7

SOUND AMPLIFICATION IN SCHOOL CONTEXTS

Implications for inclusive practice

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The research described in the previous chapter highlighted the benefits of a structured, visual classroom environment. This type of approach was developed in response to the needs of students on the spectrum but evidence suggests that such an approach also supports the needs of many students. The research reported in this chapter investigates a universal environmental adjustment to improve classroom *listening* environments: sound field amplification (SFA). Increased demands on listening caused by poor classroom acoustics affect everyone in the classroom and can be particularly challenging for some students. As such, the authors present classroom acoustics as a risk factor that, if appropriately managed, can put all students in a better position to learn while recognising that their learning still has to take place over time. A series of environmental adjustments which can safely make the teacher's voice louder (increase the signal) while designing the classroom to be quieter (decrease the noise) are discussed. These adjustments can support educators to make the classroom more accessible for all students while also responding to the needs of diverse learners in inclusive ways. We have stressed the importance of a shared understanding of inclusion between allied health professionals and educators when working in inclusive schools. The chapter further contributes to our understanding of the many interactive and dynamic factors that pave the way for successful student participation and learning.

Put simply, classroom acoustics describes how sound 'behaves' in the classroom. The behaviour of the sound contributes positively or negatively to the listening conditions for students and the speaking conditions for the teacher. In part, the acoustics of a classroom is influenced by the materials used and the size and shape of the space. Elements that can contribute to the quality of the acoustics in a room are described in Figure 7.1 and include the level (volume) of the sound in a room when it is both occupied and unoccupied, reverberation times, signal-to-noise ratio (SNR), and measures of speech intelligibility such as the speech transmission index. The Joint Australia/New Zealand Standard – AS/NZS 2107:2016 – recommends preferred values for many of these aspects which, when met, can help create better listening conditions for all students

(Standards Australia, 2016). However, many Australian classrooms do not meet the recommended standards and tend to be too noisy and/or reverberant, making it difficult for learners in those classrooms to listen (Wilson et al., 2019).

Listening in the classroom – A hierarchy of listening skills

The ability to accurately hear and recognise what is said can be referred to as 'speech perception'. Adequate speech perception is thought to require a hierarchy of listening skills that progress from earlier events such as hearing (being able to detect sound) and auditory processing (being able to process the frequency, intensity, timing, and location of sound) to later events such as auditory attention (being able to attend to sound) and language processing (being able to process words and sentences) (Crandell & Smaldino, 2000; Johnson, 2000; Moore, Cowan, Riley, Edmondson-Jones, & Ferguson, 2011).

Listening in a classroom with poor acoustics

Listening in poor acoustic environments can be challenging for students and adults alike. Consider how difficult it can be to hear someone across the table in a canteen with uncovered hard surfaces and floors, loud talking, and the clatter of cutlery. Many students experience similar listening challenges in their classrooms as they contend with noise sources both internal (e.g., background chatter, chairs scraping) and external (e.g., lawnmowers, traffic noise) in classrooms with high reverberation. This can make it sound like the teacher is talking in a stair well (Wilson et al., 2019).

A concerning feature of poor classroom acoustics is its potential to place high demands on students at every level of the listening hierarchy (Dockrell & Shield, 2004). In the earlier stages of the hierarchy, these demands can include making it difficult for students to simply hear the

Unoccupied sound level: The sound present in the classroom when students and teachers are absent.

Reverberation time (RT): The time it takes for sound to decrease in the classroom; how long the sound 'bounces around' the room.

Occupied sound levels: The sound present in the classroom when the students and teachers are present.

Signal-to-noise ratio (SNR): The ratio of the level of the signal (e.g., the teacher's voice) to the noise (e.g., the background noise of the classroom).

Speech transmission index (STI): An estimate of how easy it is to hear speech sounds in a classroom.

FIGURE 7.1 Elements that contribute to a classroom's acoustics.

Increased demands on listening caused by poor classroom acoustics is concerning for all students, but can be particularly concerning for certain student populations.

teacher's voice and increasing the load on auditory processing skills to process the basic features of the sound. In the later stages of the hierarchy, these demands can include increasing the load on auditory attention and language processing as students need to use more of their attention and language skills, as well as their prior experience and other contextual cues, to 'fill in the gaps' and make informed predictions about what was said. This can see students expending greater cognitive effort than would be needed otherwise when listening to the teacher (Baldwin, 2008). These demands can be made worse by maturation with many of these auditory processing, attention, and language skills not expected to fully mature until as late as the teenage years (Baldwin, 2008; Johnson, 2000; Moore et al., 2011).

Increased demands on listening caused by poor classroom acoustics is concerning for all students, but can be particularly concerning for certain student populations. This could include students who rely more on listening as their major means of learning in the classroom and students whose listening abilities could be compromised by other factors. Such populations could include younger students (e.g., Rosenberg et al., 1999) as well as students who attend schools in poorer socio-economic areas (e.g., Kazmierczak-Murray & Downes, 2015), have English as a second language (e.g., Massie & Dillon, 2006), have fluctuating conductive hearing impairment (e.g., Heeney, 2004), and/or have neurodevelopmental disorders such as attention deficit hyperactivity disorder, specific learning difficulties, auditory processing disorders, or are on the autism spectrum (e.g., O'Connor, 2012; Reynolds, Kuhaneck, & Pfeiffer, 2016; van der Kruk et al., 2017).

The potential benefit underpinning our call to improve classroom acoustics

The potential for students to benefit from improved classroom is represented in Figure 7.2. In this analogy, the higher steps represent increasing improvements in classroom acoustics. A high-quality signal can be heard more clearly; this makes for easier listening conditions for learning and demands less of cognitive processing. While an oversimplification, Figure 7.2 captures the premise of our research into classroom acoustics. The legibility of the writing on each student's t-shirt shows the extent to which their personal learning needs could be affected. On the top step, both students have legible t-shirts, which means they are each in a better position to learn from what they have heard.

While the means by which improved classroom acoustics could benefit students can be described in many ways (Figure 7.1), perhaps the simplest is to consider SNR. The SNR is the ratio of the level of a desired signal (e.g., the teacher's voice) to the level of the noise (e.g., the general background noise). When represented in decibels, the SNR can be conveniently calculated as the difference between the signal and noise levels (Crandell & Smaldino, 2000; Siebein, Gold, Siebein, & Ermann, 2000). The potential for an improved classroom SNR to help students at all levels of the listening hierarchy is represented in Figure 7.3. In this analogy, improving the classroom's SNR by increasing the level of the teacher's voice and/or decreasing the level of classroom noise (preferably both) can be seen as one way to help students to better hear the teacher's voice and lessen the auditory and cognitive demands on their ability to listen in the classroom.

How to improve classroom acoustics – The basics

The basics of improving the acoustics of a classroom might best be approached from the perspective of the SNR. Using this approach, improving the acoustics of a classroom proceeds as a

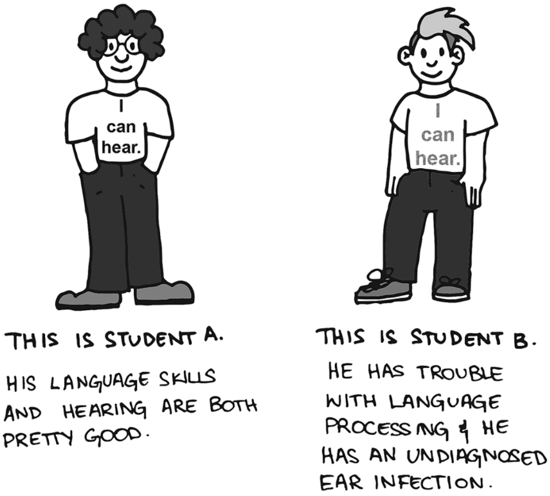

FIGURE 7.2 Ideal classroom acoustics position for students to learn.

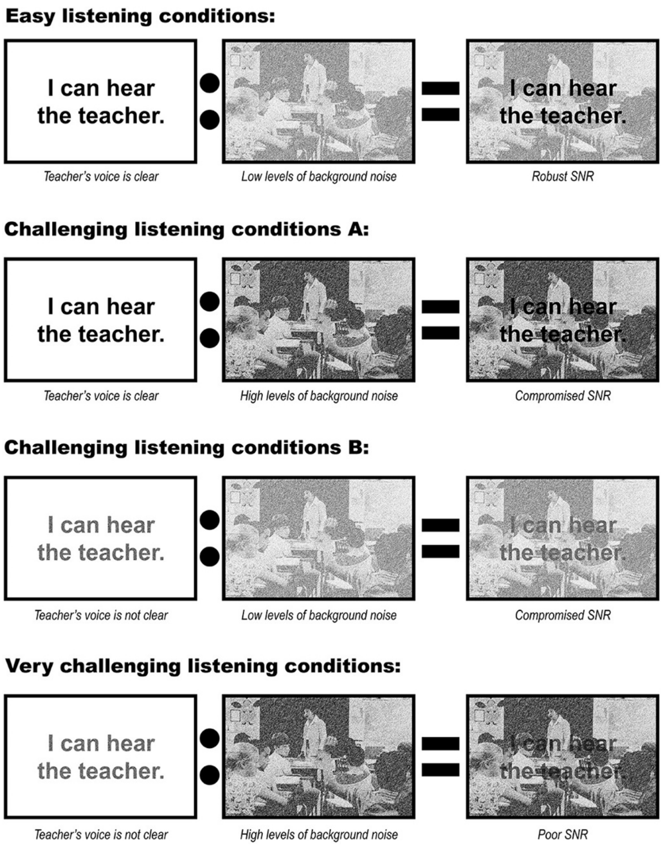

FIGURE 7.3 Influence of the teacher's voice and background noise levels on classroom listening conditions. Moving from left-to-right along each row, the quality of the teacher's voice (the 'signal') in relation to the levels of background noise (the 'noise') is presented as ratios, the Signal:Noise Ratios. The SNRs are presented in the boxes on the very right of each row.

series of actions to make the teacher's voice louder (increase the signal) and the classroom quieter (decrease the noise).

> *… improving the acoustics of a classroom proceeds as a series of actions to make the teacher's voice louder (increase the signal) and the classroom quieter (decrease the noise).*

Methods for making the teacher's voice louder can range from the simple to the complex. Simpler options can include: i) re-arranging classroom furniture or seating positions (but should avoid identifying individual students as the 'other' who always sits at the front of the class as this can be a form of microexclusion); and ii) the teacher actively monitoring classroom activities to reposition herself as the listening needs of students change during the course of a lesson. The all too common method of simply having the teacher raise her voice should be avoided due to it increasing the risk of vocal strain and teacher fatigue (e.g., Cutiva, Vogel, & Burdorf, 2013).

More complex options for making the teacher's voice louder include using devices such as remote microphone hearing aids (RMHAs) or sound field amplification (SFA). RMHAs see the teacher wear a microphone and transmitter to transmit her voice directly to an individual student wearing a receiver and ear piece. SFA sees the teacher wear the same microphone and transmitter to transit her voice to a speaker that then projects her voice evenly across the classroom (Keith & Purdy, 2014).

Making the classroom quieter is all about identifying the sources of noise both inside (e.g., air vents, fans, chair legs scraping on the floor) and outside (neighbouring classroom noise, school maintenance work, road traffic) and doing something to reduce those noises. Methods for doing this can also range from the simple to the complex. Simpler options can include: i) opening windows to allow the noise to escape out of the room (where feasible, with this action being counter-productive if a loud noise source is present outside the classroom; e.g., traffic noise from a main road); ii) reducing the noise at its source (e.g., sticking half-tennis balls on the ends of chair legs to reduce the scraping noise); iii) repositioning, removing, or replacing noisy devices; and iv) covering acoustically hard surfaces with acoustically soft surfaces to reduce reverberation (e.g., covering hard windows with soft curtains, covering hard floors with soft carpet, etc.) (Acoustical Society of America, 2003a, 2003b; National Acoustic Laboratories, 2018; Siebein et al., 2000; The HEARing Cooperative Research Centre, 2018).

More complex options for making the classroom quieter can include installing acoustic barriers to separate dual classrooms, installing (and maintaining) central air conditioning systems with long duct lengths, and reducing classroom volume by adding a lay-in ceiling. It can also include avoiding poor acoustic builds such as those often used in open plan and demountable classrooms (Acoustical Society of America, 2003a, 2003b; National Acoustic Laboratories, 2018; Siebein et al., 2000; The HEARing Cooperative Research Centre, 2018).

How to improve classroom acoustics – Where to get help

Many educators will understandably be daunted by the prospect of taking a 'do-it-yourself' approach to improving the acoustics of their classroom. Luckily, help is at hand from a range of sources, including those referenced in the section above.

Taking your first steps to improving the acoustics in your classroom can come from online resources such as the 'Improve your Classroom's Acoustics' practice module[1] on the Autism CRC's *inclusionED* web-based platform. This module details a range of information, tools, strategies, and a community of practice to help teachers to both assess and manage the acoustics in their classrooms. Included in this module is information about the SoundOut Room Acoustics Analyzer app for iPads created by the National Acoustic Laboratories in Australia. This app provides step-by-step instructions to guide users through the measurements outlined in Figure 7.1 in this chapter, their interpretation, and what can be done to improve the classroom acoustics for classrooms that don't meet Australian standards on these measures.

Finally, educators can also seek professional help from acoustic engineers and some audiologists who can measure the 'acoustic health' of existing classrooms. The Australian Acoustical Society website has information on acoustic engineers according to specialty and locality in Australia[2].

Improving classroom acoustics – A hierarchy of potential benefit

With regards to the functional benefits to individual students, research suggests that some student behaviours could be expected to change sooner and others later following improvements in classroom acoustics (e.g., Good & Gillon, 2014; Grube, Kumar, Cooper, Turton, & Griffiths, 2012; Reynolds et al., 2016). This hierarchy of potential benefit could follow the hierarchy of listening skills. If the immediate benefit of improving classroom acoustics is that the teacher's voice is easier to hear, then its potential benefits could flow from proximate to distant on the listening hierarchy. In this argument, proximate benefits would be expected first in student hearing and auditory processing as these areas would benefit more immediately from improved classroom acoustics alone.

Distant benefits would be expected later in student phonological processing, auditory attention, memory, and language as these areas would benefit less immediately from improved classroom acoustics alone. Instead, benefits in these areas would need *sustained* improvements in classroom acoustics (providing students with consistently clear, less effortful access to the teacher's voice in the classroom) plus the presence of other factors for improvements to be realised. This argument of proximate versus distant benefits is consistent with our proposition that improving classroom acoustics could put students in a better position to learn, but their learning still has to take place over time.

Improving classroom acoustics as a universal adjustment within inclusive classrooms

Improving classroom acoustics could be implemented universally as part of a commitment to the *Disability Standards for Education* (Commonwealth of Australia, 2006) which mandate for the right of all students to have equitable access to choices and opportunities within their learning environment. As discussed in Chapter 4, the second principle of Universal Design for Learning (UDL) is to 'Provide multiple means of representation of information' (CAST, 2020a). Within this principle, UDL recognised that learning is compromised 'when information is presented in formats that require extraordinary effort' (CAST, 2020b) and advocates for different options in the presentation of visual or auditory information in the classroom. Further, it recommends that information should be customised in response to the perceptual needs of students (Checkpoint 1.1) by improving perceptual clarity including the volume of speech. Improving classroom acoustics could serve as a universal adjustment that puts all students in a better position to learn.

In the above context, improving a classroom's acoustics is particularly appealing because some of its methods can potentially benefit all students with no one student appearing to be 'different'. This potential can be seen in the example of using RMHAs that require individual students to wear a receiver and ear piece versus SFA that requires a speaker to be placed in the classroom to assist students on the spectrum. While reporting students on the spectrum benefited from RMHA use, Rance, Saunders, Carew, Johansson and Tan (2014) reported some students on the spectrum refused to wear ear pieces as it set them apart from their peers. This was thought to relate to Polgar's (2010) argument that acceptance of particular technologies is mediated not only by the functional advantage they provide the user but the degree to which they are perceived as 'stigmatising' by the user. Rance et al. (2014) and Schafer et al. (2013) have also reported some students on the spectrum having difficulty tolerating RMHAs due to tactile sensitivities. Countering these suggestions that SFA more than RMHAs could serve as a universal adjustment within inclusive classrooms is the risk that students who are hyper-sensitive to noise may not tolerate amplification systems of any sort, be it from SFA or RMHA technologies.

> *… improving a classroom's acoustics is particularly appealing because some of its methods can potentially benefit all students with no one student appearing to be 'different'.*

Research method

The Autism CRC classroom acoustics research described in this chapter sought to contribute to the many interactive and dynamic factors that pave the way for successful student participation and learning as described in this volume. The premise of the research presented here is *not* that low-quality acoustics is *the direct* or primary cause of poor classroom performance or learning outcomes for all students. Rather, the premise is that classroom acoustics have the *potential* to support or impede subsequent processing of what the teacher says. This identifies classroom acoustics as an important risk factor (after Bishop, 2006; Halliday, Tuomainen, & Rosen, 2017) which we assert needs to be managed appropriately in the inclusive classroom.

Research aim

Our overall aim was to determine if a diverse group of students benefitted from the use of SFA in their classrooms.

Research design

Our research design was a two-group, randomised controlled trial (RCT) with crossover. The two groups were as follows: i) students on the autism spectrum; and ii) classroom peers who were not on the autism spectrum (referred to as 'classroom peers'). The RCT meant that classrooms in which the students were located were randomly allocated an SFA system for the first or the second semester of an academic year. The crossover meant that classrooms allocated an SFA system in Semester 1 'crossed over' to not be allocated an SFA system in Semester 2, and vice versa, helping us to separate any effects of the SFA from effects of the time of year in which we completed the assessments.

Participants

Table 7.1 details participants from 12 schools in the greater Brisbane area, Australia who took part in the study.

Seventeen students had an SFA system in their classrooms in Semester 1 and 13 in Semester 2 of the same school year. Students classified as being on the autism spectrum had previously received a clinical diagnosis and had been verified through the stringent process administered by the Queensland Department of Education. The allocation of students to each group was supported by parental ratings of their child on the Social Responsiveness Scale, 2nd edition (SRS-2; Constantino, 2012), the Short Sensory Profile (SSP; Dunn, 2014), and the Social Communication Questionnaire-Lifetime (SCQ-L; Rutter, Bailey, & Lord, 2003). While both groups of students performed similarly on a measure of non-verbal intelligence (the non-verbal component of Kaufman Brief Intelligence Test, 2nd edition [KBIT-2; Kaufman & Kaufman, 2004]), the groups performed differently on a measure of verbal intelligence (the verbal component of Kaufman Brief Intelligence Test, 2nd edition [KBIT-2, Kaufman & Kaufman, 2004]) and a measure of receptive language (the concepts and following directions sub-test of the Clinical Evaluation of Language Fundamentals, 4th edition [CELF-4; Semel, Wiig, & Secord, 2003]).

Measures

We were interested in measuring potential proximate and distant benefits from SFA. Our measures of potential proximate benefits were a questionnaire for the teachers to appraise student

TABLE 7.1 Research Participants

	Students on the autism spectrum	*Classroom peers*
Number of Year 3 students	13	17
Male:Female ratio	9M:4F	7M:10F
Age range (years, months)	7yrs, 6mo to 8yrs, 4mo	7yrs, 6mo to 9yrs, 3mo

TABLE 7.2 Assessments and Sub-Tests Administered and Domains Measured

Assessment	Sub-test	Domain
Measures for potential proximate benefits of SFA administered at the end of each semester (twice in total)		
Assessment	**Sub-test**	**Domain**
The Listening Inventory For Education-Revised, Teacher Appraisal of Listening Difficulty (LIFE-R TALD)[a]	–	Level of challenge when listening and learning in different situations in the classroom
Video recordings of students' listening behaviours during normal classroom activities		Student response time to teacher question or directive
Measures of potential distant benefits of SFA administered at the beginning of Semester 1, between semesters, and at the end of Semester 2 (three times in total)		
Assessment	**Sub-test**	**Domain**
Comprehensive Test of Phonological Processing, 2nd edition (CTOPP-2)[b]	Nonword repetition in quiet	Phonological processing
	Nonword repetition in noise: Presented with four-speaker babble noise[c]	Phonological processing in the presence of background noise
	Blending nonwords in quiet	Phonological processing
	Blending nonwords in noise: Presented with four-speaker babble noise	Phonological processing in the presence of background noise
Test of Variables of Attention (TOVA™)[d]	Auditory attention	Attention
Test of Auditory Processing Skills, 3rd edition (TAPS-3)[e]	Number memory forward Number memory backward	Memory
Kaufmann Test of Educational Achievement, 3rd edition (KTEA-3)[f]	Literacy Numeracy	Literacy and numeracy

[a] Anderson, Smaldino, & Spangler, 2011
[b] Wagner, Torgesen, Rashotte, & Pearson, 2013
[c] the nonword repetition sub-test of the CTOPP-2 was adapted to present half of the stimuli in noise
[d] Greenberg, Kindschi, Dupuy, & Hughes, 2008
[e] Martin & Brownell, 2005
[f] Kaufman & Kaufman, 2014.

listening difficulty in the classroom and a video analysis of student response times to teacher questions and directives. Our measures of potential distant benefits were standardised measures of phonological processing, auditory attention, memory, and educational achievement. These measures are shown in Table 7.2 and in further detail below.

Questionnaires

At the end of each semester, teachers used the Listening Inventory For Education–Revised Teacher Appraisal of Listening Difficulty (LIFE-R TALD; Anderson, Smaldino, & Spangler, 2011) to reflect on the listening behaviour of the participating students. This questionnaire asked teachers to reflect on participation behaviours recognised to be sensitive to acoustic changes to the environment; for example, 'Attending to and following directions and class activities'. The teachers completed this questionnaire once for the semester in which their classroom had SFA and once for the semester in which their classroom did not have SFA.

Video observation

On a morning towards the end of each semester, approximately three hours of regular classroom activity was captured by two cameras positioned at the front and rear of each classroom, providing one recording with SFA and one recording without SFA. These videos were analysed for occasions of teacher instructions or questions that required a response from the students. Responses were timestamped to identify the average time taken by each student in each recording to respond to teacher instructions and questions. These analyses were completed in each classroom once with SFA (in the semester where the classroom had SFA), and once without SFA (in the semester where the classroom did not have SFA).

Standardised measures

Before, between, and after the two semesters in the year of our study, we assessed the participating students using a range of standardised measures (see Table 7.2). These measures included:

1. A modified version of the Nonword Repetition (NWR) and Blending Nonwords (BNW) sub-tests from the Children's Test of Phonological Processing, version 2 (CTOPP-2; Wagner, Torgesen, Rashotte, & Pearson, 2013) to assess phonological processing in quiet and in noise.
2. The auditory component of the Test of Variables of Attention (TOVA; Greenberg, Kindschi, Dupuy, & Hughes, 2008) to assess auditory sustained attention.
3. The Number Memory Forward (NMF) and Number Memory Backwards (NMB) sub-tests of the Test of Auditory Processing Skills, 3rd edition (TAPS-3; Martin & Brownell, 2005) to assess auditory short-term memory and auditory working memory.
4. The Kaufman Test of Educational Achievement, 3rd edition (KTEA-3 Brief; Kaufman & Kaufman, 2014) to assess academic achievement in the areas of spelling, reading, and mathematics. These assessments were conducted on each participating student before Semester 1 (as a baseline assessment) and at the end of the semester in which their classroom had SFA and at the end of the semester in which their classroom did not have SFA.

Results

The results of our study are shown in Figure 7.4. Our main findings showed that following one semester of SFA, teachers reported improved listening behaviour (LIFE-R TALD) for all participating students, and improvements were seen in one aspect of phonological processing (BNW) in students on the spectrum but not their classroom peers. We found no changes following SFA in student response times to teacher questions or directives (video analysis), auditory attention (TOVA), memory (TAPS-3 NMF and NMR), or academic achievement (KTEA-3). Finally, we received no reports of SFA aggravating hypo- or hyper-sensitivity to sounds, phonophobia, or over-interest in sounds in any of the participating students.

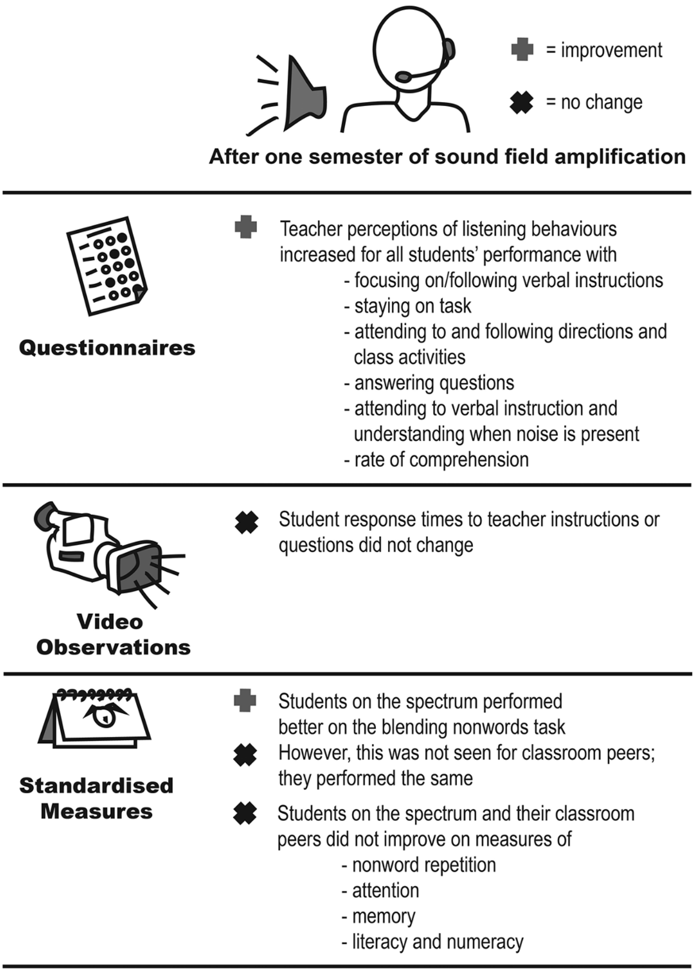

FIGURE 7.4 Summary of the findings following analysis of student performance on questionnaire responses, classroom observations, and standardised measures.

Conclusions and take-home messages for teachers

Our results were consistent with our proposition that any benefits from improved classroom acoustics could proceed along the hierarchy of listening skills. In this regard, the teacher reports of improved listening behaviour for all participating students could be seen as a proximate benefit of SFA resulting more directly from students being in a better position to hear the teacher's voice. The improvements in one aspect of phonological processing in students on the spectrum following SFA could be seen as a more distal benefit of SFA resulting from those students being in a *sustained* better position to hear the teacher's voice and benefitting from that position by going on to improve one aspect of their phonological processing.

The absence of improvements in our other measures of student performance adds further support to our proposition that any benefits from improved classroom acoustics could proceed along the hierarchy of listening skills. In this regard, the absence of benefit in response times reminds us that improving classroom acoustics will not automatically realise all potential proximate listening benefits. Similarly, the absence of benefits in other aspects of student phonological processing as well as auditory attention, memory, and educational outcomes reminds us that improving classroom acoustics may not be enough on its own to realise potential distant benefits, particularly in the short term such as the single semester of SFA used in our study.

Finally, the benefits realised in the absence of any reports of SFA aggravating hypo- or hypersensitivity to sounds, phonophobia, or over-interest in sounds in any of the participating students supports the consideration of SFA as a universal adjustment for a potentially wide range of students in the classroom.

Limitations

Our study had several limitations including the low number of participating students, the need for these students to complete long batteries of standardised tests, the duration of SFA being limited to one semester only, and the study being limited to one academic year only. Taken together, these limitations suggest that while the results of this research were promising, caution is needed before applying the study's results to individual students on the spectrum, to the use of SFA for periods longer than one semester, to student outcomes beyond those measured in the study, and to student outcomes measured beyond a single academic year.

Take-home messages

Take-home message 1: Classrooms can be noisy

Many Australian classrooms do not meet the recommended standards and tend to be too noisy and/or reverberant, making the listening environment difficult for learners in those classrooms.

Take-home message 2: Listening in the classroom requires a hierarchy of skills

Listening in the classroom requires a hierarchy of skills starting with hearing (being able to detect sound) and progressing to other skills such as auditory processing (being able to process the frequency, intensity, timing, and location of sound), auditory attention (being able to attend to sound), and language processing (being able to process words and sentences).

Take-home message 3: Poor classroom acoustics challenges the hierarchy of listening skills

Poor classroom acoustics places high demands on students at every level of the listening hierarchy. This can be worse for students who are younger, from poorer socio-economic areas, are attending school in a language other than their first language, have hearing loss, and/or have neurodevelopmental disorders.

Take-home message 4: Improving classroom acoustics could benefit students on a hierarchy from proximate to distant

Improving classroom acoustics could lead to more immediate, proximate benefits to listening skills more dependent on simply being able to hear, as well as later, distant benefits to listening and other skills dependent on more than simply being able to hear.

Take-home message 5: Improving classroom acoustics could put students in a better position to learn, but they still have to go on to learn

Improving classroom acoustics will not lead to improved listening and other skills in all students. Instead, improving classroom acoustics can put students in a better position to learn, but students still have to go on to learn.

Take-home message 6: Improving classroom acoustics can be a universal adjustment within inclusive classrooms

By potentially benefitting all students within the classroom without stigmatising individuals, improving classroom acoustics could be implemented as a universal adjustment within inclusive classrooms. In Australia, this could form part of a commitment to the *Disability Standards for Education* (Commonwealth of Australia, 2006) which mandate for the right of all students to have equitable access to choices and opportunities within their learning environment.

Take-home message 7: Help is available

Educators can get help for managing the acoustics in their classroom from a range of sources including the Autism CRC's *inclusionED* teacher practice titled 'Improve your Classroom's Acoustics', apps such as the SoundOut Room Acoustics Analyzer app for iPads created by the National Acoustic Laboratories in Australia, and professional groups such as the Australian Acoustical Society[3].

Creating a genuinely inclusive educational setting: Closing thoughts for the health professional

It is readily apparent that allied health professionals such as audiologists, speech pathologists, and occupational therapists have a role to play in supporting students who could benefit from improved classroom acoustics. Historically, health services were positioned to be allied to medicine, situated within clinical settings and defined by the 'disorder' for which they provided treatment. In this regard, audiology assessments may include, but are not necessarily restricted to, evaluation of hearing and auditory processing; speech pathology assessments include evaluation of speech and language skills; and occupational therapy assessments include evaluation of classroom functioning; all with the purpose of remediating any deviations from the expected norm. This identifies students who fall 'outside the normal range' as being 'others' who are in need of service provision.

It is clear that the translation of allied health services into a genuinely inclusive education setting, as described by Cologon (2019), cannot be a cut and paste of regular clinical service. The ableism which is inherent within such services is an uncomfortable fact for many clinicians who are deeply dedicated to improving student outcomes and driven to ensure that all students, in all of their diversity, have equitable opportunities to participate in school. Cologon (2019) suggests that one of the social outcomes from a conflict between ableist attitudes within inclusive school environments is perpetuation of exclusion. This is clearly inconsistent

> *There is a need to ensure the acoustics of all classrooms meets the relevant Australian standards in order to provide equitable learning opportunities for all students in all classrooms.*

with beneficence, a primary principle underpinning the work of allied health professionals and provides an impetus to interrogate the role of allied health professionals, and the service delivery models adopted in inclusive settings. Prolonged, confronting discussion and debate is required if educators are to be supported in the provision of education opportunities which are inclusive of all students. As allied health professionals, the authors of this chapter have interrogated their own potential for bias and attempted to present and discuss the implications of this research through the lens of genuine inclusion. There is a need to ensure the acoustics of all classrooms meets the relevant Australian standards in order to provide equitable learning opportunities for all students in all classrooms.

Notes

1 https://www.inclusioned.edu.au/node/2400
2 https://www.acoustics.asn.au/joomla/index.php
3 https://www.acoustics.asn.au/joomla/index.php

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