

Design considerations for the autism spectrum disorder-friendly Key Stage 1 classroom

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There is a growing consensus that an appropriate classroom environment will aid the performance of the pupil with autism spectrum disorder (ASD). There are, however, very few design guidelines available when considering ASD and the school environment. Such guidelines that do exist tend only to be in general terms. Therefore, this article seeks to highlight design considerations specifically for the ASD-friendly Key Stage 1 (age five to eight) classroom. It will first highlight some of the challenges for those with autism spectrum disorder in a school environment and the *triad of challenges* faced by architects and designers when considering ASD-friendly classroom design. It will then go on to describe the findings and results of a two-year study carried out in conjunction with the ASD teaching staff of Northern Ireland's Southern Education and Library Board. These consist of 16 specific design considerations for the Key Stage 1 ASD-friendly classroom applicable to all classrooms for pupils between five and eight years of age.

Key words: architecture, autism, children, design, school environment.

Introduction

Autism spectrum disorder (ASD) is a term that covers the many subgroups within the spectrum of autism. Autism can be termed as a lifelong complex developmental disorder. It is characterised by a triad of qualitative impairments in social communication, social interaction and social imagination (Wing and Gould, 1979). The range of the spectrum is such that, while some of those with ASD may be able to live relatively independently, others will require lifelong continuous support. In addition to these problems, those with ASD often struggle with sensory sensitivity to visual, auditory, tactile, proprioceptive, gustatory and olfactory stimuli (Hinder, 2004). Consequently, one of the many difficulties for people with autistic spectrum disorder can be simply to feel at ease in their own environment. For such people, the built environment can become difficult, confus-

ing and even threatening (Grandin, 1995; Lawson, 1998; Harker and King, 2002; Whitehurst, 2006a; Williams, 1996).

Being sensory sensitive and unable to integrate or communicate fully with others means that those with ASD can find the world a disorientating and even frightening place. For the school child this is especially damaging. Any unwanted distraction can impact badly upon that child's ability to learn. The background and surrounding environment that most of us are able to ignore or cope with will actually act as a barrier between child and teacher, further hampering the child's development.

Adding to this concern is the fact that recent statistics suggest that the incidence of ASD is on the increase and may even be growing at alarming levels. The UK National Autistic Society and recent statistics have put the current incidence of ASD at around 1% of the population (Baird *et al.*, 2006; Brugha *et al.*, 2009). Despite this, ASD has so far been largely ignored by the architectural profession. In the UK there are no specific guidelines when considering ASD. Those guidelines that do make mention of ASD tend to do so in general terms only and then in less detail than other learning difficulties and special needs (DfEE, 2001; DENI, 2005). With regard to the school environment, the 2009 UK Government Building Bulletin 102 (BB102), *Designing for Disabled Children and Children with Special Educational Needs*, lists the design issues for children with autistic spectrum disorder as:

'Simple layout: calm, ordered, low stimulus spaces, no confusing large spaces; indirect lighting, no glare, subdued colours; good acoustics, avoiding sudden/background noise; robust materials, tamper-proof elements and concealed services; possibly H&S risk assessments; safe indoor and outdoor places for withdrawal and to calm down' (DfEE, 2009, p. 199).

The widespread exclusion from, or when included, the general nature of the design considerations listed in the current guidelines is in no doubt due to the difficulties and challenges presented when dealing with a spectrum of disorders (Young, 2004; Khare and Mullick, 2008; Mostafa, 2008). Not only may those with ASD exhibit different sensitivities and personal difficulties, but also the severity of these can vary. In effect, the design parameters are fluid and

variable. There is of course the danger when dealing with autism that prescriptive design guidelines or single rules will not take into account variations among individuals with autistic spectrum disorder and their different levels of ability. Freeman (1997, p. 654) reminds us of the all-important fact that children with autism are, first and foremost, individuals. Therefore, the challenge is both complex and difficult. But the need to confront these difficulties is huge. This, it could be argued, is especially true in a school setting. For children, school has a special and important place in their formative years. To a child, a school is many things; not just a place of learning but also a place of new experiences, a test bed to develop social skills and a supportive environment in which to grow and find themselves. In all aspects it should be an environment in which the child feels comfortable and one that, if designed carefully, may be considered, as advocated by Nair *et al.* (2005) as a three-dimensional textbook for its pupils that can actively aid in their education.

Conversely, feeling ill at ease in the classroom environment can hamper learning, thereby further alienating those with ASD in society. Accordingly it is encouraging that a number of researchers internationally have recently looked specifically at the design criteria of ASD-friendly classrooms (Humphreys, 2005; Vogel, 2008; Scott, 2009; McAllister, 2010; Shabha and Gaines, 2011). This article seeks to add to the ongoing discussion and research by suggesting ASD-friendly classroom design guidelines and considerations specifically for Key Stage 1 pupils (aged five to eight) in a primary school setting.

The challenge

With regard to the classroom (environment), the author and artist Donna Williams, who has been diagnosed with ASD, outlined her ideal environment as:

‘one where the room has very little echo or reflective light, where the lighting was soft and glowing and upward projecting rather than downward projecting lighting. It would be one where the physical arrangements of things in the room was cognitively ordered and didn’t alter and where everything in the room remained within routine defined areas. It would be an environment where only what was necessary to learning was on display and there were no unnecessary decorations or potential distractions. It would be one where nobody unexpected would enter without everyone getting a cue and processing time to expect the change’ (Williams, 1996, p. 284).

This description helps illustrate the many concerns the writer had when at school. She makes the case for constancy and structure, while minimising the unexpected and superfluous. In many ways, Donna Williams is advocating a potential solution for classroom design for the pupil with autistic spectrum disorder. Designing for the ‘worst case

scenario’ would ensure that all children would be catered for on the autistic spectrum. Put simply, why not have a classroom environment that is totally calm, quiet, without distraction and enclosed from external influences? Would that not constitute an inclusive design solution?

However, if we consider inclusive design as *better design*, this is not the case. The classroom is a learning environment for life, a place of preparation for the challenges and negotiations we all face in our everyday life. Cocooning the pupil with autistic spectrum disorder from all external factors will not necessarily help them reach their full potential in life. Maximising a pupil’s ability to cope with change and external factors is an important and vital consideration for teachers in the ASD classroom. Therefore, providing a classroom environment that always completely shields the pupil with autistic spectrum disorder from outside influences is not necessarily the best solution for their long-term development.

Therein lies the most difficult challenge for the designer when dealing with the pupil with autistic spectrum disorder in the classroom – that of trying to provide an environment where change can be introduced, where the pupil with autistic spectrum disorder can be challenged, encouraged and supported to maximise their potential. Dominic Cullinan makes this point:

‘A recent seminar for teachers at the Institute of Education, looking at the relationship between buildings and behaviour, explored the idea of designing spaces specifically for children with autism. Underlying the discussion was the belief that certain criteria could hold true; setting a desk facing a blank white wall, for example, might give the child the visual calm they need for concentration. However, it was also argued that such spaces do not help the child learn to live in the world at large. This refinement neither helps the child to cope, nor those who support them’ (Cullinan, 2009, p. 51).

So in effect, just as a person with autistic spectrum disorder can have a triad of impairments to contend with, so too do designers have a *triad of challenges* to overcome. Not only are there, first, the challenges of the differing severity of the autism inherent within the spectrum and, second, the varying and differing range of sensory difficulties of individuals with autistic spectrum disorder to contend with, there is also a third difficulty in the classroom setting to consider – how best to promote and bring change and subsequent independence for the pupil with autistic spectrum disorder in that environment. Overcoming the triad of challenges for designers will hopefully then allow, in a school setting, the design of the best possible and most appropriate learning environment to aid in pupil performance. With increased pupil performance and the corresponding ability to cope with the challenges of their environment, the pupil with autistic spectrum disorder is more likely to manage to integrate more fully into mainstream education and society in general.

Within the school setting, as the place where most teaching takes place, the classroom environment is therefore worthy of special study. Yes, the classroom may be only one component of the school environment, but it is a key component. A school for any child is in many ways a world within a world, a 'micro-city' within the city (Hertzberger, 2008, p. 112). In the overall school, assembly hall, playground, music room, principal's office and classroom represent for the child agora, piazza, concert hall, town hall and street, respectfully. In this analogy the classroom becomes the pupil's home – a place of peace, structure and calm among the incidental and unplanned that many children with special educational needs can find stressful. The classroom is then the place of safety, tranquillity and respite in the 'micro-city' that is school (Dudek, 2005, p. 52). Significantly, this is especially true for the pupil with autistic spectrum disorder where visual timetables, structured zoning and teaching strategies help make them feel 'more at home'. Moreover, if the pupil with autistic spectrum disorder feels comfortable in the classroom they are less likely to be distressed and can prepare better when proceeding to the other areas of the school.

Therefore, it was as a result of recognising not only the difficulties but also the potential benefits of providing a supportive ASD-friendly classroom that the following study was conducted.

The study

The study was carried out with the help of teaching staff from the Southern Education and Library Board (SELB) in Northern Ireland. The SELB is currently one of five Education and Library Boards covering Northern Ireland. It spans 1,450 square miles and is responsible for providing education for 75,000 pupils in an overall population of 322,000 residents in its area. In 2005, as a response to the report *Evaluating Provision for Autistic Spectrum Disorders in Schools* (DENI, 2005), the SELB implemented a scheme where existing school accommodation in ten different schools would be converted and refurbished into ten ASD-friendly classrooms. Refurbishment and conversion of the classrooms took place in 2005 and 2006. Nine of the classrooms were for Key Stage 1 (KS1) pupils (aged five to eight) and one was for Key Stage 3 (KS3) pupils (aged 11–16). The schools at KS1 level operate with eight pupils being supported by one teacher and two classroom assistants. The hope is that after completing KS1 level in the ASD-friendly classrooms, the pupils with autistic spectrum disorder may then be able to progress into the mainstream classroom within their school.

It was decided at an early stage not to interview or work with the pupils, but with the teaching staff instead. This was done for three reasons:

1. As commonly noted (Woodcock *et al.*, 2006; Khare and Mullick, 2008; Tufvesson and Tufvesson, 2009),

because of their disability, those with ASD can find it hard to communicate freely.

2. The age of the majority of the children, five to eight, would render objectivity extremely difficult.
3. As outlined by Whitehurst (2006b), environments designed for those with ASD not only impact upon the individual but also for the teacher/carer. An environment where staff too can feel at ease is extremely important. That too can have a profound effect on the individual with autistic spectrum disorder. As highlighted by Plimley (2004), autism-friendliness is a combination of both a human component and the built environment.

Moreover, an advantage of the study was that the staff visited all had four years' experience of operating in adapted and refurbished ASD-friendly accommodation. In all cases the classrooms had been adapted from existing school accommodation. This meant that the adapted classrooms covered a wide range of typologies since, by their very nature, the refurbishments and conversions were in some ways always constrained by the existing structure and fabric of the former accommodation. This also meant that the teaching staff had had the opportunity to evaluate and appraise the interventions, thereby developing a good understanding not only of what worked well but also what might be done better.

Methodology

The study was carried out in three stages over a two-year period. It was recognised from an early stage that one of the main challenges and considerations in the study would be identifying a method by which the teaching staff could best pass on their knowledge to the researchers. It was therefore proposed that a valid way of doing so would be to get the teachers to design their *ideal* ASD-friendly classroom as a method of conveying best practice for ASD-friendly classroom design. This then meant that a method had to be devised to best help the teachers, as non-designers, when designing their ideal classroom.

The method selected for this was by using models. This was chosen to facilitate input from the teachers. Models are by their nature three-dimensional and intrinsically have scale, colour and form to facilitate recognition. They are in many ways an 'interim ground' between the verbal-centric language of the teacher and the drawing-centric language of the architect/researcher. It was therefore decided that an ASD Classroom Design Kit would be designed. This would then allow the teachers to construct their ideal ASD-friendly classroom environment and, in doing so, convey their ideas to the researchers.

Study stage 1

To facilitate the development of the ASD Classroom Design Kit, two tasks were carried out. Both were completed to get

background information on what components were likely to be needed within the ASD Classroom Design Kit and also to get a better understanding of what constitutes an ASD-friendly learning environment. First, a review of the existing available literature was undertaken to get an understanding of the challenges presented by the built environment for those with ASD. Second, nine ASD-friendly classrooms in the SELB were visited and surveyed. Alongside this, the teaching staff were asked to rank and give consideration to a number of autism-friendly design criteria for the classroom. To compose a set of criteria for the ASD-friendly classroom teachers to rank, existing available literature was appraised (Harker and King, 2002; Humphreys, 2005; Beaver, 2006; Whitehurst, 2006a; Mostafa, 2008; Vogel, 2008) from which 16 design criteria for ranking were then compiled. These consisted of combining the eight considerations detailed by Vogel (2008) in *Classroom Design for Living and Learning with Autism* with eight of the less classroom-specific criteria suggested for consideration by Humphreys in *Autism and Architecture* (2005). For purposes of comparison and understanding afterwards, the 16 chosen criteria were broken down into four category bands: control and safety, classroom character, classroom usage and classroom physical factors (McAllister, 2010).

Finally, to allow further analysis and understanding, a checklist of factors was also employed, based largely on Tufvesson and Tufvesson (2009) and used to gain a greater understanding of each classroom environment visited.

Study stage 2

As a consequence of the data collected after stage 1 of the study, the Classroom Design Kit was fabricated. It was decided from an early stage that the kit had to be both legible and easy to use. The resultant kit therefore consists of a series of internal classroom furniture elements and flexible components at a scale of 1 : 20 (Figures 1 and 2). Furniture used in different classroom zones was colour coded to facilitate analysis and legibility. Free-standing

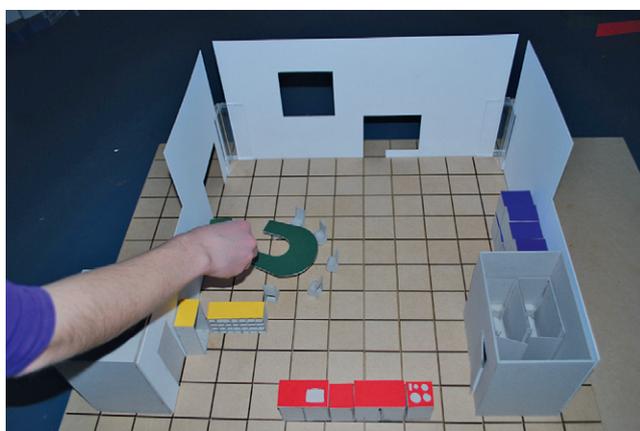


Figure 1. Kit of parts

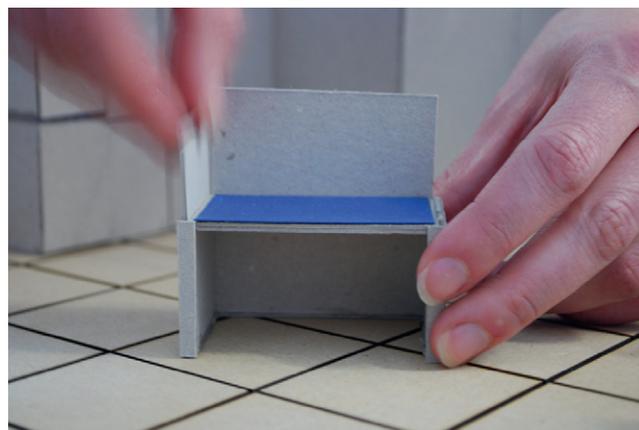


Figure 2. Workstation

adjustable wall junctions were made from clear Perspex. These allowed wall elements of different lengths to be slotted into them at different angles in order to form wall and classroom divisions. A baseboard was constructed with raised squares on a metre grid, allowing card to be dropped into the recesses and slid into the required position. White card wall elements were coated in clear plastic to allow window and door openings to be marked on or rubbed off as required. The fact that many items of classroom furniture are often fairly standard, such as workstations, desks and shelving storage units, aided in increasing the legibility and understanding of the kit by the teacher.

In visiting the nine classrooms, the same criteria of introduction and operating were always followed. Visits were held in the classroom when the children were not there, commonly at the end of the school day. After introducing how the ASD Classroom Design Kit could be used, the teaching staff were invited to use the model. Two architect/researchers were present, one to record notes and the other to aid the teacher by providing model component parts as required. Sessions normally lasted between one and two hours, after which the completed model was photographed. To concentrate on the classroom itself and keep the project within manageable limits, the teachers were asked not to consider classroom orientation or classroom position in relation to the rest of the school (Figures 3 and 4).

Study stage 3

Using the recorded model photographs and notes, the teacher-designed classrooms were then transferred to a Computer Aided Drawing (CAD) programme by the architect/researchers allowing the design to be viewed in plan, section, elevation and three dimensions (Figures 5 and 6). Finally, after model analysis and a feedback session with staff, the ASD-friendly classroom guidelines and design considerations specific to the KS1-level classroom were discussed and ultimately agreed with the teaching staff (see Figure 7).



Figure 3. Armagh CB PS layout

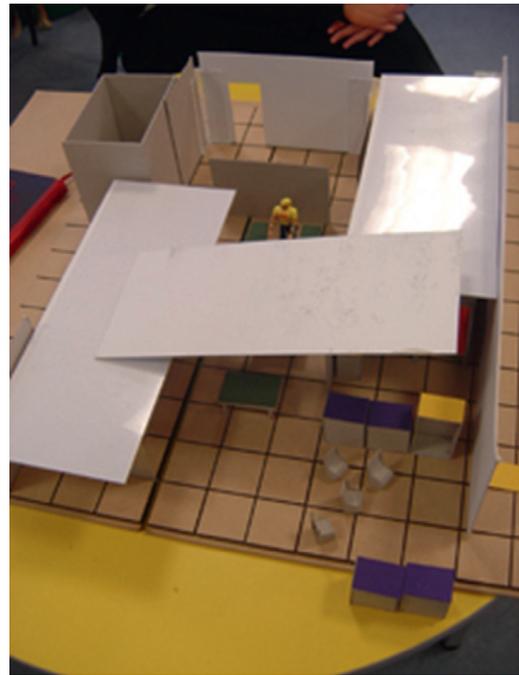


Figure 4. Armagh CB PS roof profiles

Study results

After analysis, and the feedback session with the teaching staff, 16 individual design considerations and guidelines were identified. Each is now described below, followed by a key consideration for each in turn.

Threshold and entrance

The transition from the exterior into the classroom needs careful consideration. For the pupil with autistic spectrum disorder, the classroom is the place of routine, safety and quiet. Conversely however, beyond the classroom is the world of the incidental, noisy and surprising. This then

makes it a potentially unsettling environment for the pupil with autistic spectrum disorder. A buffer between the calm of class and turbulent world of hall, corridor and playground is needed. Therefore an area for the pupil to prepare for transition to and from the quieter classroom environment is advantageous. This may be outside the classroom. If outside, it may be a recess within the corridor allowing pupils to wait to the side of the circulation zone of the corridor. If inside the classroom, it may be a seated area or cloakroom area in which the pupil may prepare and get ready for the change of environment.

- Having a transitional buffer for pupils before entering the teaching areas of the classroom helps maintain the quiet and calm of the classroom.



Figure 5. Cookstown PS model



Figure 6. Cookstown PS perspective

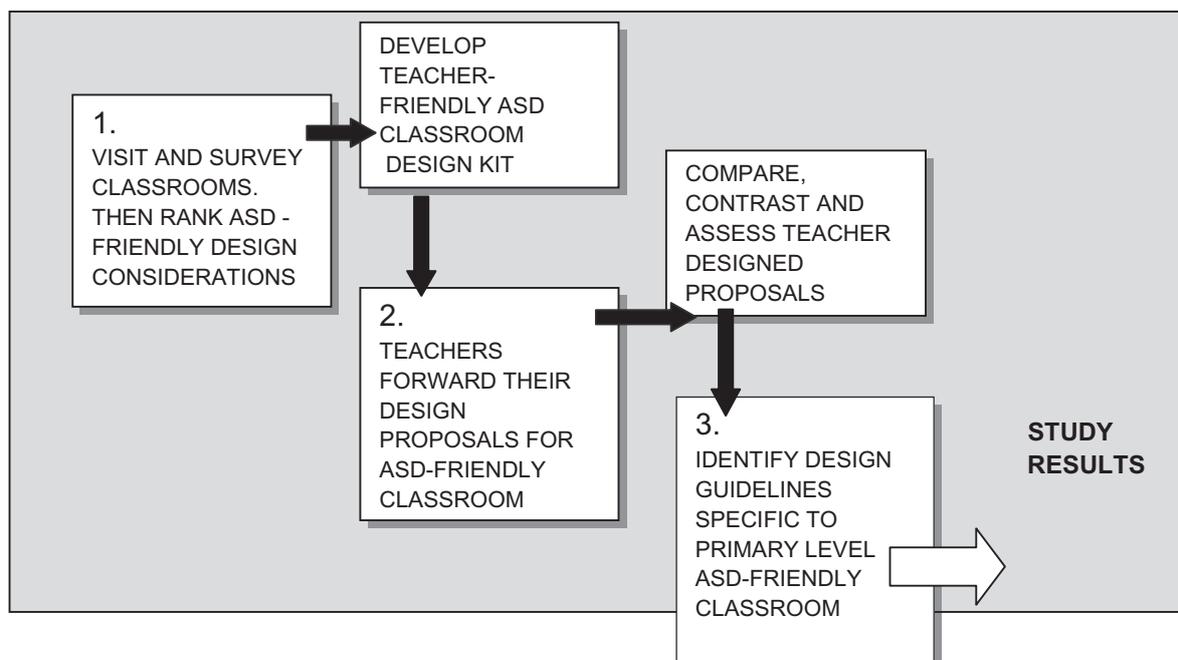


Figure 7. Study stages

Cloakroom provision

It is essential that adequate cloakroom provision be provided for each pupil. This should consist of an area for shoes, bags and coat storage. It is best if these are clearly identifiable for each pupil to aid individual pupil recognition. Each child should have a seat to aid in changing. This may be a shelf extending over a storage area with coat storage behind. A well-considered cloakroom can act as the buffer between classroom and corridor beyond.

- Having a designated cloakroom area with seating, shelving and coat storage helps each pupil prepare and ready themselves for change.

Sight lines entering the classroom

After entry into the classroom, whether from the corridor or cloakroom area, it is important that pupils remain focused on the classroom activity before them. It was therefore noticeable that, when entering the classroom, the view available to the pupil would not extend to the exterior but instead be purposely curtailed. This was done by either the positioning of the visual timetable and storage shelves or, alternatively, by purposely directing the pupils' view towards the main teaching area.

- Give consideration to pupil sight lines when entering the classroom. Curtail views to the exterior from the classroom entrance.

Visual timetable

The visual timetable is an important educational aid for pupils with autistic spectrum disorder, many of whom like

routine and order. It is the point of reference in the classroom that helps the pupil understand and prepare for what is happening in the class. Consideration therefore must be given to where this is positioned. It should be in a location where the pupils can easily access it with enough space around it to aid the pupils in recognising and locating it within the classroom. It should also be in a position where pupils visiting it do not disturb pupils working nearby. The visual timetable itself needs to be placed at a height suitable for young children to read it.

- Make provision for the positioning of the visual timetable in its own designated zone in the classroom.

High-level glazing

If possible, high-level or clerestory glazing should be provided in the classroom. Therefore, if visual distraction outside the classroom demands that the curtains or blinds of lower-level windows be closed, a visual connection to daylight and the exterior can still be maintained. This is especially important for teaching staff who, unsurprisingly, do not like working in a darkened room with only artificial light for illumination. Care though needs to be taken with high-level glazing, as with any windows, to avoid unwanted sunlight, solar gain and glare.

- Provide high-level windows to the exterior. Be mindful of orientation, glare and possible solar gain.

Volumetric expression

People feel, and therefore can react differently, within separate spaces of different character. Pupils with autistic

spectrum disorder are no different in this regard. Making a space more intimate by increasing the sense of enclosure or by lowering the ceiling level can aid in promoting a sense of calm. Conversely, increasing the openness or raising the ceiling level of an area can increase the sense of freedom, encouraging greater physical activity and expression.

- If possible, consider volumetric changes in height and character in conjunction with different teaching zones requiring different characters.

Control

Child safety and comfort are of course of paramount importance in any classroom. With pupils who can become severely distressed or agitated this is especially important. Ensuring clear sight lines in the classroom can allow a skilled teacher to see when a pupil is starting to get agitated or distressed. This then facilitates staff intervention or calming measures to be employed before the pupil becomes very distressed. Ideally, clear sight lines should be ensured from the position where the teacher spends most of their time. This is often in the teaching zone and from the white-board position.

- Ensure clear sight lines from the teaching areas to other areas of the classroom.

Access to classroom external play

The classroom should have direct access to a secure external play area. Ideally this should be specific to an individual classroom. This limits opportunities for pupils to get lost or distressed if travelling to and from external play areas. The secure outside play area can then be used, in addition to playtime, as a potential reward or as an external classroom for introducing weather, nature and the seasons to pupils by teaching staff. External seating and a canopy outside the doors can also act as a buffer between classroom and exterior. This can allow a pupil to watch his or her peers if unwilling to join in or as a place to withdraw to from external play, if wanting to rest.

- Ensure direct access from the classroom to a dedicated external classroom play area. The play area must be secure.

Access to school playground

Ideally the classroom-specific play area for the pupil with autistic spectrum disorder should connect to a larger enclosed play area or a school playground used by the wider school population. This hierarchy of external space allows the pupil, if they wish, to join the greater school population, thereby increasing the opportunities for social interaction. If unwill-

ing to do this, or preferring a quieter environment, the pupil can instead stay in the enclosed classroom external play area.

- Provide access from the classroom external play area to a larger school play area.

Quiet room

A quiet room in the classroom is essential. This is to allow a child time to 'recharge their batteries' if getting tired or alternatively calm down if distressed. It can also become an extension to the classroom – a small stage, storytelling or reading area if required, thereby adding to the flexibility of the classroom. Rather than include a sensory room, if adequate storage is provided, equipment to transform the quiet room into a temporary sensory room can be wheeled or carried to the quiet room. Further flexibility can be included by providing a sliding screen or door to the quiet room, allowing the quiet area to be opened up or closed off as desired.

- Provide a quiet room. Give consideration to the materiality of the quiet room. This should be different from the classroom, thereby helping make it a separate identifiable area. Consider employing a sliding door or screen to the quiet room if applicable.

Toilet provision

Each classroom should have direct access to its own toilets. This can be from the classroom itself or from the cloakroom area which acts as a buffer between classroom and exterior. The toilet area should include an adequate area for changing. Fixtures and fittings should be at a scale suitable for the children. Generally two toilets and two wash hand basins are suitable.

- Provide two toilets, two wash hand basins and corresponding changing space directly off the classroom.

Kitchen

The classroom should have a kitchen area including a sink and equipment for making snacks and heating food. This can either be sited within the classroom or located in a separate room adjoining the classroom. Both have advantages. If within the classroom, the kitchen can become a focal point and social area for the children and staff. The worktop and sink can readily be used to support art classes. If in a separate room, potentially unsettling olfactory smells can be better contained. Also the separate room can be used as an impromptu quiet room or a room for occupational or speech and language therapists when wishing to spend time with a pupil. Again art classes can be supported by the sink and worktop, and if located next to the exterior, can also support external play.

- Provide a kitchen area for the classroom. Decide if this is best within the classroom or in a separate room adjoining the classroom. Give consideration to the kitchen area supporting other class activities such as art.

Floor area

Those with ASD often require greater personal space around them in which to feel comfortable in comparison to others. Also, the need to have identifiable teaching zones necessitates a larger area than would be the case in a non-ASD classroom. These factors combined mean that for a classroom of eight pupils and three staff an average of approximately 100 square metres, excluding storage and toilets, was indicated as being required by staff.

- Provide additional area for the ASD classroom in comparison to mainstream classrooms.

Storage

The ASD classroom needs to be flexible, not only in terms of furniture layouts but also with the ability for teaching staff to bring or remove items into the classroom as required. As pupils with autistic spectrum disorder can struggle with visual distraction, this is especially important. Increased storage is also needed to cater for the many large-scale toys and equipment used by both teaching and support staff when working with young pupils with autistic spectrum disorder.

- Maximise available storage accessed from the classroom. This should cater for small- and large-scale items.

Computer provision

On all occasions teachers requested two computers for pupil use. This was so that if one computer was in operation, a second would be available for use should the need arise. The computer is not only a valuable teaching aid but, for visually orientated pupils, a great incentive to complete work. Pupils with autistic spectrum disorder can become upset if having to wait for a reward when they think it is due. Positioning of the computers is important. Their screens can be a distraction to pupils elsewhere in the classroom and therefore often need to be shielded from view from other teaching areas.

- Make provision for two computer workstations. These need to be carefully positioned to minimise distraction for non-users.

Workstations

Workstations are individual desks dedicated to pupil working. To aid with concentration and to minimise

distraction from elsewhere, they have side and back screens. To aid further in supporting pupil concentration, they tend to be positioned up against a blank wall or in a corner away from other activity. In comparison to other identifiable areas in the classroom, the workstation area was the one designated for visual calm and quiet. Pupils, when seated at their workstations, need direct and immediate access to open storage shelves where their work baskets will be positioned. Accordingly, low-level storage shelving will often act as a barrier between the workstations and the rest of the classroom.

- Make provision for a minimum of three workstations. These need to be positioned carefully to allow access to pupils' work baskets and away from potential sources of distraction.

Discussion

When examining the 16 design considerations there are a number of points that are particularly evident. First, the need for a careful consideration of threshold becomes clear. All too often scant regard is paid to the threshold: it is usually seen solely as a doorway mediating between two different rooms. The threshold is therefore not usually genuinely considered as a 'place in its own right' (Hertzberger, 2005, p. 32). However, for the pupil with autistic spectrum disorder, it needs to be much more than that (McAllister and Maguire, 2011). Since the physical activity of change can itself be very difficult for the pupil with autistic spectrum disorder and threshold is the point of exchange and transference between two separate environments, the threshold itself is spatially the place of change. It is therefore beneficial to recognise that a threshold can become the place where the pupil with autistic spectrum disorder can prepare or ready themselves for that change. In effect, the threshold between two environments becomes not just a spatial entity but a recognisable place where the event of preparing for change can be accommodated. With regard to the school classroom, this can occur in a number of different situations. It occurs between classroom and corridor. Here, making adequate provision for a cloakroom area in which the child can ready themselves for entry into the main classroom, or conversely, if leaving the classroom, can prepare for departure, is advantageous. It also occurs between the interior classroom environment and the exterior. There, an external covered seated area between the classroom and its outside play area can become, not only a useful 'external classroom' area, but also an interim place where the pupil can ready themselves for entry out into the wider play area or, if returning to the class, can prepare for entry back into the interior.

Within the classroom, too, there is the need to consider the threshold between different identifiable zones. The need for a clear structure is evident, where pupils know what will happen where. One activity will take place in one zone. The identification of one activity with one area is an important one for someone with autistic spectrum disorder (Mostafa,

2010). Of particular importance within the classroom is the visual timetable which, by its very nature of being a reference point informing the pupils with autistic spectrum disorder of change, becomes a place of transfer between different activities. It therefore needs careful consideration regarding its positioning, space allocation and character.

Consideration for quiet within the classroom is also clear. The need for a dedicated quiet space was the element most strongly advocated by teaching staff. This was even if its inclusion was to be at the cost of a dedicated sensory area. The inclusion of a quiet area meant that a pupil, if becoming distressed, could be temporarily withdrawn to the quiet area until ready to return. However it is worth noting that the description of quiet not only refers to auditory stimuli, but also visual stimuli. In this regard it is noticeable that there is a need for the pupil workstations to provide a low-stimulus environment to facilitate concentration when working there. However, the rest of the classroom should be as similar as possible to other mainstream classrooms in the school. This is helpful in preparing the pupil for transferring into the mainstream classroom environment at a later date. Nonetheless, having dedicated quiet areas within the classroom, whether workstations or withdrawal spaces, is absolutely essential.

It is also worth stressing that, within the provision of certain elements, the teachers always wanted to highlight the need for flexibility within the classroom. This is evidenced by the need for both additional storage space and overall classroom area in comparison to mainstream classrooms. Importantly, the extra storage space gives the teacher the opportunity physically to change the environment to suit the needs and mood of the pupils (Khare, 2010, p. 47). This can be especially important for younger children whose toys and learning aids can be physically big (Myler *et al.*, 2003). Elements can be brought in or out of storage as required. The additional classroom floor area not only accommodates the increased personal space that pupils with autistic spectrum disorder often need, but also gives the teachers the opportunity to reconfigure the classroom layout if required, to suit an individual pupil's needs.

Conclusion

There are of course limitations to the outlined study. First, it would be both arrogant and wholly wrong to think that changing the classroom environment and architectural intervention alone can solve and improve the school environment for those with ASD. Architectural input is only one component to consider and one that ideally requires input from teachers, carers, therapists, parents and, if possible, the children themselves. However, the built environment and the structure employed in the classroom are important elements for pupils (Wannarka and Ruhl, 2008) and, if handled thoughtfully, one that can both aid the pupil with autistic spectrum disorder in their education and, importantly, also help the school staff in their work.

Second, there are of course other considerations worthy of additional investigation when dealing with the classroom environment that fall outside the remit of this study. These might include colour, finishes, materiality and lighting. It is also important to stress that the scope of the study focused on design considerations for an ASD-friendly learning environment for eight Key Stage 1 pupils supported by one teacher and two classroom assistants. While the design considerations may be relevant for other age groups, further study would need to be undertaken to verify this assertion. Similarly, the study focused solely on the classroom environment: there are of course many other learning environments within the broader school setting that could be investigated.

However, the classroom is an important element as the place within the school where the pupil with autistic spectrum disorder will spend most of their time and, if comfortable and relaxed, may be the secure starting point for those venturing into the bustle of the wider school environment with their peers. Therefore the ASD-friendly classroom is worth looking at, and in detail, where generalised design guidelines, as is commonly the case when designing for children with cognitive disabilities (Khare, 2010, p. 1), however well intentioned, may be so generic that they do not actually make a meaningful difference to the pupil with autistic spectrum disorder. Moreover, lessons learnt by looking at ASD-friendly classrooms might be introduced or considered in mainstream learning environments, thereby further encouraging integration of the pupil with autistic spectrum disorder into the mainstream classroom.

Difficulties exist. Any examination requiring greater levels of inquiry and effort is often likely to be ignored for an easier option. However the potential benefits are huge. As advocated by Humphrey (2008, p. 46), ensuring a better fit between a pupil with autistic spectrum disorder and their school environment can only benefit the pupil by increasing opportunities for their success. School is surely an environment where every child should be supported and encouraged to fulfil their potential. A well designed ASD-friendly classroom is just one step that can support the pupil with autistic spectrum disorder in this aspiration.

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