Austin Journal of Neurological Disorders & Epilepsy

Open Access

Austin Publishing Group

Review Article

Noise and the Implications for Children with Autism Spectrum Disorder in Mainstream Education

McLaren SJ* and Page WH
College of Health, Massey University, New Zealand

***Corresponding author:** McLaren SJ, College of Health, Massey University, P.O. Box 756, Wellington 6140, New Zealand

Received: December 23, 2014; **Accepted:** May 29, 2015; **Published:** June 02, 2015

Abstract

New Zealand has taken a far-reaching approach in comparison to other countries with the inclusion of children with special education needs in regular mainstream classrooms. Many deficiencies have been identified in the implementation of inclusive education in legislation, policy, training of teaching staff in behavior management and the physical learning environment these children are placed in.

Considerable debate has occurred around the effects noise has on those with Sensory Processing Disorder (SPD), which is widespread among those experiencing Autism Spectrum Disorder (ASD). Sensory processing disorder results in many adverse reactions to noise and other forms of sensory input. A range of noise categories have been suggested which produce the most adverse effects in those with ASD, although reactions to certain sounds are often individual specific.

A busy, active mainstream classroom is more prone to produce the triggers that create meltdowns in ASD individuals when compared to the environment and education delivery of a special education classroom. There needs to be adequate provision to meet the needs of children experiencing ASD and others with SPD who are placed in mainstream classrooms. This includes a space with good quality acoustics, adequate noise management, and appropriate education delivery and particularly in the case of those with high and complex needs, a well-defined behavioral management plan.

Keywords: Autism spectrum disorder; Noise; Inclusive education; Behavior

Introduction

Noise is ubiquitous and pervades most aspects of society. It is an environmental stimulus of concern for a range of individuals experiencing disability including; Autism Spectrum Disorder (ASD - including Asperger's syndrome), hearing impairment, Down syndrome and a range of disabilities involving auditory function, development and language delay. A cohort of the gifted is also known to experience similar aberrant responses to noise as those experiencing ASD [1].

Autism spectrum disorder consists of a range or continuum of disorders which vary from the severe or classical autism (often referred to Kanner's syndrome) to the higher functioning forms of autism and Asperger's syndrome [2,3]. It is considered a neurological and genetic developmental disorder resulting in deficiencies in the way in which information is processed [4]. It has been described as interlinking and widespread deficits in social interaction, social communication, social imagination and occupational function [2,5,6].

Sensory processing disorder

The unusual or aberrant responses to noise characteristic of those experiencing ASD are largely due to a condition now referred to Sensory Processing Disorder (SPD) or Sensory Integration Disorder (SID), which has been previously described by other terms such as sensory integrative/modulated dysfunction. Kanowitz [7] describes SID as the inability to process information received through the senses and is a form of inefficient neurological processing. This highly complex condition was firstly characterized by Ayres [8] and based around the work carried out in the disciplines of neuromuscular functional neuroscience and physical development. Bogdashina [9] explained that understanding of this complex condition has been hindered by over-simplification of sensory problems in autism. It is not as simple as identifying the hypersensitivities of each individual and then desensitizing or modifying the environment to solve all problems, although it would appear to be the most basic requirement to attend to before attempting to address the more complex issues. This illustrates the level of difficulty in adequately addressing all the complex issues of this condition.

Considerable debate has occurred around the effects noise has on those with ASD as SPD is widespread among this group. Ozonoff, Rodgers and Hendron [10] report that sensory hyper-arousal and SPD exist with most of these individuals along with many adverse reactions to light touch, some textures of clothing, crowd noise, alarms sirens, and a variety of loud noises. They suggest that the basis of these symptoms could be enhanced sympathetic responsivity to all modalities of sensory input (pathways through which information is received or stored) and decreased vagal tone (the degree of activity in the parasympathetic nervous system). Treatments such as medication and occupational therapy can be prescribed for improvement [11]. Along with these treatments, there has to be management of noise levels and other environmental stimuli to reduce the overall arousal

Citation: McLaren SJ and Page WH. Noise and the Implications for Children with Autism Spectrum Disorder in Mainstream Education. Austin J Neurol Disord Epilepsy. 2015; 2(1): 1009.

and stress levels. By doing this, an individual often will show increased capacity to self-regulate those stimuli which cannot be readily avoided.

Noise and adverse effects

A wide range of noise types were identified from the study by McLaren [1] that caused distress for young autistic children, these included:

- Sirens and whistles
- Bells and cymbals
- Unexpected sudden noises
- Machinery noise such lawn-mowing
- Air hand dryers
- The general din created by many people talking (e.g. crowd noise, classroom noise)
- Sharp impact or explosive sounds such as hammering

In summary, the following categories of noise were found to create the most adverse effects [1,2]:

- Sudden unexpected noises such as barking dogs, baby crying
- High pitched continuous noises such as mechanical fans, hand dryers, lawn mowers, vacuum cleaners
- Confusing, multiple or complex sounds such as crowd noise in shopping centers and school classrooms
- Noise in an excessively reverberant rooms

However the response to these sounds and indeed specific sensory inputs is individual specific within the population experiencing ASD, with substantial variation between individuals. An adverse effect from a certain sound may have no effect or evoke a completely different response from other individuals.

For individuals experiencing SPD, sensory stimulation from noise could have the greatest impact when compared to other sensory input because of the ubiquitous nature of noise. Environmental noise intrusion is often the most difficult type of sensory stimulation to effectively control. For other types of sensory stimulation, such as light, tactile and olfactory senses, it appears possible to regulate these to a much greater extent than it is possible for noise. For example, it is easy for the carer to control the food the individual eats or the clothing they wear, whereas noise intrusion from natural or anthropogenic activities in the vicinity is completely outside the control of the individual or carers. Common examples include noise from weather conditions (thunder, heavy rain), construction noise, dogs barking and crowd noise. The adverse effects of noise can have major consequences in the confined space of a vibrant and active regular classroom with the presence of a large number of children, or in busy, noisy and crowded places. If there is noise intrusion which cannot be controlled, such as a barking dog, lawn mowers and from other noisy and over stimulating sources; this can lead to heightened arousal levels and anxiety.

Many existing classrooms have little or no effective acoustic treatment, leading to excessive noise, and in some cases, highly reverberant learning spaces. Inclusive education for children with a wide range of special needs began in New Zealand with legislation establishing a legal right for all children to attend their local school [12,13]. This was further enhanced by the government education policy, "Special Education 2000", which aimed to bring about the inclusion of all children with special education needs in regular schools. However it appears that only those with physical needs such as requiring wheel chair access, were given priority in many jurisdictions, with resources set aside for access ways into buildings and use of sanitary facilities. However for those with '*invisible disabilities*' such as SPD, inclusion often occurred in an inadequate and haphazard fashion with scant regard for the specific needs of the individuals. These needs include good classroom acoustics, small class sizes, management of classroom noise, and suitable methods of education delivery.

Hornby [13,14] in his analysis of the New Zealand situation described the thrust towards main stream education as being one of the most radical in comparison to many other countries. New Zealand has one of the highest percentages of children with special education needs in regular education with less than one percent in special education facilities. Hornby also outlined numerous shortcomings in the legislative procedure and policies in the inclusion of children with special education needs. These include deficiencies in the legislative framework, the lack of statutory guidelines for schools to follow, lack of coherent policy about inclusive education, the lack of requirement for appropriate training of special education teachers and special education needs co-coordinators, lack of school counselors in primary or intermediate schools, and no requirements to have Individual Education Plans (IEPs). He described the contrast between rhetoric of inclusive education and reality in the inclusion of students with special education needs in the mainstream classroom. From the experience of the authors, this radical policy has had a profound effect on those students of high and complex needs such as ASD. In addition to what Hornby has demonstrated, there has been a lack of commitment on the part of the regulatory authorities in New Zealand to meet the needs of the most vulnerable children in education, by ensuring appropriate acoustical quality for all classrooms. A proposal was made to include a classroom acoustic standard in the New Zealand Building Code (the regulatory requirement for buildings in New Zealand) Clause G6 -Air and Impact Sound [15]. This proposal would have required all new classrooms to meet this standard. Every effort was made through due process to have a classroom acoustic standard included in the revision of the New Zealand Building Code, but to date this has not been successful. This indicates that good classroom acoustics are considered a low priority. However it is interesting to note that the New Zealand Ministry of Education (MoE) states under the Designing Quality Learning Spaces (DQLS) standards that "*All Modern Learning Environment (MLE) classroom upgrades must comply with the Designing Quality Learning Spaces (DQLS) standards on internal environment learning spaces design. Guidelines have been developed by the Building Research Association of New Zealand for boards of trustees, principals and teachers to help them understand the importance the internal environment plays in the design of quality learning spaces*". The first of the DQLS guidelines, specifically addresses classroom acoustics [16]. The MoE funds the

design and construction of all facilities (including upgrades) at a standard rate per square meter that is regularly reviewed. Under the MoE design standards, acoustics is considered both a requirement and best practice.

Loudness discomfort level and hyperacusis

The most common subjective behavioral test used by audiologists for the evaluation of patients suspected of hyperacusis (the over-sensitivity to certain frequency and loudness ranges of sound) is the Loudness Discomfort Level Tests (LDL) [17]. It can be given using pure tones, speech, or recorded voices. An abnormal LDL test will indicate a reduced or collapsed tolerance, often more severe in the higher frequencies. One of the first studies on loudness perception in autistic children [18] found that they have a smaller auditory dynamic range and an increased perception of loudness, both indicators of hyperacusis. A more extensive study by Jones et al [19] on adolescents with ASD, found that those who performed poorly on the intensity discrimination task also reported more auditory sensory behaviors associated with coping with loudness levels. Those who performed well on the duration discrimination task reported more auditory sensory behaviors across the full range evaluated. They stated that "individual differences in auditory discrimination ability may influence the expression of auditory sensory behaviors by modulating the degree to which sounds are detected or missed in the environment".

Often the subjective assessment of the loudness of a sound is related to whether or not it has distinctive characteristics, for example, noticeably impulsive or tonal in character. Sounds with special audible characteristics such as whistles, whines, hums, pops and clicks can often be far more annoying at a given loudness than general sounds. A barking dog may not significantly contribute to ambient sound levels but can cause a high degree of nuisance and result in numerous complaints in the general population. For some individuals with ASD, the noise of a barking dog next door causes a severe adverse behavioral response. In others, it may be the sound of thunder or rain on the roof that results in an adverse behavioral response. The actual sound level may not be high and is often well below the LDL for pure tones, but the level of discomfort as indicated by the adverse response, may be very high. Thus it is not an issue of loudness discomfort in general but specific to the particular sound and the individual. Hence it is prudent to identify sounds that adversely affect ASD individuals using a mixture of observation and information gained from parents and clinical sources. These should be addressed in individual educational, development and support plans for these individuals.

Adverse education outcomes

In a survey conducted among general teaching staff and specialist staff of young children [1], a number of primary and secondary effects were identified as a response to noise; these included:

- High levels of distress
- Aggravation of behavior
- Putting hands over ears
- Agitation
- Self-stimulating behaviors such as hand flapping or rocking
- Screaming or groaning to try and block out the sound
- Fleeing the area and refusing to go back
- Epileptic seizure in an individual case

Secondary adverse effects of noise resulted in:

- Learning impairment
- Distraction from learning and other tasks
- Compromised communication with other children and with the teacher

Since ASD children, especially those presenting with classical autism, have serious impairments with speech production and communication, noise only exacerbates the difficulties they already have. It has been estimated in McLaren [1], that ASD individuals and indeed any of those with SPD, are probably the most seriously affected by noise compared to any other cohort, based on the number of serious adverse effects.

A severe case was reported [1] when drop pile driving for a new bridge being constructed over a sea inlet, resulted in the sound travelling across the water to a kindergarten located on the foreshore. It caused a high level of distress for a young autistic child attending the center. Despite there being provision in the environment law, no consultation took place to ensure the protection of the children at both the school and kindergarten which were located nearby.

The most common strategies suggested by many respondents reporting [1] on ASD children were to remove them to a quiet area to escape the din (if one exists) and the provision of earmuffs or headphones playing soothing music.

If a child is placed in a mainstream classroom with up to 30 other children, there will usually be a higher level of sensory input from that environment than a special education facility, typically with 10 or less students in the classroom and a lock down of the environment to control the sensory input as much as reasonably practicable.

There are clear benefits to a mainstream education with other typical children where children experiencing ASD can be matched to their abilities and learn alongside others. For example, a child with savant music, art or mathematical abilities would usually be better placed for academic purposes in a regular learning environment where they can advance and exploit their abilities by joining in with a normal school orchestra or art class. However such opportunities are much less common in a special education school where they are unlikely to have a school orchestra, music groups or an advanced mathematics class.

Acoustic quality

Acoustical quality is an important factor in mitigating or enhancing existing sound levels. How rapidly the sound dies down after it stops (called the reverberation time), is one of the most important parameters of acoustic design. For speech to be intelligibly heard, it needs to perceived about three times louder (15 dB higher in sound level) than the background noise. The ratio of the loudness of the speech to the background noise is called the signal-to-noise ratio. The interrelationship between reverberance and signal-to-noise ratio is shown in Figure 1. Despite the number of speakers remaining

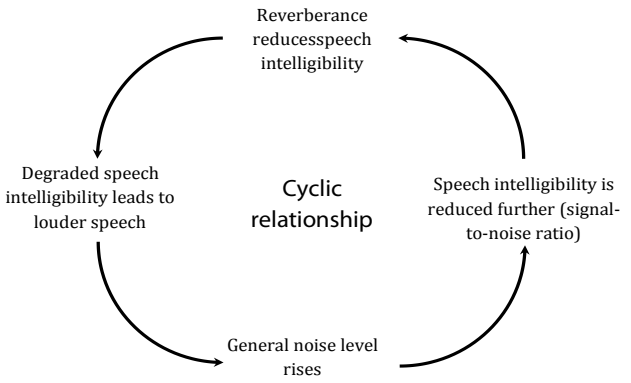

Figure 1: Cyclic interrelationship of noise levels and acoustical quality (Adapted from [22]).

constant, poor reverberant learning spaces can set a cyclic pattern in motion leading to increasing noise levels as speech levels are raised in an attempt to counteract degraded speech intelligibility. This phenomenon is known as the Lombard Effect [20]. Good acoustical quality can lead to significantly quieter teaching environments, which is particularly important in enhancing the educational outcomes of ASD children in such environments [21,22], see Figure 1.

Short reverberation times have been identified as the most important indicator in determining a good acoustical environmental in a classroom or learning space, for the improvement of speech intelligibility and general reduction of noise levels [21]. An Australian and New Zealand Standard for building interiors [23] which follows similar standards in many comparable jurisdictions, such as the United Kingdom [24], recommends an unoccupied reverberation time (RT60) of 0.4-0.6 seconds in classrooms and learning spaces and a maximum ambient (unoccupied) time-average sound level of 45 dB (A-frequency weighted). For young children, who are typically immature listeners, and for those experiencing hearing loss and/or Auditory Processing Disorder (APD), a reverberation time of 0.4 seconds creates the optimum acoustic conditions, especially when combined with an ambient sound level of 40 dB (A-frequency weighted) or less.

A committee established to review the noise and acoustics provisions of the New Zealand Building Code proposed the following acoustic requirements for classrooms and learning spaces. These criteria should include the following for all new schools and early childhood education classrooms and learning spaces:

- A reverberation time (unoccupied) of between 0.4-0.6 seconds in the single octave (1/1) frequency bands, 125 Hz to 5 kHz
- Positioning of acoustic absorption materials according to the teaching practice used in each space/classroom

The following is also needed for all levels of education:

- Protection from outside noise to achieve an inside level (unoccupied) of an A-frequency weighted time-average level measured over 10 minutes of 35 dB (35 dB $L_{Aeq,\,10\,min}$)
- Protection from noise in other classrooms (inter-tenancy noise) of 35 dB $L_{Aeq,\,10\,min}$
- A maximum permitted A-frequency weighted sound level (L_{Ap}) of 65 dB for bells and warning signals (including fire alarms but excluding burglar alarms) which latter shall not be connected to the school bell system
- Acoustic insulation of roof/ceiling structures to protect from rain noise
- In multi-story structures, floor ceiling acoustic insulation as per that for inter-tenancy noise requirement

Inclusion for all?

While there has been impassioned debate of over the inclusion in mainstream classrooms of a range of children experiencing disability, occasionally generalizations are made which suggest the needs of all such children are similar. The authors of this paper argue that the needs of children experiencing ASD are often very specific and cannot be generalized, like many other cohorts. Noise and other forms of sensory stimulation are major obstacles for this group of children in regular classrooms. MacArthur [25] in her report, states that *"research suggests that all students do better in inclusive classrooms. Everyone benefits from the changes in teaching and learning needed for teachers to work successfully with a mixed group of students"*. The experience of one well documented case study of a child experiencing severe autism [26] does not support this absolute claim with no provision for any exceptions. There was little evidence presented in MacArthur's report which supported the claim that all children (including those with ASD) were better served in an inclusive classroom when compared to a special education facility. The problems confronting the high and complex issues characteristic of ASD children were only given cursory coverage in the report, with no in-depth analysis of the issues that many in this cohort face. In particular, the sensory processing difficulties and effects of sensory inputs such as noise were not addressed. It is our opinion that this report did not meet the evidential threshold justifying an absolute claim involving all children.

Furthermore, the issue of behavioral management was also not addressed and yet it was suggested to be the most pressing issue in the success of inclusion [27]. The effects of adverse behavior in many jurisdictions can be so serious as to be deemed to present harm to the individual or to others and will result in the child's exclusion from the school. This can happen even if the behavior is a response to distress or pain caused by the excessive sensory stimulation due to the environment the child is in.

Meltdowns and tantrums

Lipinski and Richards [28] describe a meltdown as an uncontrollable extreme emotional or behavioral response to overwhelming stress or over stimulation. There is a sudden release of adrenaline leading to heightened anxiety and a switch to a primitive survival mode. This state of being can be referred to as sensory defensive reaction, resulting from sensory overload and can manifest in a "fight" or "flight" reaction. By comparison, a tantrum is a pre-meditated and planned voluntary behavior to try and force someone else to take a certain action [28].

Lipinski and Richards [28] describe conditions such as noise, sensory stimulation and overload, novel situations, sudden unexpected changes, and transitions (class, topic or subject changes) where the stage is set for frequent meltdowns. These are conditions

typically found in a modern vibrant and dynamic mainstream classrooms [29]. One has to only compare this to the typical model of a special education classroom with far fewer students in the classroom and where there is careful control of the environment and delivery to reduce the number of triggers. It therefore follows that in the case of ASD individuals, the regular mainstream classroom environment is considerably more prone to produce the triggers that create meltdowns. Lipinski and Richards [28] refute any explicit or implied claims that with careful planning and scripting, all such behaviors can be prevented. In the case of meltdowns there will always be uncontrollable noisy events occurring in the vicinity. These could include a dog barking nearby, the operation of heavy machinery, a siren, a clap of thunder or many other conditions normally found in a modern vibrant classroom. It unrealistic and unachievable to propose blanket strategies to reduce behaviors caused by meltdowns, when the conditions creating the meltdown cannot be controlled or avoided [26].

There are several recognized and established procedures for crisis management and intervention. Two common procedures in use are "Nonviolent Crisis Intervention" and "Safe Crisis Management" [26,28]. Both of these are used in New Zealand psychiatric institutions and in residential facilities for children with high and complex social, emotional, behavioral and learning needs. Lipinski and Richards [28] developed the "S.C.A.R.E.D. Calming Technique" for children and adults with autism, especially for use in United States hospital emergency rooms.

Discussion

MacArthur [25] states that *Inclusive Education* means that barriers to each student's learning are identified, and resources and support are put in place to overcome any barriers. This statement is also promoted by Breakley [30] who explained the concept of being person-centered, where the school matches their provision of support and education delivery to meet the needs of the individual. She further uses the analogy of forcing a square peg into a round hole if it means slotting an autistic child in a readymade provision. Such claims imply that all barriers or impediments can be overcome in the mainstream learning environment.

Is it ever reasonable or practicable to expect a child with serious SPD to negotiate and manage in a noisy, unpredictable and over stimulating environment of the busy mainstream classroom? McLaren [26] found that in the case study of a child with high and complex needs due to ASD, that to meet the individual's needs would require the education delivery of a regular school to change drastically, massively reducing the class size and implementing strict controls to regulate the sensory input of the child. Included in this would also be a suitable physical environment with optimal acoustics. If this is what is required, it is forcing a square peg into a round hole to not meet these criteria. Inclusion of any child with such high and complex needs in a mainstream learning environment is slotting that child into a readymade provision of a regular classroom and then trying to introduce strategies to make it work. When such basic needs cannot be addressed, such as the provision of an optimal acoustic learning space, the lockdown of the environment to reduce noise and other sensory stimuli to a minimum, and to radically alter the way education is delivered, it cannot meet the definition of being person-centered or removing barriers, if these obstacles are essential to the successful inclusion and education of the child.

The inclusion of children with high and complex needs (such as many with ASD) in New Zealand has been strong on rhetoric but the reality has been very different with many deficiencies both in the physical learning environment, legislative framework, policy training of teaching staff and practice [14]. As out lined in the case study by McLaren [26], where full inclusion of a child with high and complex needs ended in multi-level failure, the child was placed back in special education with a class of five students with a teacher and four education support workers. Sensory stimulation is carefully controlled in this environment through low students numbers, noise management and acoustical treatment of the learning space.

McLaren [26] finds that children with high and complex needs due to ASD could be a very difficult group to fully include in regular school environments. While his paper only included one detailed case study, the child's characteristics were well defined in the literature on autism, meaning that there are likely to be a number of children presenting with similarly characteristics who will likewise struggle in regular school environments. Anecdotal evidence in New Zealand suggests this is the case with a number of parents and school staff reporting the difficulties with children with high and complex needs due to ASD.

If a child with physical disabilities was expected to negotiate their way up a flight of stairs it would be regarded as a cruel and inhumane form of treatment. However if children presenting with serious SPD are expected to negotiate their way through the noisy and over-stimulating environment of a regular classroom, it can likewise be considered a cruel and inhumane form of treatment if it causes distress, pain or harm [26].

However, there will be many children presenting with various degrees of ASD, who could be mainstreamed. For those children one of the most fundamental requirements is a good quality learning space where noise and other sensory stimulation is mitigated as far as practicable.

Recommendations

The authors of this paper have four recommendations relating to noise in classrooms and the inclusion of children with special education needs (such as ASD) in mainstream education.

1. All classrooms should have good acoustic quality (as defined in appropriate standards and guidelines for learning spaces) as this will benefit all children.
2. All classroom and learning spaces containing children with special education needs that are adversely affected by noise must have good acoustics as a priority, supported by appropriate noise management strategies. For learning environments containing children with high and complex needs which can result in adverse behavior, there must be implemented crisis management plans and strategies. These include:
    - The ability to foresee potential problems and intervene early
    - Training in and implementation of de-escalation techniques

- The ability and means to keep all others safe and to safety remove a child to an appropriate safe area when there is a meltdown or similar crisis.

References

1. McLaren S. Noise in early childhood education centres - the effects on the children and their teachers [PhD Thesis]. Wellington: Massey University. 2008.
2. Shields J. NAS early bird programme - Parent manual. United Kingdom: National Autistic Association; 1998.
3. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5th edition. Washington, DC: American Psychiatric Association; 2013.
4. Janzen JE. Understanding the nature of autism. Texas: Therapy Skill Builders. 1996.
5. Cashin AJ. Autism: understanding conceptual processing deficits. J Psychosoc Nurs Ment Health Serv. 2005; 43: 22-30.
6. Tseng M-H, Fu Cheung-Pei, Cermak Sharon A, Lu Lu, Shieh Jeng-Yi. Emotional and behavioral problems in preschool children with autism. Relationship with sensory processing dysfunction Research in Autism Spectrum Disorders. 2011; 5: 1441-1450.
7. Kranowitz C. The out-of-sync child -recognising and coping with sensory integration dysfunction. New York: Berkley Publishing Group; 1998.
8. Ayres A. Sensory intergration and the child. Los Angeles, CA: Western Psychological Services. 1979.
9. Bogdshina O. "Sensory issues in autism are recognised but...". Awares Online Conference. 2005. http://www.awares.org/conferences.
10. Ozonoff S, Rodgers SJ, Hendron RL, editors. Autism Spectrum Disorders - A Review for Practitioners. Washington DC: Amercian Psychiatric Publishing Inc. 2003.
11. Belsito KM, Law PA, Kirk KS, Landa RJ, Zimmerman AW. Lamotrigine therapy for autistic disorder: a randomized, double-blind, placebo-controlled trial. J Autism Dev Disord. 2001; 31: 175-181.
12. Education Act. 1989. (New Zealand legislation). www.legislation.govt.nz/act/public/1989/0080/latest/DLM175959.html.
13. Hornby G. Inclusive special education: Evidence based practices for children with special needs and disabiltities. New York: Springer. 2014.
14. Hornby G. Inclusive education for children with special education needs: A critique of policy and practice in New Zealand. Journal of International and Comparative Education. 2012; 1: 52-60.
15. Dept. of Building and Housing. New Zealand Building Code: Clause G6: Air and impact sound. Wellington, New Zealand: Dept. of Building and Housing. 2014.
16. Building Research Association of New Zealand, Ministry of Education. Designing quality learning spaces: Acoustics. Wellington: Ministry of Education. New Zealand. 2007.
17. La Guinn S, Formby C. Estimates of loudness, loudness discomfort, and the auditory dynamicrange: Normative estimates, comparison of procedures, and test-retest reliability. Journal of Academic Audiology. 2005; 16: 85-100.
18. Khalfa S, Bruneau N, Roge B, Georgieff N, Veuillet E, Adrien JL, et al. Increased perception of loudness in autism. Hear Res. 2004; 198: 87-92.
19. Jones CR, Happe F, Baird G, Simonoff E, Marsden AJ, Tregay J, et al. Auditory discrimination and auditory sensory behaviours in autism spectrum disorders. Neuropsychologia. 2009; 47: 2850-2858.
20. Lombard E. Le signe de l`e'levation de la voix. Ann Maladies Oreille Larynx Nez Pharynx. 1911; 37: 101-19.
21. Oberdorster M, Tiesler G. Acoustic ergonomics of school: Research report Fb 1071. Dortmund, Germany: Federal Institute for Occupational Safety and Health. 2006.
22. Oberdorster M, Tiesler G. Noise in educational institutions. Dortmund: Federal Institute for Occupational Safety and Health. 2008.
23. Australian and New Zealand Standard-AS/NZS 2107:2000. Acoustics - Recommended design, sounds levels and reverberation times for building interriors Wellington: Standards New Zealand. 2000.
24. Department for Education and Skills (UK). Acoustic design in schools: Building Bulletin 93. London: The Stationery Office. 2004.
25. MacArthur J. Learning better together - Working towards inclusive education in New Zealand schools. Wellington, New Zealand: IHC Inc. 2009. http://www.ihc.org.nz/wp-content/uploads/learning-better-together.pdf.
26. McLaren S. Is inclusive education right for every child? An account by a parent of a child with high and complex needs due to autism spectrum disorder. Kairaranga (A New Zealand journal of education practice). 2013;14(2). http://eric. ed.gov/?id=EJ1025671.
27. McLaren SJ, Page WH. Noise issues in inclusive learning environments. In: Bevan Brown J, editor. Inclusive Education - Perspectives on professional practice. Auckland Dunmore Publishing. 2013.
28. Lipinski D, Richards W. Managing meltdowns- Using the S.C.A.R.E.D. calming technique with children and adults with autism. London Jessica Kingsley Publishers. 2009.
29. Baker E, Lane A, Angley M, Young R. The Relationhsip Betweeen Sensory Processing Patterns and Behaviorual Reponses in Autistic Disorder. Jounal of Autism and Developmental Disorders. 2007; 38: 867-875.
30. Breakley C. Inclusion, being person centred and further education. Awares Online Conference. 2006. http://www.awares.org/conferences.

Austin J Neurol Disord Epilepsy - Volume 2 Issue 1 - 2015
ISSN: 2472-3711 | www.austinpublishinggroup.com

Citation: McLaren SJ and Page WH. Noise and the Implications for Children with Autism Spectrum Disorder in Mainstream Education. Austin J Neurol Disord Epilepsy. 2015; 2(1): 1009.