Summary

Sound-field improvement learning and literacy outcomes, creates enhanced classroom harmony and improved student behavior, and reduces voice strain among teachers. Sound-field achieves this by addressing problems associated with noise, distance and reverberation.

Sound-field is not a panacea for all problems in modern education. Effective teaching practice needs to be considered, as well as other environmental factors such as acoustics, lighting and ventilation.

Sound-field should not be reserved for children with special needs, as it benefits all students, regardless of school decile, ability or whether or not they have middle ear dysfunction.

Sound-field is one of the most cost effective interventions a school can invest in to increase literacy outcomes.

Recommendations

All classrooms should be fitted with sound-field systems to support good teaching practice. Other research showed that the benefits of sound-field are equally relevant to children, intermediate and secondary school classrooms.

Teachers in classrooms with sound-field should use the system consistently to maximise the benefits that sound-field can provide.

Teachers and schools should take advantage of opportunities to trial and experience sound-field in a classroom setting so they can experience the benefits for themselves.

Schools should install sound-field that are compatible with deaf and hearing impaired students’ personal FM systems.

Trainee teachers should be made aware of the issues associated with classroom acoustics and the benefits that sound-field can provide.

All classrooms should have basic acoustic treatment, including carpets and curtains, to reduce noise levels.

All schools should consider more advanced acoustic treatment such as absorptive ceilings.

Issues associated with the most comfort of sound-field microphones should be proactively addressed.

Appendix: Performance measures

Phonological Awareness Test — measures achievement in ten specific phonologic areas from letter-sound relationships to phonemic awareness.

Reading vocabulary and reading comprehension – to year three and above students.

Listening comprehension — to year three and above students.

Reading vocabulary and reading comprehension – to year four and above students.

Mathematics — to year five and above students.

References


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Research shows that excessive noise levels impair children’s speech perception, reading and spelling ability, attention and overall academic performance. Teachers also find classroom noise to be an issue in New Zealand schools.

Sound-field classroom amplification systems provide a practical and cost-effective solution to the problem of noisy classrooms. They use FM technology to transmit and amplify a teacher’s voice signal above the classroom noise, with the aim of making it easier for students to hear the teacher no matter where they are in the classroom.

This study aimed to establish whether sound-field amplification systems provide a significant improvement in educational achievement in the areas of listening, reading vocabulary, reading comprehension, and mathematics, and phonological awareness. It was particularly useful for children of lower socioeconomic backgrounds, ethnic groups and those who have a history of middle ear dysfunction (glue ear) due to the ability of children to hear the teacher’s speech (not just if they hear the children doing loud tasks). The determination of the effectiveness of these systems was based on the comparison of students who used the equipment consistently for most teaching sessions while 27 percent used it consistently for selected sessions.

Students

Teachers found that most students noticed improvements or enjoyed the experience. Teachers were also able to hear instructions more clearly, no matter where the teacher was or where they were in the classroom.

The improvement in the control group’s listening comprehension scores was statistically significant. The improvement in the intervention group’s listening comprehension scores was also statistically significant.

Mathematics

Significant improvements were noted in the intervention group’s scores in the PAT for listening comprehension, reading comprehension, reading vocabulary and mathematics.

The deterioration in the control group’s scores for mathematical and reading comprehension scores was not statistically significant. The improvement in the control group’s listening comprehension scores was not statistically significant.

The improvement in the intervention group’s scores in the PATs for listening comprehension and reading comprehension was statistically significant. The improvement in the intervention group’s scores in the PATs for reading vocabulary and mathematics was also statistically significant.

Table 1: Progressive Achievement Test Results

<table>
<thead>
<tr>
<th>Group</th>
<th>Students</th>
<th>Mean Change</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>107</td>
<td>3.62</td>
<td>0.044</td>
</tr>
<tr>
<td>Intervention</td>
<td>104</td>
<td>8.37</td>
<td>&gt;0.0001</td>
</tr>
<tr>
<td>Control</td>
<td>98</td>
<td>3.8</td>
<td>0.056</td>
</tr>
<tr>
<td>Intervention</td>
<td>233</td>
<td>11.3</td>
<td>&gt;0.0001</td>
</tr>
</tbody>
</table>

**FINDINGS**

- Significant improvements were noted in the intervention group’s scores in the PATs for listening comprehension, reading comprehension, reading vocabulary and mathematics.

- The deterioration in the control group’s scores for mathematical and reading comprehension scores was not statistically significant.

- The improvement in the intervention group’s scores in the PATs for reading vocabulary and mathematics was statistically significant.

**Discussion**

- Teachers commented on the quieter calmer classroom tone and the ability to refocus when students went off-task.
- Teachers noted that it was easier to hear the teacher present when the sound-field was used consistently.

**Recommendations**

- Teachers are recommended to use the sound-field systems for most teaching sessions.
- Teachers are recommended to use the sound-field systems for selected sessions.
Sound-field, classroom amplification systems can provide a practical and cost-effective solution to the problem of excessive classroom noise, with the aim of making it easier for students to hear the teacher and other classroom members clearly as well as speaking up in class and fully participate in learning activities. Research has shown a strong relationship between poor acoustics and students’ poor performance on writing tasks and a significant impact on their absence from teaching during the school year. Both teachers and students commented that the enhanced learning environment had a positive impact on their daily lives.

### Findings

#### Effectiveness of Sound-Field Systems

Students who were using sound-field systems reported:

- Increased comprehension and listening skills.
- Higher levels of attentiveness during lessons. Seventy-three percent of teachers noted increased on-task time.
- Improved student cooperation. Sixty percent of teachers reported improved student cooperation.
- Improved understanding of instructions. Two thirds of teachers noted improved understanding of instructions.
- Reduced vocal strain. Over half of the teachers involved in this study identified being able to speak naturally at reduced voice intensity levels and the ease of communication as key factors in feeling less tired and more productive.

#### Outcome Measures

- **Listening and Reading**: Students commented on the quieter, calmer classroom tone and enhanced ability to hear the teacher and other classroom members clearly as well as speaking up in class and fully participating in learning activities.
- **Knowledge and Understanding**: Improved understanding of instructions.
- **Task Behaviour**: Improved student cooperation. Sixty percent of teachers reported improved student cooperation.
- **Satisfaction and Well-being**: Teachers commented on the enhanced classroom environment and the benefits it had on their health and well-being.

### Conclusion

The use of sound-field systems significantly improved educational achievement in the areas of listening, reading, vocabulary, reading comprehension, and mathematics, and phonological awareness. Students who were using sound-field systems reported improved listening and reading skills, higher levels of attentiveness during lessons, and improved understanding of instructions. Teachers commented on the enhanced learning environment and the benefits it had on their health and well-being. The study concluded that sound-field systems are a practical and cost-effective solution to the problem of excessive classroom noise, with the aim of making it easier for students to hear the teacher and other classroom members clearly as well as speaking up in class and fully participating in learning activities.

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[Appendix] This study aimed to establish whether sound-field amplification: significantly improved educational achievement in the areas of listening, reading, vocabulary, reading comprehension, and mathematics; and phonological awareness. Teachers also found classrooms to be no more in New Zealand schools.

Sound-field classroom amplification systems provide a practical and cost-effective solution to the problem of excessive classroom noise, with the aim of making it easier for students to hear the teacher and other classroom members clearly as well as speaking up in class and fully participating in learning activities. Research has shown a strong relationship between poor acoustics and students’ poor performance on writing tasks and a significant impact on their absence from teaching during the school year. Both teachers and students commented that the enhanced learning environment had a positive impact on their daily lives.

Students who were using sound-field systems reported:

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- Improved understanding of instructions. Two thirds of teachers noted improved understanding of instructions.
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**High acceptance of sound-field by teachers**

Sixty-three percent of teachers used the systems for most teaching sessions while 27 percent used it consistently for selected sessions. Ninety-one percent of teachers reported improved student cooperation. Students who were using sound-field systems reported improved listening and reading skills, higher levels of attentiveness during lessons, and improved understanding of instructions. Teachers commented on the enhanced learning environment and the benefits it had on their health and well-being. The study concluded that sound-field systems are a practical and cost-effective solution to the problem of excessive classroom noise, with the aim of making it easier for students to hear the teacher and other classroom members clearly as well as speaking up in class and fully participating in learning activities. **Achievement Tests** (PATs), phonological awareness tests, a survey of teachers and feedback from students (Appendix). Performance measures for the study included Progressive Achievement Tests (PATs), phonological awareness tests, a survey of teachers and feedback from students (Appendix). Performance measures for the study included Progressive Achievement Tests (PATs), phonological awareness tests, a survey of teachers and feedback from students (Appendix).
Sound-field dramatically improves phonologic skills

Phonologic awareness and skills are indicators of a student’s development and are linked to mastery of literacy. Statistically significant (Figure 5) improvements were noted in the intervention group on all measures of performance, with the improvements in the intervention group greater than that of the control group in all aspects of the task.

High acceptance of sound-field by teachers

Some 98 percent of students reported improved learning conditions. “Sound-field provides a calming and well-structured environment. They help to promote a positive tone within the room.”

Students find it easier to hear...

Some 98 percent of the students who provided feedback about the sound-field systems were positive about them. Most students commented that it was easier to hear the teacher and that the teacher’s voice was clearer. Students also commented that it was easier to hear whispered contributions even from inside or outside the classroom.

Teachers found that fewer students needed instructions clarified or repeated. Students were also able to hear instructions more clearly. “I am not competing with them.”

“Teachers commented on the quieter calmer classroom tone and that it was easier to hear teachers when they read stories. Some 90 percent of teachers reported using the sound-field systems consistently throughout the year-long study. Sixty-three percent used the equipment consistently for most teaching sessions while 27 percent used it consistently for selected sessions.

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intervention period. The benefit of low vocal strains when they had a cold or throat irritation, or had an antibiotic course meant that some were able to remain teaching rather than taking time off.

Sound-field use was most beneficial for low decile schools.

The results of the PAT for listening comprehension were analysed for each of the different decile rated schools. The means for all decile schools improved markedly (Figure 6). While there was no significant difference between the deciles, those in the lower decile schools improved more than those in high decile schools.

Sound-field improved listening comprehension for both Maori and Pacifica.

The means for listening comprehension of both ethnic groups improved markedly. There was no significant difference between the improvements for Maori and Pakeha.

The results of the PAT for listening comprehension was analysed for the each of the different decile rated schools. The means for all classrooms were surveyed using a written questionnaire. Teachers were asked to focus on the frequency of using the system consistently to maximise the benefits that sound-field can provide.

Teachers and schools should take advantage of opportunities to trial and experience sound-field in a classroom setting so they can experience the benefits for themselves.

Schools should install sound-field systems that are compatible with deaf and hearing impaired students’ personal FM systems.

Trained teachers should be made aware of the issues associated with classroom acoustics and the benefits that sound-field can provide.

All classrooms should have basic acoustic treatment, including carpets and curtains, to reduce noise levels.

All schools should consider more advanced acoustic treatments such as absorptive ceilings.

Issues associated with the most comfort of sound-field microphones should be proactively addressed.

SUMMARY

Sound-field improvement in learning and literacy outcomes, creates enhanced classroom harmony and improved student behaviour, and reduces voice strain among teachers. Sound-field achieves this by overcoming problems associated with noise, distance and reverberation.

Sound-field is not a panacea for all problems in modern education. Effective teaching practice needs to be considered, as well as other environmental factors such as acoustics, lighting and ventilation.

Sound-field should not be reserved for children with special needs, as it benefits all students, regardless of school decile, ability or whether or not they have middle ear dysfunction.

Sound-field is one of the most cost effective interventions a school can invest in to increase literacy outcomes.

RECOMMENDATIONS

All classrooms should be fitted with sound-field systems to support good teaching practice. Other research shows that the benefits of sound-field are equally relevant to children’s classrooms, intermediate and secondary school.

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Appendix: Performance measures

Progressive Achievement Test (PAT)—as standardised to New Zealand students and are group-administered to all New Zealand students from year three. Children’s percentile rankings are not expected to change significantly from year to year. The following PATs were undertaken for this study:

• Listening comprehension — to year three and above students
• Reading vocabulary and reading comprehension — to year four and above students
• Mathematics — to year five and above students

2. Phonological awareness tests were developed by Joy Allcock for New Zealand children based on the Sutherland Phonological Awareness Test. The test measures achievement in specific phonological areas from letter-sound relationships to counting phonemes and the ability to substitute phonemes in blend words. Children in your one and two junior classes that were too young to participate in the standardised PAT took these tests at the beginning and end of the 2002 school year.

3. Teacher questionnaires — teachers in the intervention classrooms were surveyed using a written questionnaire. Teachers were asked to focus on the frequency of using the equipment and its effect on student behaviour, the learning environment, and their health and wellbeing.

4. Student perceptions — teachers were asked to invite students to comment on the sound-field systems from their perspective. Students were asked to focus on their ability to listen to directions, noise levels in the classroom, and the effort related to the teachers.

5. Parents provided information on ethnicity and history of middle ear dysfunction.

6. Students that had previously been treated for middle ear dysfunction and those that had not.


Acknowledgements

• Oticon Foundation in New Zealand for funding the research.
• Nina Energy Chairlifts Trust for providing the sound-field systems.
• Dr Rod Beattie, University of Newcastle for supervising the study.
• Rotorua Energy Charitable Trust for providing the sound-field systems.
• The principals, teachers and students at Western Heights School, Kelston Deaf Education Centre.
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References


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intervention period. The benefits of low vocal strain when they had a cold, sore throat, or had an antibiotic were more than the same or were to remain teaching rather than taking time off.

Sound-field use was most beneficial for low decile schools. The results of the PAT for listening comprehension was analysed for each of the different decile rated schools. The means for all decile schools improved markedly (Figure 6). While there was no significant difference between the deciles, those in the lower decile schools improved more than those in high decile schools.

Sound-field improved listening comprehension for both Māori and Pākehā. The means for listening comprehension of both ethnic groups improved markedly. There was no significant difference between the improvements for Māori and Pākehā.

Improved listening comprehension for students with middle ear dysfunction

Some 32 percent of students in the intervention group were identified as having a history of middle ear dysfunction. There was no significant difference between the improvements for those students that had previously been treated for middle ear dysfunction and those that had not.

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Sound-field improves learning and literacy outcomes, creates enhanced classrooms harmony and improved student behaviour, and reduces voice strain among teachers. Sound-field achieves this by addressing problems associated with noise, distance and reverberation.

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4. Student perceptions—teachers were asked to invite students to comment on the system's effectiveness. Students were asked to focus on their ability to listen to instructions, noise level in the classroom, and the effort to listen to the teachers.

5. Parental information—parents were informed on their child's school's website to return to the Ministry of Education.

6. Absenteeism was recorded from each school's weekly returns.

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The benefits of sound-field amplification systems

Michael Heeney, MA, Adv DipTch, ADCC, Dip EHI, PhD student at University of Newcastle, Australia Regional Co-ordinator Kaitoa Dukin Education Centre

CReating enhanced learning environments The benefits of sound-field amplification systems

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Published in February 2004

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Acknowledgements

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