “What is Sound Field?” The project was coordinated by Sound Field specialists from H.A.S.S. Communications.

The Listening and Learning Observation (LLO) questionnaires and the Evaluation of Classroom Listening Behaviours (ECLB) questionnaires (adapted from VanDyke, 1985) were completed for between 5 and 10 learners in each classroom. Questionnaires were completed at different periods during the project in the structure of pre-evaluation (prior to installation), mid-evaluation (3 – 5 weeks) and post-evaluation (6 – 10 weeks). Teachers and learners participated in project evaluation.
Selection of Schools and Teachers

Principals were given a presentation on Sound Field to determine interest in the project and teachers were selected based on their willingness to participate in the project. English was the medium of education in all the classes. Classes were not selected to ensure specific ability groupings. Different grades were used to determine the difference in improvement between younger and older learners.

Classroom Environment

Classrooms (grades 2, 4, 7 and 10) were located in three different schools. Two of the schools were located in quiet neighbourhood areas while the other one was located at the intersection of a busy street. One of the schools was near an airport with aeroplanes flying over frequently. Additional information was collected from the Classroom Profile questionnaire used for this project. Results from this questionnaire have shown that all of the participating classrooms are poor listening environments and regular support is needed for teachers and learners in addition to modification of listening environments, including the addition of Sound Field amplification.

Learner Evaluation

Emphasis was placed on change in learner's listening behaviours in selecting observation scales for this project. Available learner observation instruments were reviewed and the Listening and Learning Observation (LLO) questionnaire emerged as the primary observation tool for this project. The (LLO) includes information on listening behaviours, academic behaviours and academic skills. Teachers rated learner’s behaviours and skills over the evaluation period.

The (LLO) total score is a maximum of 75 points. Observations were completed on learners prior to the beginning of the amplification project (pre-evaluation), 3 – 5 weeks (mid-evaluation) and 6 – 10 weeks (post-evaluation).

The Evaluation of Classroom Listening Behaviours (ECLB) was also used as an observation tool in the Classroom Amplification project. The (ECLB) was completed in conjunction with the (LLO) for between 5 – 10 learners in each class who were selected by their teachers. Maximum score on the (ECLB) is 50 points. This observation tool has been used effectively in some schools as pre- and post-assessment for use of assistive listening devices.

Project Evaluation

Classroom Amplification evaluation forms were completed by all learners and teachers involved in the project. Some of the items used in the evaluation instruments were selected based on findings of previous research, such as a decline in referrals for special services and teacher’s perceptions of Sound Field amplification benefits.
Results and Discussion

Classroom Evaluation

The Classroom Profile questionnaire was used to evaluate the Classroom environment. This was completed for each classroom involved in the project.

- Results from this questionnaire has revealed that 100% of the classrooms had no acoustic treatment (acoustic wall tiles, acoustic ceiling tiles, carpets). Hard walls, high ceilings, glass windows and uncarpeted floors reflect many sounds, which has a negative impact on speech understanding.

- 83% of the classrooms had more than one constant noise source and at least one occasional noise source (noises from inside and outside - rotation of classes, trains, aeroplanes, chatting learners, desk and chair movement). All these interfere with a learner’s ability to hear effectively.

- Classroom structure consisted of 50% lecture-style rows, meaning that the learners in the back row only receive about 55% of the speech signal and the situation becomes worse when the number of learners per class increases. The other 50% consisted of learner-centred groups, meaning that the learners don’t always face the teacher during teaching, which makes listening even more difficult.

- Classroom sizes showed that 50% of classes had between 20-25 learners and 50% had more than 25 learners. The higher the number of learners per class the more difficult the listening situation becomes.

- It was noted that 33% of classes had at least three learners that are difficult to educate or have special needs (attentional problems, hearing impairment, visual impairment, speech impediment and hyperactivity) and 67% had more than three learners with special needs. These learners find it even more difficult to focus auditory attention on the teacher in a poor listening environment.

- 67% of teachers believed that the teaching method (syllabus) affected the learner’s listening skills and makes listening more difficult while 33% believed it didn’t have any effect.

- Results for the teacher’s attitude towards technology showed 80% enthusiasm in all teachers.

After evaluating all the information from the Classroom Profile questionnaire results revealed that all the classes were poor listening environments. Regular support is needed for teachers and learners in addition to modification of the listening environment, including the addition of Sound Field amplification.
**Learners Evaluation**

The *Learner Profile* questionnaire was used to evaluate learners. All learners in the classes involved completed these questionnaires. Pre-, mid- and post evaluations were completed.

Learners revealed enthusiasm regarding the use of FM Sound Field classroom amplification.

Learners gave the following positive ratings on the *yes/sometimes/no* response instrument:

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>SOME TIMES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Listening to my teacher is easier</td>
<td>84%</td>
<td>16%</td>
<td>0%</td>
</tr>
<tr>
<td>My teacher doesn’t have to raise her voice so often</td>
<td>64.6%</td>
<td>27.2%</td>
<td>8.2%</td>
</tr>
<tr>
<td>I can clearly hear my teacher when she’s writing on the board</td>
<td>79.8%</td>
<td>16.8%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Background noises don’t bother me so much anymore</td>
<td>32.4%</td>
<td>53.6%</td>
<td>14%</td>
</tr>
<tr>
<td>Other learners make less noise</td>
<td>39%</td>
<td>39.6%</td>
<td>21.4%</td>
</tr>
<tr>
<td>My teachers instructions are more clear to me</td>
<td>66.2%</td>
<td>28.2%</td>
<td>5.6%</td>
</tr>
<tr>
<td>The classroom is more quiet and calm with the system</td>
<td>43.4%</td>
<td>44.6%</td>
<td>12%</td>
</tr>
<tr>
<td>I can hear the teacher from anywhere in the room</td>
<td>85.4%</td>
<td>14%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Understanding my work is easier because I can hear better</td>
<td>65.4%</td>
<td>28.8%</td>
<td>5.8%</td>
</tr>
<tr>
<td>I feel less tired at the end of the day</td>
<td>44.8%</td>
<td>38.8%</td>
<td>16.4%</td>
</tr>
<tr>
<td><strong>Average:</strong></td>
<td><strong>60.5%</strong></td>
<td><strong>30.76%</strong></td>
<td><strong>8.74%</strong></td>
</tr>
</tbody>
</table>

Their positive evaluation was further amplified by comments obtained from the teacher evaluations.
On the question “**Would you like to have a Sound Field System in your class next year?**”

93% of the learners said **YES**.

**Reasons:**

- I can hear more clearly and it’s easier to understand my teacher
- I can do dictation
- It helps me to work and listen better
- I can hear when other learners are reading when using the hand-held microphone
- It helps to improve my marks
- My teacher doesn’t have to shout anymore
- I like it because I don’t want to strain my ears and always feel tired from trying to hear
- I can hear my teacher from anywhere in the class
- I can hear everything that’s happening in the class and don’t miss any work. I want my principal to buy it for next year
- My teacher doesn’t have to repeat herself anymore
- Grade 11 is a very difficult year and we need to concentrate and the Sound Field system is a very good device for us. It improves our listening skills
- It helps us when learners are out of control and the background noises are too much.
- Makes maths much easier to learn and to concentrate
- It will improve the pass rate of the learners and therefore give the school a good name because everyone will understand the work better
- Makes hearing easier and learning more enjoyable
- I don’t sleep in class anymore and can hear my teacher when she’s writing on the board
- Can hear clearly without disturbances and without getting distracted
- I don’t have to look at the teacher in order to hear, I can write and hear at the same time
- It grabs my attention when my teacher speaks
- I understand my work better and get my work done in time
- I don’t get so tired anymore and because I don’t have to strain my hearing
- When my classmates are talking I can still hear my teacher.

7% of the learners said **NO**

**Reasons:**

- It’s too loud
- When my teacher shouts when wearing the microphone, it hurts my ears
- I can hear the teacher without the system
- It didn’t make a difference to me. I choose not to listen and when I’m not listening I allow myself to get distracted. People learn and understand when they feel like it
- Sometimes it makes me feel sleepy
LLO and ECLB

The *(LLO)* **Listening and Learning Observation** and *(ECLB)* **Evaluation of Classroom Listening Behaviours** were used to evaluate the listening behaviours, academic behaviours and academic skills of the learners.

There was an overall improvement of **13.5%** noted in the *(LLO)* evaluation and **11.75%** in the *(ECLB)* evaluation over the evaluation period (between 6 and 10 weeks).

**Overall improvement in grade level:**

<table>
<thead>
<tr>
<th>Grade</th>
<th>LLO</th>
<th>ECLB</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>6%</td>
<td>11%</td>
</tr>
<tr>
<td>4</td>
<td>8%</td>
<td>1%</td>
</tr>
<tr>
<td>7</td>
<td>30%</td>
<td>31%</td>
</tr>
<tr>
<td>10</td>
<td>10%</td>
<td>4%</td>
</tr>
</tbody>
</table>

**Teacher Observation**

Teachers likewise showed approval for usage of the systems. Teachers rated decreased vocal strain as the major benefit realized when using the classroom amplification system.

**Additional comments of benefits offered by teachers included the following:**

- Learners hear and understand better
- It improves learner attention; the system assists in getting and keeping learners’ attention.
- Learners’ are not so passive anymore – some even stopped their sleeping habits.
- It reduces teacher’s vocal strain, produced a relaxed teaching environment and teachers felt less tired at the end of the day.
- Efficient classroom management
- Learners became calmer and responded positively. I used to shout so they could hear me but since the system was put in, they became more relaxed because I wasn’t shouting anymore.
- Improved language skills – learners wanted to make sure they pronounce and read the words correctly when speaking with the handheld microphone.
- Encourages shy learners to speak and share information in front of the class. It builds confidence in all learners when they use the microphone.
- I used to suffer from tonsillitis and my throat was usually itching but since I’ve been using the microphone, my health condition is excellent.
- I would recommend that the system be installed in classrooms to make the learning/teaching process more efficient. It is really a must have equipment.
- Less repetition of instructions
Even in Secondary schools I feel that the system would be to the advantage of learners and teachers.

I also for the first time realised how much strain a teacher puts on his/her voice – I am really missing my amplifier now!

Less repetition of instructions, learner attention improved.

Less time wasted throughout the day trying to obtain learner’s attention.

I would definitely recommend a Sound Field system to be installed in my class.

Learners enjoyed using the hand-held microphone.

All learners were able to hear and participation and attention definitely improved.

Dictation in my class improved as learners were able to hear words more clearly.

It did improve learner’s desire to participate orally and others more readily listened to the learner speaking compared to a situation without a speaker.

My voice is not so strained

There was a calmer atmosphere and learners kept quiet while I spoke. This aids the learning process.

I am free to walk around and have my back to some of the class while standing by a learner who needs individual guidance.

Other comments:

The learners could all hear better but it did not necessarily mean that they listened any better.

I found that once they’d got use to the speaker, I still had to repeat instructions or call them more than once, to quiet them down.

I can see this system being an advantage in classes with larger numbers (e.g. 40 learners per class)

I did not notice any academic improvements but the interaction with the learners was much easier

I found that once the novelty wears off the learners revert to their normal, noisy selves.

I sometimes wondered if the normal class noises didn’t become louder – a sort of counter-reaction by the learners

It would be more comfortable if the teacher could wear a clip-on microphone.
The teachers also agreed with the following points on the **teacher evaluation questionnaire**:

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>SOME TIMES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>I felt less emotional strain and fatigue during teaching</td>
<td>88.8%</td>
<td>11.2%</td>
<td>0%</td>
</tr>
<tr>
<td>My learners seem to be more attentive</td>
<td>77.7%</td>
<td>11.2%</td>
<td>11.2%</td>
</tr>
<tr>
<td>There was a decrease in the need to repeat directions and information</td>
<td>44.4%</td>
<td>55.5%</td>
<td>11.2%</td>
</tr>
<tr>
<td>My learners seem to listen and understand better</td>
<td>33.3%</td>
<td>55.5%</td>
<td>11.2%</td>
</tr>
<tr>
<td>My voice seemed to reach all learners in the room no matter where they were seated</td>
<td>100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I did not have to strain my voice</td>
<td>100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Sound Field equipment helped with classroom control and managing learner behaviour</td>
<td>66.6%</td>
<td>22.2%</td>
<td>11.2%</td>
</tr>
<tr>
<td>The Sound Field equipment was easy to use</td>
<td>77.7%</td>
<td>22.2%</td>
<td></td>
</tr>
<tr>
<td>I enjoyed using the Sound Field system</td>
<td>77.7%</td>
<td>22.2%</td>
<td></td>
</tr>
<tr>
<td>I felt comfortable using the Sound Field system</td>
<td>77.7%</td>
<td>22.2%</td>
<td></td>
</tr>
<tr>
<td>I would like to keep the classroom amplification equipment in my classroom</td>
<td>66.6%</td>
<td>22.2%</td>
<td>11.2%</td>
</tr>
<tr>
<td>The assistance from the specialist prepared me to use the system</td>
<td>100%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SUMMARY AND CONCLUSIONS

Overall findings of the pilot project showed that learners in amplified classrooms demonstrated greater and faster changes in listening behaviours, academic/pre-academic behaviours and skills. In particular, primary school learners in amplified classrooms showed great improvement.

Learners gave a positive evaluation for the use of Sound Field amplification. More than 90% of the learners agreed that the FM Sound Field system made it easier for them to hear their teacher, helped them listen better and helped them to hear when their teacher was writing on the board. 97% of the learners agreed that their teacher’s voice was loud and clear when using the system and that they wanted the FM system in their class again the following year.

Teacher benefits were identified which support the use of FM sound field classroom amplification in regular education classes. Teachers identified a decrease in vocal strain as the foremost benefit from using the Sound Field amplification.

The implementation of the Sound Field system into the classroom required an adjustment period for both the teachers and the learners.

FM Sound Field amplification a cost effective teaching tool based on a R 1.37 daily cost, R 41.60 monthly cost and R 500.00 yearly cost per person for a typical class of about 25 learners.
Appendix I  Pilot Project Evaluation Report

Appendix II  Evaluation forms