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for 21st Century Education

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Learning Lessons from the Scottish School Building Programme: Providing an Accessible, Sustainable Environment for 21st Century Education

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Abstract: The largest school building programme in the history of Scotland is taking place from 2000–2011 to extensively refurbish or replace 21% of local authority schools. Thereafter, the Scottish government has pledged to improve all schools remaining in poor or bad “condition” or “suitability” (Scottish Government, 2009). Based on the School Estate Statistics 2010 (Scottish Government, 2010), 36% of the school estate could still require improvement work. As the first stage in this long-term building programme draws to a close, it is necessary to reflect on the performance of new and refurbished school buildings in meeting the requirements of 21st century education. This paper argues that further research is required to establish the strengths and weaknesses of accessible design in Scotland’s new and refurbished schools. Reference is made to relevant national and global educational initiatives, such as “Inclusive Education” and “Education for Sustainable Development”, and changes to the national curriculum in the form of the new Curriculum for Excellence. A brief summary of Scottish government design guidance also helps to establish the requirements of the built environment in helping to deliver modern education. “Improving the School Estate” (Audit Scotland, 2008), the most comprehensive study of new and refurbished school buildings in Scotland, found the worst performing factors to be lighting, temperature, acoustics, and air quality. The adverse effects that these factors can have on all people, and particularly those with impairments or additional support needs, are examined. It is concluded that further investigations within the area of accessible design in Scotland’s new and refurbished schools should be undertaken in order to achieve an inclusive, inspirational, and sustainable learning environment for current and future generations.

Keywords: School Buildings, Accessibility, Sustainability, Educational Environments, Architecture

INTRODUCTION

This paper argues that conclusive research is required to investigate the performance of accessible design in Scotland’s new and refurbished schools in order to meet the requirements of 21st century education. It also suggests that further clarification is required of the links between the two areas of accessible design and sustainable design, and the paper is premised on the grounds that accessible design is a necessary requirement in order to achieve sustainable design. The most recent school estate statistics are presented, which highlight that while 21% of local authority schools have been extensively refurbished or replaced, 36% still require improvement work in order to fulfil the government’s pledge that all schools

are adequate in terms of condition or suitability. The requirement for the educational environment to be accessible to all is demonstrated by referring to relevant educational initiatives and curricular changes. A brief summary of the Scottish Government's school design guidance for local authorities emphasises the importance of reflecting educational priorities in school design and examines the extent to which accessibility is embedded in this guidance. "Improving the School Estate" (Audit Scotland, 2008) is the most comprehensive study of new or refurbished school buildings in Scotland. Both the research methods used in the study and the main findings are discussed, in order to establish the extent to which conclusions can be drawn relating to accessible design. Importantly this study found the worst performing factors in schools to be lighting, temperature, acoustics and air quality. The adverse effects of these factors on all people and particularly people with impairments or additional support needs are examined. It is argued that best practice design standards for accessible design are not being met and that further research be undertaken in this area.

School Building Programme

The biggest school building programme in the history of Scotland has taken place between the years 2000 to 2011 to extensively refurbish or replace over 570 schools, constituting 21% of the entire local authority school building stock (Scottish Government, 2009). In 2003 the Scottish Executive and the Convention of Scottish Local Authorities (COSLA) launched the School Estate Strategy, with the specific aim of improving and maintaining the quality of school buildings throughout 10 to 15 years in order that no school remain in unsuitable condition for 21st century education (Scottish Executive & COSLA, 2003). In 2009, the Scottish Government reaffirmed this commitment in the report "Building Better Schools: Investing in Scotland's Future":

"All children and young people will be educated in, and community users able to use, schools that are 'fit for purpose' in terms of condition, suitability and sufficiency"
(Scottish Government 2009)

Government statistics are available which detail the condition, suitability and capacity of each school building, within three main sectors of primary, secondary and special schools. 'Condition' refers to the state of repair of features and facilities present within the existing building fabric (Scottish Executive, 2009) and 'suitability' refers to the adequacy of the building design (Scottish Government, 2008). Issues relating to the accessibility of the school building are dealt with under suitability; however this section refers to statistics for both condition and suitability, as these are used as a basis on which to estimate the amount of future improvement work to be undertaken in the school estate. Each school is given a rating for condition and suitability, from A-good, to D-bad. Table 1 details the definitions for condition and suitability category ratings A to D.

Table 1: Definitions for (a) Condition (Scottish Executive, 2009 p.5) and (b) Suitability (Scottish Government, 2008 p.5) Category Ratings

Category	Condition Definition	Suitability Definition
A	Good–Performing well and operating efficiently	Performing well and operating efficiently
B	Satisfactory–Performing adequately but showing minor deterioration	Satisfactory–Performing well but with minor problems
C	Poor–Showing major defects and/ or not operating adequately	Poor–Showing major problems and/ or not operating optimally
D	Bad–Economic life expired and/ or risk of failure	Bad–Does not support the delivery of services to children and communities

Table 2 details the most current statistics for the condition and suitability of the school building stock, published by the Scottish Government in April 2010 (Scottish Government, 2010). While the majority (79%) of school buildings are categorised as being in good or satisfactory condition, almost one quarter (21%) remain in poor or bad condition. Similar statistics are recorded for the suitability of school buildings, with 74% achieving ratings of A or B, and 24% receiving ratings of C and D. This is significant as the coming years will see the replacement or extensive refurbishment of the 546 (21%) schools which remain in poor or bad condition, in order to achieve the government’s aspiration that no school remain in poor or bad condition. Audit Scotland have indicated that if the programme continues at the current rate of progress it could take up to 20 years to realise this aspiration (Audit Scotland 2008). In addition, many of the schools which received an A or B rating in the condition category were rated with a C or D with regards to suitability, and vice versa. The total number of schools rated as poor or bad either in the condition or suitability category is 960, indicating that more than one third (36%) of all schools will require some form of improvement work in the coming years.

Table 2: Statistics for the Condition and Suitability of Local Authority School Building Stock (Scottish Government, 2010)

Category	Condition		Suitability	
	No. of schools	Percentage of entire school stock	No. of schools	Percentage of entire school stock
A	515	19%	546	20%
B	1,590	60%	1,429	54%
C	506	19%	595	22%
D	40	2%	55	2%
Not Recorded	15	1%	41	2%

While the School Estate Strategy has made substantial improvements to the school building stock, it is clear that a substantial amount of work remains to be undertaken. As the first stage in this long-term improvement programme reaches completion, it is a prominent time to reflect on the quality of new and refurbished school design, identifying both strengths and weaknesses in order to establish improved and more sustainable methods of meeting the requirements of 21st Century education. The following section summarises the most prominent educational initiatives and developments in the curriculum, with an emphasis on ‘Inclusive Education’, in

order to understand what may be required of the built environment as an integral part of the education system.

Education Initiatives & Curriculum

‘Inclusive Education’ is a term used widely in Scotland and is related to a number of different parliamentary acts, which aim to give every child, regardless of disability, the option to be educated in the school of their choice. The “Equality Act 2010” (British Government, 2010) came into force in October 2010 and is intended to bring together and supersede separate pieces of legislation related to people with disabilities which are already in force, such as the Disability Discrimination Act (DDA) 1995 and 2000. Because the Act was passed by the Westminster Parliament it did not have the authority to supersede Scottish legislation. Therefore the most recent legislation relating to inclusive school design in Scotland is the Education (Disability Strategies and Pupils’ Educational Records) (Scotland) Act 2002 (Scottish Government, 2002). This act enforces the requirement made in the DDA 1995 (British Government, 1995, Part IV, Chapter 1), for the body responsible for each school to prepare, implement and review an ‘accessibility strategy’ in order to increase access to the curriculum and also the physical environment in which the pupil is educated. Other important legislative acts include “The Standards in Scotland’s Schools etc. Act 2000” which made provision for 5 “national priorities in education” (Scottish Government, 2000, Section 4): Achievement and Attainment; Framework for Learning; Inclusion and Equality; Values and Citizenship; and Learning for Life. In addition, the “Education (Additional Support for Learning) (Scotland) Act 2004” (Scottish Government, 2004) replaces the term “Special Educational Needs” with “Additional Support Needs”, in order to include a wider group of children and young people who may be entitled to additional support.

Major global initiatives such as ‘Education for All’ and ‘Education for Sustainable Development’ also endorse ‘Inclusive Education’ and the provision of a suitable environment to support this. The vision of the “World Declaration on Education for All” was adopted by UNESCO in 1990 (UNESCO 1990). A decade later, the World Education Forum adopted “The Dakar Framework for Action, Education for All: Meeting our Collective Commitments.” (UNESCO, 2000). In particular, the framework pledges to: “create safe, healthy, inclusive and equitably resourced educational environments...for all” (UNESCO, 2000 p.9). The international Education for Sustainable Development (ESD) initiative aims to teach the values of Sustainable Development. Sustainable Development was first endorsed at the UN General Assembly in 1987 (UNGA, 1987) and thereafter, the concept of learning to support sustainable development has been widely explored and promoted. The period 2005–2014 has been declared as the United Nations Decade of Education for Sustainable Development (UNGA, 2002), the goal of which is to integrate the principles, values, and practices of sustainable development into all aspects of education and learning. It is important that the built environment in which ESD is taught is exemplary of the values of sustainable development, demonstrating best practice in terms of the cultural, environmental, social and economic aspects of the building design. In order for a school building to be sustainable it should be fully accessible to all.

The new Curriculum for Excellence also strives towards the creation of a more inclusive education system. The curriculum was introduced to the Scottish education system in 2010 and aims to provide a framework for 21st Century Education for children and young people aged 3–18. The aspiration of the new curriculum is:

“to enable all children to develop their capacities as successful learners, confident individuals, responsible citizens and effective contributors to society.”

(Scottish Executive, 2004a p.3)

The new curriculum is aligned with the five National Priorities for Education and therefore promotes ‘Inclusion and Equality’ in every aspect of the curriculum, emphasising that the aspirations and objectives it aims to achieve, are relevant to all children and young people (Scottish Executive, 2004a). In addition, it is recognised that one of the prime purposes of education is to make pupils aware of the values on which Scottish society is based. The environment in which education is delivered is symbolic of, and should properly represent, the values of Scottish society in facilitating access for all.

Guidance for School Design

As the school building programme has progressed the Scottish Government has produced various documents clarifying their aspirations for school design, providing design guidelines, and detailing consultation events, case studies and post-occupancy evaluations in which they have invested. This section briefly summarises these documents, referring mainly to those which stipulate the design aspirations of the Scottish Government (Scottish Executive & COSLA, 2003; Scottish Executive, 2004b; Scottish Executive, 2007; Scottish Government, 2009) and drawing specifically on issues of accessible design. At the beginning of the School Estate Strategy programme, the Scottish Executive published design guidance in the form of “School Design, Building our Future: Scotland’s School Estate” (Scottish Executive & COSLA, 2003). This guidance states that school design should reflect the national priorities in education, all of which promote accessibility, and one of which is specifically titled “Inclusion and Equality” (Scottish Government, 2000). Furthermore it is recommended that developments being made in the education system, such as those described in the previous section, be taken into consideration in the design of a school. Accessibility forms a major part of the guidance, with the following questions suggested for consideration through the design process:

- “Does the design take account of the needs of children and adults with a disability?”
- Is the design of classrooms and other spaces inclusive of children with additional support needs?
- Are external play and social areas fully accessible by all users?
- Are entrances well positioned, safe, welcoming and attractive?
- Does the design provide for a safe and secure environment for pupils and staff in a discrete manner, which has been considered at the initial design stage?”

(Scottish Executive & COSLA, 2003 p.6)

The importance of consulting with building users throughout the design process in order to achieve full accessibility is also highlighted. The guidance refers designers to 10 key points for a good design of a school (Scottish Executive & COSLA, 2003 p.12), originally published by the Commission for Architecture and the Built Environment (CABE, 2002 p.8) and presented in Table 3. The first of these is “Good clear organisation, an easily legible plan, and full accessibility”. Furthermore, when evaluating design quality, it is recommended that the Design Quality Indicators developed by the Construction Industry Council are used, a principle component of which is access (Scottish Executive & COSLA, 2003 p.20).

Table 3: (Scottish Executive & COSLA, 2003 p.12)

10 key points for a good design of a school	
1	Good clear organisation, an easily legible plan, and full accessibility.
2	Spaces that are well proportioned, efficient, fit for purpose and meet the needs of the users.
3	Circulation that is well organised, and sufficiently generous.
4	Good environmental conditions throughout, including appropriate levels of natural light and ventilation.
5	Attractiveness in design, comparable to that found in other quality public buildings.
6	Good use of the site, and public presence as a civic building.
7	Attractive external spaces with a good relationship to internal spaces and offering appropriate security and a variety of different settings.
8	A layout that encourages broad community access and use out of hours, where appropriate.
9	Robust materials that are attractive, that will weather and wear well and that are environmentally friendly.
10	Flexible design that will facilitate changes in policy and technology and which allows expansion or contraction in the future, where appropriate.

Another important ambition stated in design guidance is the provision of shared community services within the school campus in order to enhance the relationship between the school and the wider community. This emphasises the need for all mainstream and special school buildings and surrounding areas to be accessible to the entire community. The aspiration to create accessible and inclusive, interior and exterior learning environments has been reaffirmed in guidance documents published since 2003 (Scottish Executive, 2007; Scottish Government, 2009). However accessible design received little or no mention in other publications regarding sustainable design (Scottish Executive, 2004b) and the design implications of the new Curriculum for Excellence (Scottish Government, 2007). While sustainable design is a main priority, there is no obvious link made between sustainability and accessibility, an area which requires clarification. It is clear that accessible design forms a major part of the government's aspirations for school design and it should therefore be one of the main areas of consideration when assessing the performance of school buildings.

Improving the School Estate: Research Method

In March 2008 Audit Scotland prepared a report entitled "Improving the School Estate" (Audit Scotland, 2008) for the Auditor General for Scotland and the Accounts Commission with the aim of evaluating the impact of the School Estate Strategy (Scottish Executive & COSLA, 2003). This is by far the most extensive study to be undertaken of new school buildings in Scotland. One of the main objectives of this study was to evaluate the general performance of new and refurbished school buildings. The study was therefore wide in scope taking into account the many factors involved in building design and also aiming to gain an idea of the quality of school design across the board rather than draw conclusions concerning individual schools.

The study involved collecting data from all 32 councils and visiting 6 of them to interview officers and review documentation, as well as interviewing Scottish Government officials and other key stakeholders. The Building Research Establishment (BRE) was commissioned to un-

undertake a design quality review of 18 new or refurbished schools. These schools were selected by Audit Scotland to ensure a mix of primary and secondary, both new and refurbished, PFI and non-PFI contract types, in a range of sizes and in rural and urban locations. All of the schools in the study were mainstream and no special schools were included. A company were also commissioned to undertake consultation with 10 of the schools in the form of questionnaires and focus groups with staff and pupils respectively.

The professional assessment method used was the Design Quality Method (DQM) (Cook, M. 2007). This method is used by all auditing bodies in the UK as a method of Post Occupancy Evaluation and includes various sources such as expert opinion, professional judgement, user opinion and scientific measurement (BRE, 2011). The six matrices of the DQM were used as a basis on which to establish key design elements in order to benchmark school design against good and best practice standards (BRE, 2007). These key design elements are fully detailed in Table 4. Accessible design is not explicitly mentioned within the six points of the matrix. The assessment method also judged the schools according to the 10 features of a well designed school, as previously presented in Table 3. Accessibility is mentioned in the first of these key design elements: “Good clear organisation, an easily legible plan, and full accessibility”.

Table 4: The Six Key Design Elements of the DQM. (Audit Scotland, 2008, Appendix 1, p.42)

Key Design Elements Assessed Within The Design Quality Method	
1	Architecture: Aesthetic merit, site and space planning
2	Environmental engineering: Lighting, noise, temperature and air pollution levels
3	User comfort: Summertime overheating, visual environment, heating comfort, audible and visual intrusion, acoustics quality
4	Whole life costs: Occupancy costs, performance of building fabric, flexibility
5	Detail design: External and internal detail, furniture and furnishings, fittings, safety and security
6	User satisfaction: Anecdotal evidence

The objectives of this study were wide in scope and while aspects of accessibility were touched upon in the visual survey and consultation, no firm conclusions regarding accessible design could be reached. While it was found that physical accessibility for pupils with disabilities almost meets best practice design standards, this did not concur with the staff survey (Audit Scotland, 2008). Over a third (36%) of staff disagreed that the design of their workspace makes it possible to meet the needs of children with a disability or additional support needs (George Street Research, 2007a, p.17). Other results also show concern in areas related to accessible design. When asked for other comments relating to the quality of design and construction 5% of teachers commented that there is insufficient wheelchair provision (George Street Research, 2007a, p.19). Ease of movement through the school building rated highly in terms of importance, however performance was rated as poor (George Street Research, 2007a, pp.20 & 22) and pupils also complained about a general lack of space in classrooms, corridors and social spaces (George Street Research, 2007b). These results indicate that certain areas of accessible design may be under-performing. The following section expands on this by examining the main findings of the report and exploring their relationship to accessible design.

Main Findings

The report “Improving the School Estate” (Audit Scotland, 2008) found that new-build schools generally perform better than refurbished schools in all areas. New-build schools meet good

practice standards for safety and security, site and space planning, internal and external design details, and choice of material and fittings. However, good practice standards for environmental conditions such as daylight, acoustics, air quality and temperature are not sufficiently met. Environmental conditions were rated as the second most important factor of school design, however they scored the lowest rating in terms of performance. Overheating problems in the summer were mentioned frequently by staff and pupils. In addition, the mechanical and electrical engineering systems that control heating, lighting, ventilation etc. were found to be problematic. Many participants complained that they are unable to control their environment, for example, overheating and inadequate ventilation being worsened due to a lack of opening windows. The report also stressed the necessity for a meaningful consultation process with building users to be carried out from at an early stage in the design process.

Impact of Identified Problems

Europeans spend around 90% of their time indoors (BRE, 2010), and the environmental quality of the indoor environment therefore impacts greatly on general health. In 1986 the World Health Organisation (WHO) officially recognised Sick Building Syndrome (SBS) as a disease, present in up to 30% of new and remodelled buildings (WHO, 1986). Research undertaken by the Commission for Architecture and the Built Environment (CABE, 2002) has found that school design can impact on teaching and learning, pupil performance, staff morale, and the relationship between the school and the wider community. The following sections examine the impact of the worst performing factors on building users, particularly people with an impairment and/ or additional support needs. Furthermore, the importance of user-control over the environment and the benefit of implementing a meaningful consultation process are also highlighted.

Lighting

A lack of daylight can cause the human brain to produce melatonin which causes drowsiness. The amount of melatonin produced by the body can affect hormone production and state of mind, causing decreased mental and physical activity and severe fatigue. This can be demonstrated through Seasonal Affective Disorder (SAD) which describes the depression experienced by some in northern countries throughout the winter when daylight hours are very low. Using daylight as the main source of light has psychological and physical benefits for the building user. In particular, various research studies have found that students are more productive in daylit classrooms and that daylight can be beneficial in classroom learning (Tanner, 2009). Symptoms attributed to a lack of daylight are both physical and psychological. These include asthenopia (eye strain), extreme fatigue and behavioural disorders such as hyperactivity, neuroticism and an inability to concentrate. Links have also been made to various types of depression, narcolepsy and sleeping disturbances which can be affected by the lack of control of biological functions on the cell level. Melatonin production also influences the immune system and irregular production may cause decreased immunity (Rostron, 1997).

An average daylight factor of 5% in each classroom would be needed in order not to use any artificial lighting (Scottish Executive, 2007). However, it is not always practically possible to use daylight alone due to factors such as local climate, building position, surrounding shading and room depth, and the use of artificial light must also be carefully considered. The use of artificial day lighting during the day is common in most schools in Scotland and the minimum daylight factor of 2% at each classroom desk is normally met through means of artificial lighting (Scottish Executive, 2007). The quality of light can be just as important, if not more so, than the quantity of light. Important features of lighting are lux levels (brightness), glare index (to reduce visual discomfort), colour rendering index, and light uniformity (Scottish Ex-

ective, 2007). This involves carefully specifying interior finishes, as well as the positioning and size of windows, shading, and the location and type of artificial light fitting.

Acoustics

Building occupants can be exposed to various noise sources, from the external environment or from within the building. External noise sources include major vehicular routes, aeroplanes passing overhead or weather conditions. Internal sources can be human-related such as talking, building-services-related such as buzzing lights and air-conditioning, or equipment-related, such as overhead projectors. Noises related to building services are generally low frequency and this can cause more discomfort than would be caused by the same level of a higher frequency noise. The acoustic design of a building involves controlling not only the background noise entering a space, but also achieving a low reverberation time within the interior of a space, in order to enable effective communication between the occupants (Scottish Executive, 2007). The effects of noise pollution are mainly related to stress and a lack of concentration (London Hazards Centre, 1990). Research studies have found that noise levels can be linked to increased stress levels (Leventhall et al, 2003) and also reduced memory, motivation, reading ability and attainment levels in school children (Shield & Dockrell, 2008; Tanner, 2009).

Indoor Air Quality

Indoor Air Quality (IAQ) greatly impacts the health and comfort of a building's occupants. Inadequate ventilation, inefficient filtration and poor hygiene all contribute to poor indoor air quality (SBSA, 2010). Carbon Dioxide (CO₂) correlates with human metabolic activity and humans are the primary source of CO₂. Indoor levels of CO₂ are therefore commonly used to indicate the adequacy of outdoor air ventilation to occupancy levels within the building and the type of activity taking place. It is recommended that school building occupants should be able to lower concentrations of CO₂ to 1000 parts per million (ppm) at any given time (DfES, 2006), however research undertaken in UK schools found some levels of CO₂ concentrations to be higher than 4000ppm (Beisteiner & Coley, 2002).

Poor IAQ has been linked to Sick Building Syndrome and underperformance in school children (BRE, 2010). It can cause illness, such as asthma, which raises school absenteeism and can also prevent children from performing to their full capacity while at school (EPA 2000). In addition, there are multiple pollutants other than CO₂ which have different effects on the human body. Chemical effects are additive and can be synergetic, and even when levels of a chemical are below toxic levels, there may still be a risk posed by exposure over the longer term or exposure to two or more pollutants at the same time (London Hazards Centre, 1990). The risk that children face from poor IAQ is greater than that of adults, as they breathe a greater volume of air in proportion to their body weight than adults (Schneider, 2002). Typical symptoms of poor IAQ are irritated eyes, nose, throat and skin, upper respiratory infections, asthma, nausea, dizziness, headaches and lethargy (London Hazards Centre, 1990; EPA 2000).

Temperature

Overheating is a common cause of complaint in new and refurbished school buildings. The human body attempts to maintain constant internal thermal conditions, responding to warm temperatures by sweating, decreasing clothing levels to expose more of the body to the air, increasing air movement where possible and reducing activity levels. The maximum internal air temperature recommended in schools when the space is occupied is 32°C and the temperature should not exceed 28°C for any longer than 120 hours. This figure is given as an absolute maximum and not as an ideal. However, even in cases when temperatures align with this

guidance there have been complaints of discomfort by users and there may be some disparity between design guidance and user comfort (Scottish Executive, 2007). Relative humidity levels also affect thermal comfort, with high humidity levels causing clamminess and overheating, preventing sweat from drying on the skin. Symptoms of thermal discomfort include tiredness, irritability and loss of concentration (Scottish Executive, 2007).

People with Impairments and/ or Additional Support Needs

It is argued that while all building occupants suffer due to the impact of poor environmental conditions, those with an impairment and/ or additional support needs may suffer to a greater extent. This link is probably most strongly demonstrated with regards to people with a sensory impairment. People with visual and/ or hearing impairments may rely on their residual sight or hearing and this can be made far more difficult by poor lighting or acoustics. When one sense is impaired people may also rely more on another in order to compensate, and for this reason acoustics should be considered as important to people with visual impairments, and lighting as important to people with hearing impairments (DfEE, 1999). Many hearing impaired pupils make use of low frequencies, under 500Hz, to obtain information from speech, and low frequency indoor ambient noise may therefore interfere in their communication and understanding of a lesson (DfES, 2003). Young children or children with a poor knowledge of the language may suffer more than others, as they are not as capable of guessing missing words in order to compensate throughout a lesson. In some cases the detrimental effects and symptoms caused by poor environmental conditions may be similar to those already suffered by occupants with disabilities or additional learning support needs. For example, children with disabilities or additional learning needs, such as Attention Deficit Hyperactivity Disorder, Asperger's Syndrome and Dyslexia, may have difficulty focusing their attention or concentrating for long periods of time. It could be argued that these symptoms may be further aggravated by poor environmental conditions, such as overheating or poor IAQ, causing either similar symptoms such as a lack of concentration, or creating additional complications such as anxiety or irritated eyes, nose or throat. Poor environmental conditions can therefore make certain tasks which are already difficult for some children, unnecessarily challenging.

Control of Indoor Environment & Consultation Process

Studies undertaken in the UK have found that occupants who complain of symptoms of SBS tend to believe they have less control over their environment (Sykes, 1988). The importance of allowing the user control over the internal environment through manual or automatic means is preferable to fully-automated systems (Audit Scotland, 2008). This is particularly important with regard to being able to open windows for ventilation (Scottish Executive, 2007). The ability to control internal environmental conditions can be particularly relevant to people with impairments, who may require different environmental conditions depending on their needs. For example, control of lighting levels and positioning of light sources may be important for someone with a visual impairment, and the type of lighting preferred may also vary depending on the type of visual impairment. Low frequency sounds made by mechanical systems may affect a child with a hearing impairment or an inability to concentrate more than others and it is important to be able to turn these systems off when required.

The need for a proper consultation process during the school design process was highlighted by Audit Scotland (2008). This would allow building users could to express the importance they place on the quality of the indoor environment. Problems such as the inability to open windows or control radiator thermostats in the classroom, and the disparity between temperature guidelines and user comfort would be dealt with from the outset. The importance of involving

users in the design process is seen as central to any inclusive design process (CABE, 2004; DCSF, 2008).

Conclusion

At the first stage in the biggest school building programme in the history of Scotland draws to a close it is a prominent time to reflect upon design standards in new and refurbished schools and how effective these are in meeting the requirements of 21st century education. Both national and global educational initiatives and the new Curriculum for Excellence highlight the importance of inclusive education and this is reflected in school design guidance issued by the Scottish Government. However, further clarification is required of the links between the areas of accessibility and sustainability which are prominent in education and architectural design guidance. “Improving the School Estate” published by Audit Scotland in 2008 is the most comprehensive study of new and refurbished school buildings in Scotland. While no firm conclusions directly related to accessible design could be taken from this study, the views of staff and pupils regarding the teaching space, ease of movement and a general lack of space suggest that certain areas relating to accessible design are underperforming. The worst performing factors of lighting, acoustics, air quality, temperature and the inability to control the indoor environment, are proven to have a detrimental impact on all occupants, however this can be far worse for people with an impairment and/ or additional support needs. It could therefore be argued that best practice standards in the area of accessible design are not being met. Further research is required in order to establish the performance of accessible design in Scotland’s new and refurbished schools, in order to achieve an inclusive, inspirational and sustainable learning environment for current and future generations.

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