

The Impact of a Sound Amplification System in a Preschool Setting: Children's and Educators' Perspectives

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Abstract

This study investigated children's and early childhood educators' perspectives on the impact of a sound amplification system in a preschool setting. The sample included 69 children aged 3-5 years and nine early childhood educators from a preschool in regional Australia. Children completed self-report booklets, rating how well they could hear in group time situations prior to and after the implementation of a sound amplification system. Early childhood educators completed an adapted version of the Listening Inventory for Education-Revised, rating the children's hearing and listening. Quantitative analyses indicated that children's hearing and listening improved, as reported by both educators and children. Qualitative analyses indicated that children and educators felt positive about the sound amplification system, that children could hear other children better, particularly at news time, that it helped children with speech difficulties to be better understood, and that it improved the confidence of the quieter children with speaking in front of the group.

Keywords: early childhood education, hearing, sound amplification, children's perspectives

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There is a growing body of research suggesting that difficulties with hearing and listening in early childhood settings can have detrimental effects on children's learning (Anderson, 2001; Robinson & Munro, 2014). Unfortunately, early childhood settings are notorious for being poor listening environments (Petry, McClellan & Myler, 2001). In Australia, there is also a significant portion of young children who have diagnosed hearing or listening difficulties (Hogan, Phillips, Howard & Yienprugsawan, 2014). Thus, it is essential that efforts are made to ensure that children in early childhood settings can hear to the best of their abilities in the best possible environment. Sound amplification systems can aid in children's hearing and listening by amplifying the educator's and other children's voices through speakers (Education Queensland, 2000).

Previous research has examined the impact of sound amplification systems, noting that there are indeed benefits in a range of educational outcomes, including literacy, numeracy, classroom behaviours and social inclusion (Millett, 2008). However, most studies focus on primary school classrooms, rather than early childhood education settings, where noise and activity can be more intense. Also, there are limited studies which include rich, qualitative data, focused on children's perspectives. The current study attempts to fill some of these gaps by gathering qualitative and quantitative data from both children and early childhood educators in an Australian early childhood setting. The aim of the study is to examine children's and educators' perspectives on children's hearing and listening before and after implementation of a sound amplification system in a preschool setting.

Literature Review

Children's Hearing and Listening

Hearing and listening problems impact a significant number of young children in Australia and around the world. In Australia, 6.7% of four- to five-year-old children experience ear infections, which can negatively impact hearing, and 2% experience a significant hearing problem (Hogan et al., 2014). Extensive research indicates that hearing problems are associated with poor outcomes in young children (Kong & Coates, 2009; Yienprugsawan, Hogan & Strazdins, 2013) including auditory processing problems

(Williams & Jacobs, 2009), poor language skills (Sarant, Holt, Dowell, Rickards & Blarney, 2008; Wake, Hughes, Poulakis, Collins & Rickards, 2004), mental health problems (Eldik, 2005), and difficulties with relationships and emotions (Fellinger, Holzinger, Sattel & Laucht, 2008), and social behaviour (Remine & Brown, 2010). Thus, given the evidence linking hearing problems to poorer outcomes in young children, it is essential to better understand how the early childhood classroom listening environment can be enhanced. Indeed, early intervention for children with hearing loss is an important factor in promoting positive outcomes for children (Calderon & Naidu, 2000; Yoshinaga-Itano, 2000). In relation to early childhood learning and curriculum standards in Australia, identification of children's hearing and listening challenges and subsequent efforts to reduce barriers that impede children's learning are related to the Early Years Learning Framework (EYLF) principle of "high expectations and equity" and practice of "responsiveness to children" (Department of Education, Employment and Workforce Relations [DEEWR], 2009).

Classroom Acoustics

Growing evidence suggests that noise in early childhood and school classrooms can have negative impacts on children (Anderson, 2001; Manlove, Frank, Vernon-Feagans, 2001). Research indicates that children's speech perception, in particular, suffers when classrooms are noisy (Anderson, 2001). Additionally, studies find that reading achievement is lower in classrooms that are more noisy (Haines, Stansfeld, Job, Berglund & Head, 2001). Not surprisingly, research with children whose spoken language was not the language spoken in their classroom, indicates that noisy classrooms can have a greater negative impact on them, compared to children whose spoken language was the same language spoken in the classroom (Anderson, 2001; Taub, Kanis, & Kramer, 2003).

For very young children who are just beginning to develop speech and language, and who may spend a significant amount of time in care, noisy classrooms may be particularly detrimental (Manlove et al., 2001). A noisy environment could interfere with a child's opportunities to hear and engage in verbal exchanges. Poor classroom acoustics in a child care setting could prevent children from practicing their language skills (Manlove et al., 2001). Research finds that in both child care and school settings, the noise level is often higher than what is recommended as ideal (Knetch, Nelson, Whitelaw & Feth, 2002;

Manlove et al., 2001). There are a number of ways that classroom acoustics can be improved. These include acoustical tiles and carpeting, creating “soft spaces”, curtains over windows, reducing music and ambient noise and installation of sound amplification systems (Taub et al., 2003). Although there are some practical solutions to reducing classroom noise, few early childhood centres have the financial resources to identify the specific acoustic problems particular to their setting in order to make significant changes to the acoustical environment (Manlove et al., 2001). Given the typical noise level of early childhood education settings and the negative impact that noise can have on children, it is important to understand how well children are hearing and listening in these settings. To ascertain this, in the current study multiple perspectives from children and early childhood educators are considered.

Sound Amplification Systems

A sound amplification system is a device that amplifies the educator’s voice and other sources of audio, throughout the classroom. To do this, an amplified signal is provided in the classroom through the placement of four or six speakers (Education Queensland, 2000). This allows the educator’s voice to be more easily heard over background noise, which is common in early childhood classrooms. Sound amplification systems also allow each child to receive the sound of the educator’s voice directly from the speakers. This reduces some of the detrimental effects of reverberation and interference from hard surfaces. As the sound amplification system provides a constant signal within the sound field area, the child will receive a clear message from the educator, regardless of where the educator is in the classroom (Education Queensland, 2000). Sound amplification systems may also allow the projection of children’s voices through speakers as they can use a microphone to speak at group time.

Research to date (Kazmierczak-Murray & Downes, 2015) suggests that sound amplification enhancements in classrooms result in a number of positive outcomes, including listening and learning behaviour in the classroom (Darai, 2000; Rosenberg et al., 1999), speech recognition (Bradley & Sato, 2008), on-task behaviour in the classroom (Eriks Brophy & Ayukawa, 2000) and a range of academic dimensions (Flexer, Kemp Biley, Hinkley, Harkema & Holcomb, 2002; Massie & Dillon, 2006). Other research has found improvements in speech perception (Mendel, Roberts & Walton, 2003), student

attention and participation (Edwards & Feun, 2005), and phonemic awareness (Flexer et al., 2002). A study focused on a sound enhancement system in the classrooms of Indigenous children showed improvements in classroom interactions and teacher vocal conditions (Massie, Theodoros, McPherson & Smaldino, 2004). However, interestingly, Dockrell and Shield (2012) found that although teachers and children were positive about the use of a sound amplification system, when compared to children in a control classroom, academic outcomes and reports of listening conditions did not differ.

Although there is some evidence to support positive outcomes of sound amplification systems in classrooms, most of the research to date focuses on school-aged children, with little attention given to children in prior-to-school settings. Most studies on sound amplification systems also lack rich, qualitative data reflecting children's perspectives, instead, focusing more on objective children's outcomes and teacher reports (Dockrell & Shield, 2012). However, some researchers argue that it is particularly important for research to focus on children's perspectives of their daily experiences (Dockett & Perry, 2007). In the current study, children are viewed as active participants in constructing their world (Kincheloe, 2004). Thus, in addition to gaining educators' perspectives, children's perspectives are sought. Indeed, the United Nations Convention on the Rights of the Child, Article 12 (United Nations, 1989) identifies children's rights to express their views on matters that affect them. Dockett and Perry (2007) argue that researchers have the responsibility of ensuring that these rights are protected in research that involves children. Given the gaps in the research on sound amplification systems, the research question in the current study is, "What are children's and educators' perspectives on the impact of a sound enhancement system on the listening environment in a preschool setting?"

Methodology

Participants

The Preschool involved in this study was a community-based, non-profit early childhood setting operating in a regional town in Australia. The Preschool provides early childhood programs for up to 160 children aged 3 - 6 who attend between one and 3 days per week.

The Preschool employs qualified and experienced staff, including specialists in early intervention and speech therapy. Children attend preschool for 5.5 hours per day. Nine early childhood educators (all female) participated in the study. Four of the early childhood educators had Bachelor's Degrees, four had Diplomas and one had a Cert 3. Sixty-nine children participated in the study, 39 males and 30 females, ranging in age from 3-5.

Procedure

This particular site was selected for this study as they were the recipient of a University-Community grant focused on improving the listening environment for children with additional needs at the preschool. The preschool identified the issues of speech, language and hearing difficulties as being prominent in the service. At the time of the study, the preschool has 25 children identified as having speech or language difficulties (e.g., significant permanent hearing impairment, temporary hearing impairments, speech development delays and English as a second language).

The preschool involved in the study has received an "excellent" rating, which is the highest rating possible of quality under the National Quality Framework in Australia (Australian Children's Education and Care Quality Authority, 2009). Only 30 early childhood services across Australia have achieved this rating. The preschool operates its curriculum in line with the National Early Years Learning Framework (EYLF) (Department of Education, Employment and Workforce Relations, 2009) and includes an age-appropriate balance of free choice time, large and small group time and outdoor time. Each group of children is supervised by three educators. Large group times generally take place twice per day, but the schedule is also flexible and based on children's interests and needs.

A sound amplification system was purchased and installed in both classrooms at the preschool. The installation of the sound amplification system occurred in September during a two-week school holiday period. Conversations between the researchers and the preschool director then took place in order to discuss the possibility of implementing research to document the impact of the sound amplification system. The research was introduced to the preschool educators by the preschool director at a staff meeting. The information sheet, consent form and hard copies of the listening inventory were then distributed to the educators. Information letters and consent forms were distributed to

families by the director of the preschool via the children's lockers. To introduce the research to the children, both researchers attended group time sessions involving the children for whom there was parental consent. During these sessions, the researchers explained why the children were being invited to be involved in the research, what they would be expected to do, and that it was okay to tell the teachers they did not want to be involved. The researchers also explained what the word "research" meant, and gave some simple examples. In accordance with suggestions by Hill (2005), the researchers took time to explain to the children the aims of the research, the time commitment required and how the results would be used. Children were invited to comment or ask questions about the research.

In addition to parental consent, children's assent was gained from the educators, who collected data from the children. The children's self-completion booklet contained a script for educators to follow when obtaining children's assent. Children were asked to circle an animated face about how they felt about completing the booklet; a happy face or a sad face. It was explained to children that it was okay if they wanted to stop talking or drawing at any time. Educators were asked to follow the script and to avoid putting pressure on children to participate. All of the children assented to participation.

The study was approved by the relevant university ethics review committee. Voluntary participation was sought by providing information and consent sheets to potential participants. Confidentiality and anonymity of participants were maintained by de-identification of data.

Measures

Data related to children's current state of hearing and listening in the classroom were collected from children and educators in September, prior to the sound enhancement system being used. Data were again collected from children and educators after a period of three months of the sound enhancement system being used. Feedback about the sound enhancement system was also collected from children and educators after the period of implementation. Data in relation to children's hearing and listening were focused on large group time, rather than free play time. We focus particularly on hearing during group time activities as these are times where a great deal of information is being transmitted and processed in a potentially noisy atmosphere where multiple children speak at once

(National Deaf Children's Society, 2015).

Prior to the sound enhancement system being used, in order to get a baseline understanding of children's hearing and listening, educators completed an adapted hard-copy version of the *Listening Inventory for Education (LIFE)-Revised* (Anderson, Smaldino & Spangler, 2011), which estimates the listening difficulty a child may have in the early education environment. This original LIFE has been used for over a decade as an educational tool (Anderson et al., 2011). The revised version was created in response to educator feedback, as the original version could only be used as a pre-test. The revised LIFE can be used as a pre- and post-test. The LIFE-Revised was adapted for the present study in order to make the questions relevant for a preschool setting and for younger children. The inventory was adapted by the two researchers, feedback was gained from the preschool educators in the study, and further adaptations were made.

For 13 items, educators were asked to rate the child's level of challenge when listening in particular situations on a scale of 1 (almost always challenged) to 5 (no challenge/very rare). Items included "Ability to focus on/follow large group instruction", "Ability to focus on or understand morning announcements or large group activities" and "ability to attend to verbal instruction and understand when noise is present". Each educator was assigned equal numbers of children for completion of this measure (approximately 11 children per educator). The adapted inventory also included open-ended responses about particular items on the inventory, children's health status in the last few months, use of hearing assistance devices, and any other feedback educators wanted to share. After three months of the sound enhancement system being used, educators completed the same measure in order to compare children's listening and hearing experiences both before and after using the sound enhancement system. Post-implementation of the sound enhancement system, educators were also asked to give feedback on the system, through a series of questions rated on a 1 (strongly agree) to 5 (strongly disagree) scale. Questions included "The amplification system was easy to use", "The amplification equipment has decreased the need to repeat directions to my class", and "I have better control over my class when the equipment is used". Three of the educators also kept diaries throughout the implementation of the sound enhancement system. All educators were given a spiral notebook and invited to jot down any comments they thought were important in relation to the impact of the sound

enhancement system.

Both pre- and post- implementation of the sound enhancement system, children were provided with a self-completion booklet to record their perceptions of hearing and listening during whole group activities, through a combination of verbal, affective and visual/arts-based expression (Carter & Ford, 2013). This occurred during the normal classroom day at the discretion of the early childhood educators, with an aim to minimise disruption to the children's daily activities. The booklets contained eight questions asking children about how easy or hard it was for them to hear in different classroom situations. Examples of questions include, "When you are listening to a story on the mat", "When one of your friends is telling their news", and "When you are sitting at the back of the mat". These questions were accompanied by photographs taken in the children's setting of these particular situations. Children were asked to circle a response of "Mostly easy to hear", "Sometimes hard to hear", and "Mostly hard to hear". These responses were accompanied by illustrated images of a smiling face with a thumbs up (easy), a confused face (sometimes hard) and a frustrated face (mostly hard). A sample page from this measure is shown in figure 1.

This figure illustrates a sample page from the children's self-report booklet

Pre-test

This is a place to tell us what you think about all kinds of listening in your classroom. You can draw a circle around the face that is the same as how you think and feel.

<p>1. When you are listening to a story on the mat.</p>		<p>Mostly easy to hear</p> 	<p>Sometimes hard to hear</p> 	<p>Mostly hard to hear</p> 
<p>2. When you are listening to a story on the mat and other children are talking.</p>		<p>Mostly easy to hear</p> 	<p>Sometimes hard to hear</p> 	<p>Mostly hard to hear</p> 
<p>3. When you are on the mat and the teacher is asking questions.</p>		<p>Mostly easy to hear</p> 	<p>Sometimes hard to hear</p> 	<p>Mostly hard to hear</p> 

Figure 1. Children's self-report booklet

The self-report booklet is a newly developed tool, which was developed based on discussions with the children's educators. The measure was modified to be as simple as possible for children to respond. In the initial implementation of the measures, educators reported back to the researchers that children seemed to understand the questions and response method. Children were also invited to draw a picture in the booklet and tell the educator about listening at preschool. The educators captioned the drawings based on what the children told them. Post-implementation of the sound enhancement system, the booklet asked children what they thought about the system with a number of questions, including, "I like it when my teacher turns on the speakers", "When the speakers are on it is easier to hear the teacher talk", "When the speakers are on I know what I should be doing", and "I would like to keep the speakers in my classroom". Children rated these statements on a scale of 1 (agree), 2 (not sure) and 3 (disagree).

Results

Quantitative Results

Educator pre and post reports of children's hearing and listening. Firstly, educators' mean ratings on the 13 items on the *Listening Inventory for Education-Revised* (Anderson, et al., 2011) were compared pre- and post- implementation of the sound amplification system. This allowed examination of whether or not educators' reports of children's hearing and listening behaviours improved. Higher scores mean better listening (on a scale of 1 to 5). A total hearing and listening score was calculated by adding up the individual ratings of each of the 13 items. Results are showed in table 1. As can be seen, mean ratings of every item, as well as the total hearing and listening score, improved post-implementation of the sound amplification system at a statistically significant level. Pearson correlation indicated that children's age was not significantly related to educator-reported total hearing and listening score.

Table 1. *Educator Reports of Children’s Listening - Listening Inventory for Education-Revised*

Inventory item	Pre-Mean (SD)	Post-Mean (SD)	t-value
Ability to focus on large group instruction	3.8 (1.13)	4.2 (1.02)	-3.14*
Ability to follow verbal instructions when you are moving around	3.6 (1.20)	4.1 (1.02)	-4.06**
Ability to focus on verbal responses by other children on the floor	3.8 (1.09)	4.2 (.97)	-3.08*
Ability to attend when listening to directions presented to class	3.8 (1.17)	4.3 (.89)	-4.48**
Ease of following directions to whole group	3.8 (1.06)	4.3 (.91)	-3.87**
Ability to attend to whole group activities	3.5 (1.17)	4.0 (.96)	-4.20**
Ability to stay on task	3.6 (1.11)	4.1 (1.02)	-3.69**
Hesitation when volunteering to answer question	3.7 (1.26)	5.2 (.97)	-3.09*
Ability to answer questions appropriately	3.8 (1.18)	4.3 (.95)	-4.05**
Ability to understand information via instructional media	4.0 (1.06)	4.4 (.94)	-2.45*
Ability to focus on and understand morning announcements	4.1 (1.08)	4.4 (.91)	-2.25*
Ability to attend to verbal instruction and understand when noisy	3.6 (1.07)	4.1 (.96)	-3.61**
Total hearing and listening score	47.9 (13.15)	54 (11.71)	-4.22**

Note: *N* = 62 for all items

**p* < .05

***p* < .001

Children’s pre and post reports of hearing and listening. Firstly, children’s mean ratings on the eight items in the children’s self-report booklet were compared pre- and post-implementation of the sound amplification system. This allowed examination of whether or not children’s reports of their own hearing and listening behaviours improved. A total hearing and listening score for each child was calculated by adding up each of the ratings on the individual items. Lower individual items scores and total hearing and listening scores mean better hearing and listening. Results are showed in table 2. Two items, “on the mat when teacher is asking questions” and “when one of your friends is telling their news”, as well as the total hearing and listening score showed statistically significant improvements. Pearson correlation indicated that children’s age was not significantly related to self-report total hearing and listening score.

Table 2. *Children Self-Reports of Hearing and Listening*

Inventory item	Pre-Mean (SD)	Post-Mean (SD)	t-value
Listening to a story on the mat	1.3 (.57)	1.2 (.52)	1.20
Listening to a story on the mat when others are talking	2.2 (.69)	2.2 (.83)	.48
On the mat when teacher is asking questions	1.7 (.69)	1.3 (.62)	3.16**
On the mat when listening to smart board	1.4 (.66)	1.3 (.65)	.62
On the mat and teacher is telling you what to do next	1.6 (.67)	1.4 (.71)	1.50
When one of your friends is telling their news	1.7 (.82)	1.2 (.56)	3.92**
When sitting at the back of the mat	1.8 (.83)	1.6 (.80)	1.59
When sitting at the front of the mat	1.23 (.46)	1.2 (.51)	.87
Total hearing and listening score	12.9 (2.89)	11.3 (2.95)	3.61**

Note: $N = 60$ for all items

* $p < .05$

** $p < .001$

Children’s and educators’ feedback on sound enhancement system. To gather feedback about what children thought about the sound amplification system, post-implementation booklets asked children what they thought about the system with a number of statements. Children rated these statements on a scale of 1 (agree), 2 (not sure) and 3 (disagree). Children’s mean ratings for these statements were calculated. Means were as follows; “I like it when my teacher turns on the speakers” (1.20) “When the speakers are on it is easier to hear the teacher talk” (1.10), “When the speakers are on I know what I should be doing” (1.10) and “I would like to keep the speakers in my classroom” (1.10). Thus, overall children’s feedback for the sound amplification system was favourable.

Post-implementation of the sound enhancement system, educators rated 14 feedback statements on a scale of 1 (strongly agree) to 5 (strongly disagree). A summary of the mean ratings of these statements can be seen in table 3. Educator ratings indicate that they thought the use of the sound amplification system generally had positive outcomes. However, they did not feel the system helped with their own tiredness, nor did it decrease the time needed for transitions or the need to repeat directions.

Table 3. *Educator Feedback on Sound Amplification System (SAS)*

Item	Mean Rating
I would like to keep the SAS in my class permanently	1.67
The SAS was easy to use	1.56
I am comfortable using the SAS	1.78
Using the SAS decreased how tired I felt at the end of the day	3.00
I have better control of my class when the SAS is used	2.44
The SAS has improved the learning environment	1.62
The SAS has increased children’s attention	2.00
Using the SAS decreased the time needed to transition to other activities	3.38
The SAS has decreased the need to repeat directions	3.00
The SAS has enhanced my use of the audio-visual equipment	2.33
Parents and staff have made positive comments about the SAS	2.00
The SAS has decreased the listening skills of the children	4.11
The children do not like the SAS	4.22
Using the SAS has decreased participation	4.22

Qualitative Data

Educator diaries. Qualitative data were also collected from educator diaries. Here, educators commented on the children’s experiences after the introduction of the sound amplification system. The diary comments suggest that educators noticed that with the use of microphones, children were hearing each other better, wanting to talk more, and those children who did not normally speak much, were gaining confidence speaking in front of the group. Overall, educators felt that children enjoyed using the microphone, particularly for news time. However, educator comments about children’s attention were mixed. Some educators reported that children who were normally distracted at group activities were still distracted, despite using the sound amplification system. The following quotes from educators illustrate some of the changes in children’s hearing. Children’s names were replaced by pseudonyms.

Great group discussion today. Children who normally don’t listen did! Joey pointed to speaker and moved and sat under it offering her ideas (Educator 1).

Children commented they could hear Sally talk when she told us about her week with Stampy

(class mascot). All sat and listened well today, apart from children with ESL (this is normal) (Educator 1).

Using the mic was great. The children stopped to listen straight away. I didn't need to use much volume to get attention (Educator 2).

Children are showing more confidence with talking, but not listening. Peter, who hardly speaks, volunteered to talk about a dream he had about zombies (Educator 2).

Used microphone at group time. Two children who are usually restless listened to two stories without being distracted (Educator 3).

Qualitative comments from the educators again indicate a generally positive opinion of the sound amplification system, particularly for children with speech or language issues and quieter children.

Children who have speech issues and/or are difficult to understand were easier to understand/ speech clearer using the amplification system (Educator 10).

It has made a big difference to group time activities. All children are listening-less restlessness and more attention overall. The children say they like it and can tell when it's not used. It has made our environment more inclusive (Educator 1).

The sound enhancement system is very beneficial when quieter children use it for news and show and tell and also children with speech difficulties (Educator 9).

Children enjoyed taking turns to use the microphone at group time to tell their news. It increased their confidence (Educator 3).

However, two educators indicated that the sound amplification system had some limitations.

My own voice is quite loud and projected so I don't think it has been as effective as with those who have a softer speaking voice (Educator 5).

I feel that with the groups I have, no real difference was made. Children either listen (most do) or they don't (ESL children still struggle a little) (Educator 4).

Discussion

The aim of this study was to examine children's and educators' perspectives on children's hearing and listening before and after implementation of a sound amplification system in a preschool setting. It was found that three months after the implementation of the sound amplification system, children and educators reported improvements in children's hearing and listening. For example, most of the educators' reports of children's listening scores on each item of the *Children's Listening - Listening Inventory for Education-Revised* improved. Additionally, children's reports of their own hearing and listening in different situations improved post-implementation of the sound amplification system for all items except for "when sitting at the front of the mat". It is likely that when sitting at the front of the mat, children are close enough to the educator and other children who are speaking, to be able to hear well with or without the sound amplification system.

Qualitative comments from educators indicated that children could hear other children better, particularly at news time, that it helped children with speech difficulties be better understood, and that it improved the confidence of the quieter children with speaking. These are particularly significant findings given previous research suggesting that poor classroom acoustics could prevent children from practicing their language skills (Manlove et al., 2001). However, although some educators saw improvements in children's attention, other educators did not, particularly for children with English as a Second Language (ESL). Educators and children generally felt positive about the sound amplification system and wanted to keep using it, although educators didn't necessarily think it helped them to feel less tired, helped them to repeat directions less often or decreased their time spent in transitions.

The findings from this study supports other research indicating that sound amplification systems are related to a range of positive outcomes for children (Kazmierczak-Murray & Downes, 2015), particularly in the area of listening (Darai, 2000; Rosenberg et al., 1999). However, the findings from this study did not indicate consistent improvements in children's attention, as reported by educators, which contradicts other studies (Edwards & Feun, 2005). This could be due to several children in our sample speaking a native language other than English, which could have contributed to more difficulty in maintaining attention and staying on task.

Most previous research examining the impact of sound enhancement systems focus on older children and on academic outcomes (Flexer et al., 2002; Massie & Dillon, 2006). However, the current study focuses on an early childhood setting and moves beyond academic outcomes. The combination of qualitative and quantitative data contributes a richer picture about which particular aspects of the sound amplification system were helpful to educators and children and the impact of these. Specifically, according to educators, the sound amplification system not only helped children hear the educator better, it helped children hear other children when they shared their news at group time. A noteworthy finding was that educators reported the sound amplification system improved the confidence of the quieter children and that these children were more willing to get up and speak in front of the group. This was an unexpected outcome of the sound amplification system, but one that makes a positive contribution to children who are shy or have difficulty projecting their voice. Not only did this research focus on children's perspectives of their daily experiences (Dockett & Perry, 2007), the finding that the sound amplification system helped quieter children gain confidence speaking supports the United Nations Convention on the Rights of the Child, Article 12 (United Nations, 1989) which identifies children's rights to express their views on matters that affect them.

There are some limitations to the study. Firstly, only one preschool was included, which could impact generalizability of the findings. Also, educators were aware of the aim of the project and there is a possibility that they could have been biased in expecting positive outcomes from the implementation of the sound amplification system. Additionally, the study spanned a period of three months, therefore, the long term impact of the sound amplification system is not known. Finally, as there was no control group, it is not known whether or not improvements were the result of novelty or familiarity of the sound amplification system, or the system itself (Dockrell & Shield, 2012).

Conclusion

The current study contributes a richer understanding of the impact of a sound enhancement system in a preschool setting, a focus which has been scarce in previous research. A combination of both qualitative and quantitative data from multiple

perspectives (children and educators), which moves beyond academic outcomes, gives a more comprehensive picture about the impact of a sound amplification system. The findings indicate that the sound amplification system was associated with positive changes for educators and children. Significantly, children's hearing and listening improved, as did quieter children's confidence in speaking in front of a group. These findings could be particularly important in that children may have been supported to feel more empowered in their classroom environment. From our results, it appears that the sound enhancement system may have helped the quieter children "find their voice". Following on from this, future research could examine social or wellbeing outcomes for shy children as a result of the sound amplification system.

Another noteworthy finding of this study is that the children's self-report booklet could be a useful method for early childhood settings to identify hearing and listening issues. Given that few early childhood centres have the financial resources to identify the specific acoustic problems particular to their setting (Manlove et al., 2001), the self-report booklet, or some version of it, could be a cost effective method to foster improvements in the classroom listening environment. Thus, there seems to be great value in identifying specific hearing and listening issues through children's own reports of what they experience.

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